# SysTemp

SySmart
ELECTRONIC REGULATOR
TECHNICAL USE AND MAINTENANCE MANUAL
Software Version 2.2

G Series | P Series | R Series | TMC Series

systemair

# SYMBOLS

**NOTE!**
This symbol is used to indicate helpful hints for the operator.

**ATTENTION! DANGER!**
This symbol is used to indicate situations or operations that may be potentially dangerous or that require the operator's attention.

**The Manufacturer adopts a policy of continuous development and therefore reserves the right to make changes and improvements to any product described in this document without prior notice. Technical data and dimensions are not binding.**

# CLOSE CONTROL
# AIR CONDITIONERS

## TECHNICAL MANUAL

## USE AND MAINTENANCE
## ELECTRONIC REGULATOR
## SySmart

## Software version 2.2

| List of revisions | | | | |
|---|---|---|---|---|
| **Revision** | **Date** | **Author** | **Chapters** | **Descriptions** |
| A | 05/2015 | AF | All | First version |
| B | 10/2017 | AF | All | Revision for software version 2.1 |
| D | 04/2018 | AF | All | Revision for software version 2.1.4 |
| E | 10/2018 | AF | All | Revision for software version 2.2 |

# CONTENTS

# WARRANTY CONDITIONS

All Products of the Manufacturer or bearing the trademark of the Manufacturer are built according to the state of the art techniques, in compliance with the current reference standards, as stipulated in the certificate of conformity provided together with the products.

All Products of the Manufacturer or bearing the trademark of the Manufacturer are designed to be installed inside a system that controls them. The designer or installer of the Product assumes all liability and risk relating to its installation in the destination system.

The Manufacturer and its Branches/Affiliates do not guarantee that all aspects of the Product and any software included will comply with the requirements of the destination system. In this case, following specific agreements, the Manufacturer can act as a consultant for the successful start-up of the Product, but will not be held liable, under any circumstances, for the smooth operation of the destination system.

All Products of the Manufacturer or bearing the trademark of the Manufacturer are subject to the following warranty which is deemed as entirely accepted and signed at the time of placing the order.

**The warranty on the Products of the Manufacturer or bearing the trademark of the Manufacturer is valid for TWENTY-FOUR MONTHS (2 years) from the shipment date of the material.**

**If start-up is not carried out by Manufacturer-authorised technicians, the warranty is validated by submitting a completed copy of the Product's technical start-up report.**

During the warranty period, the Manufacturer, under its sole discretion and as quickly as possible, undertakes to repair or provide as new any parts with acknowledged defects relating to material, construction or workmanship, which make them unsuitable for their intended use.

The claim must be submitted in writing, indicating the details of the reported fault, the serial number or code of the Product, where the fault was identified and indication of the component that caused the fault, if this is easily identifiable. The Manufacturer will accept no claim made over the phone.

For operational purposes, claims can only be accepted during office hours, Monday to Friday. If a request is submitted on a public holiday, the Manufacturer will consider it as received at the beginning of the next business day after it was sent.

Faulty components are replaced ex works (EXW). Transport costs are borne by the Customer, even if the warranty cover is applied, unless specified otherwise by the Manufacturer.

The costs to replace faulty components (labour, materials, refrigerant, etc.) are borne by the Customer, even if the warranty cover is applied, unless specified otherwise by the Manufacturer.

Materials replaced while under warranty are the property of the Customer, who must dispose of them according to current regulations. Any disposal costs are borne by the Customer.

If parts should be returned while under warranty, they must be returned no later than three (3) months from the shipment date of the replacement part, organised and at the expense of the Customer. Otherwise, all the parts will be charged at the applicable list price at the time of their shipment.

The Manufacturer is not liable to pay compensation for direct or indirect damage, of any kind and for any reason. The Manufacturer is also not liable for any delay in the supply of parts under warranty or in the execution of work under warranty.

# WARRANTY RESTRICTIONS

The above mentioned warranty conditions are valid as long as the Customer has fulfilled all obligations according to the contract and in particular those relating to payment. A delayed payment or non-payment of the supply, even if partial, suspends any warranty. The warranty does not give the Customer any right to suspend or delay payments, which must be paid in any case according to the stipulations of the order and specified in the written order confirmation.

**Without precluding due compliance with other instructions provided in the technical documentation supplied with the Product, it must be noted that the following instructions must be complied with accordingly, in order for the warranty to be valid:**

**Transport and positioning**

- Do not remove the Product from its original packaging until it has reached the installation site.
- Do not drop, knock or shake the Product, as the internal circuits and mechanisms may be irreparably damaged.
- Store the Product in an environment that complies with the temperature and humidity limits specified in the technical documentation.

**Installation**

1) The Product must be installed by skilled personnel who fulfil the adequate requisites for the task as defined by the regulations in the country where positioning and installation take place.
2) The system that will control the Product must be implemented according to professional standards, according to the instructions provided in the technical documentation and the regulations of the country where positioning and installation take place, with particular attention to the setting up of:

- Water or cooling lines serving the Product and the relevant components.
- Electrical power and connection lines of the Product and the relevant components.
- Aeraulic lines of the Product and the relevant components.

3) Do not install the Product outdoors or in areas that are subject to adverse weather.
4) Do not install the Product in areas where there is oil, or where there are oil vapours or various kinds of aerosols, and where there are flammable vapours.
5) Do not install the Product in an environment where there are corrosive gases, such as sulphur gases.
6) Do not install the Product in environments where there is equipment that generates electromagnetic waves, and where the line voltage is subject to great fluctuations.
7) Do not install the device in an environment where the air is highly saline, such as near sea cliffs.
8) Do not install the device in vehicles or boats.

**First start-up**

1) The Product must be started up by skilled personnel who fulfil the qualification requisites for the task as defined by the regulations in the country where positioning and installation take place.
2) The system controlling the units must be started up according to professional standard, according to the instructions provided in the technical documentation and the regulations of the country where positioning and installation take place.
3) A copy of the technical start-up report of the Product must be delivered to the Manufacturer.

**Use and maintenance**

1) Do not use the Product for applications other than those specified in the technical documentation.
2) Do not use the Product in an environment that does not comply with the temperature and humidity limits specified in the technical documentation.
3) Perform maintenance cycles according to the schedules specified in the technical documentation.
4) Clean the Product with neutral detergents. Do not use corrosive chemicals and solvents or aggressive detergents.

**Furthermore, the Manufacturer reserves the right to void the warranty of the products sold if:**

A) The labels or plates bearing the trademark of the Manufacturer and the serial number or the registration number of the Product have been deleted and/or removed.
B) The Product has been subjected to alterations or mechanical processes not specifically authorised by the Manufacturer.
C) The Product has been used inconsistently with the instructions provided in the technical documentation and regulations of the country where positioning and installation take place, or for purposes other than what it was designed for.
D) The defects are due to negligence, incompetence, poor maintenance, carelessness and inability of the End-user, damage caused by third parties, unforeseeable circumstances or force majeure or for any other reason not attributable to defects in the construction quality.

**The following are henceforth considered excluded from the warranty:**

A) All parts with marginal defects that have a negligible effect on the value or function of the Product.
B) All parts typically subject to sliding or rolling friction (bearings, brushes, etc.).
C) All parts typically subject to consumption (filters, humidifier cylinders, etc.).
D) All parts typically subject to oxidation or corrosion if not properly used or serviced (headers, wires and copper contacts or metal alloys, internal or external parts of the units, etc.).
E) All parts not supplied by the Manufacturer, even if these are an integral part of the system that controls the product.

# 1 INTRODUCTION

## 1.1 SySmart ELECTRONIC REGULATION SYSTEM

SySmart 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:

- One basic I/O C-PRO3 control board, in plastic container the size of 4 DIN modules, for installation on DIN guide inside the electrical panel:
- A VGRAPH user terminal with single-colour LCD graphic display (black with white LED back lighting), 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 the size of 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 the size of 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.

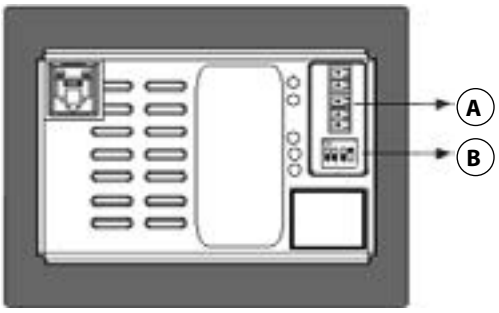
Thanks to the high degree of interfacing of the unit's main components, with the SySmart electronic control system it is possible to monitor and control any operational aspect of the system, assuring the user has real time access via the display at the front of the machine or via a supervision system 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 a minimum.

# 2 DESCRIPTION OF INPUTS-OUTPUTS ON SySmart

## 2.1 DESCRIPTION OF INPUTS-OUTPUTS ON THE VGRAPH USER INTERFACE

Below is a description of the meanings of the inputs and outputs of the VGRAPH user interface.

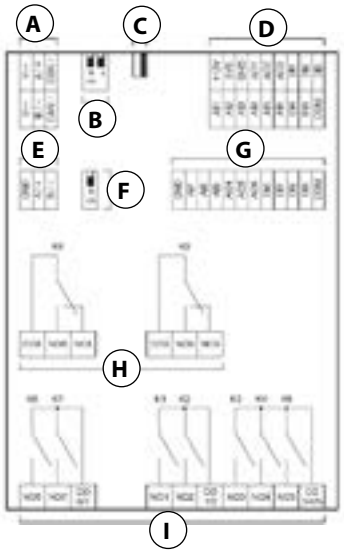



| A - Power supply - CANbus Port | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **V ≈ +** | 24 V AC | Power supply input |
| **V ≈ -** | 24 V AC | Power supply input |
| **CAN +** | - | Signal + CANbus port |
| **CAN -** | - | Signal - CANbus port |
| **GND** | - | CANbus port ground |

| B - Termination heater micro-switches | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | - | Reserved |
| **2** | - | Reserved |
| **3** | - | Reserved |
| **4 (CAN TERM)** | - | CANbus port termination |

## 2.2 DESCRIPTION OF INPUTS-OUTPUTS ON BASIC I/O C-PRO3 CONTROL BOARD

Below is a description of the meanings of the inputs and outputs of the basic I/O C-PRO3 control board.




| A - Power supply - Modbus Slave RS485 port - CANbus port | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **V ≈ +** | 24 V AC | Power supply input |
| **V ≈ -** | 24 V AC | Power supply input |
| **A / +** | - | Signal + Modbus Slave RS485 port |
| **B / -** | - | Signal - Modbus Slave RS485 port |
| **CAN +** | - | Signal + CANbus port |
| **CAN -** | - | Signal - CANbus port |

| B - Termination heater micro-switches | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **CAN LT** | - | CANbus port termination |
| **RS485 LT** | - | Modbus Slave RS485 port termination |

| C - USB port | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **USB 2.0** | A | Interfacing and programming port |

| D - Analogue inputs 1... 6, digital inputs 1... 5 and analogue outputs 1... 3 | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **AI 1** | 0-5 V DC | Air pressure sensor / Water temperature probe IN 2 |
| **AI 2** | 4-20 mA | Air humidity sensor IN (Ambient) |
| **AI 3** | 4-20 mA | Air humidity sensor OUT (Supply) / Water Temperature Probe OUT 2 |
| **AI 4** | NTC | Air temperature sensor IN (Ambient) |
| **AI 5** | NTC | Air temperature sensor OUT (Supply) |
| **AI 6** | NTC | Water Temperature Sensor IN 1 / Free Cooling Temperature |
| **DI 4** | N.C. | General electric coil alarm |
| **DI 5** | N.C. | Flooding / Condensate discharge alarm |
| **COM** | - | Digital input common |
| **+12 V** | 12 V DC | Power supply to 0-20 mA / 4-20 mA / 0-10 V transducers (12 VDC, 120 mA max.) |
| **5 VS** | 5 V DC | Stabilised ratiometric transducer power supply 0-5 V (5 VDC, 60 mA max.) |
| **GND** | - | Analogue input and analogue output common |
| **AO 1** | 0-10 V | Supply fan modulation / Dry cooler modulation |
| **AO 2** | 0-10 V | Cooling water valve modulation / Free Cooling / Compressor inverter |
| **AO 3** | 0-10 V | Heating water valve modulation / Modulating electric coil |

| | | |
|---|---|---|
| **DI 1** | N.O. | Motorised damper opening status |
| **DI 2** | N.O. | Clogged air filter alarm |
| **DI 3** | N.O. | Remote OFF |

| **E - Modbus Master RS485 port** | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **GND** | - | Modbus Master RS485 port ground |
| **A / +** | - | Signal + Modbus Master RS485 port |
| **B / -** | - | Signal - Modbus Master RS485 port |

| **F - Termination heater micro-switches** | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **RS485 LT** | - | Modbus Master RS485 port termination |

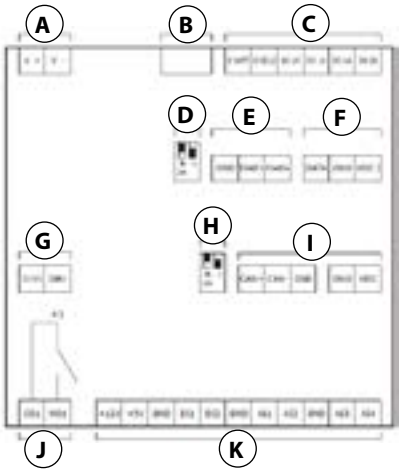
| **G - Analogue inputs 7... 9, digital inputs 6... 9 and analogue outputs 4... 6** | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **GND** | - | Analogue input and analogue output common |
| **AI 7** | 0-10 V DC | Water temperature probe OUT 1 |
| **AI 8** | 0-10 V DC | Water flow rate measuring device 1 / Liquid temperature 1 (RH) |
| **AI 9** | 0-10 V DC | Water flow rate measuring device 2 / Liquid temperature 2 (RH) |
| **AO 4** | 0-10 V DC | Two Sources water valve modulation |
| **AO 5** | 0-10 V DC | Modulation condenser 1 |
| **AO 6** | 0-10 V DC | Condenser 2 / Humidification modulation |
| **DI 6** | N.C. | Configurable input 1 |
| **DI 7** | N.C. | Configurable input 2 |
| **DI 8** | N.C. | Configurable input 3 |
| **DI 9** | N.C. | Configurable input 4 |
| **COM** | - | Digital input common |

| **H - Digital outputs 8 and 9** | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **CO 8** | - | Digital output common 8 |
| **NO 8** | N.O. | Configurable digital output 3 |
| **NC 8** | N.C. | Configurable digital output 3 |
| **CO 9** | - | Digital output common 9 |
| **NO 9** | N.O. | Configurable digital output 4 |
| **NC 9** | N.C. | Configurable digital output 4 |

| **I - Digital outputs 1... 7** | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **NO 6** | N.O. | Configurable digital output 1 |
| **NO 7** | N.O. | Configurable digital output 2 |
| **CO 6/7** | - | Digital output common 6 and 7 |
| **NO 1** | N.O. | Fan control |
| **NO 2** | N.O. | Motorised dampers control |
| **CO 1/2** | - | Digital output common 1 and 2 |
| **NO 3** | N.O. | Electric heating coil stage 1 control |
| **NO 4** | N.O. | Electric heating coil stage 2 control |
| **NO 5** | N.O. | - |
| **CO 3/4/5** | - | Digital output common 3, 4 and 5 |

## 2.3 DESCRIPTION OF EVDRIVE REGULATOR INPUTS-OUTPUTS

Below is a description of the meanings of the inputs and outputs of the EVDrive regulator.




| A - Power supply | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **V ≈ +** | 24 V AC | Power supply input |
| **V ≈ -** | 24 V AC | Power supply input |

| B - Programming port | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **Prog.** | TTL | Programming port |

| C - Bipolar stepper motor output | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **V BATT** | - | Backup power supply input |
| **SHIELD** | - | Bipolar stepper motor cable shielding input |
| **SO 1A** | - | Bipolar stepper motor coil 1 |
| **SO 1B** | - | Bipolar stepper motor coil 1 |
| **SO 2A** | - | Bipolar stepper motor coil 2 |
| **SO 2B** | - | Bipolar stepper motor coil 2 |

| D - Termination heater micro-switches | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **MBS LT** | - | Modbus Slave RS485 port termination |
| **2** | - | Reserved |

| E - Modbus RS485 port | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **GND** | - | Modbus Slave RS485 port ground |
| **A / +** | - | Signal + Modbus Slave RS485 port |
| **B / -** | - | Signal - Modbus Slave RS485 port |

| F - Reserved port | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **DATE** | - | Reserved |
| **GND** | - | Reserved |
| **VDC I** | - | Reserved |

| G - High voltage digital input | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **DIHV1** | - | High voltage digital input common |
| **DIHV1** | N.C. | Compressor low pressure alarm |

| H - Termination heater micro-switches | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **CAN LT** | - | CANbus port termination |
| **2** | - | Reserved |

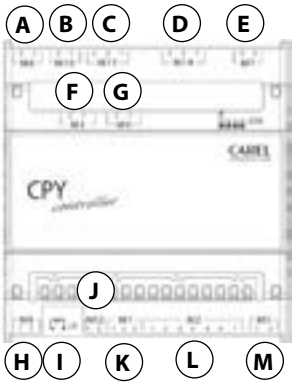
| I - CANbus port for remote interface | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **CAN +** | - | Signal + CANbus port |
| **CAN -** | - | Signal - CANbus port |
| **GND** | - | CANbus port ground |
| **GND** | - | Remote interface power supply ground |
| **VDC** | 22-35 VDC | User terminal power supply (22-35 VDC, 100 mA max.) |

| J - Digital output | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **CO 1** | - | Digital output common |
| **NO 1** | N.C. | Compressor control |

| K - Analogue inputs and dry digital inputs | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **+12 V** | 12 VDC | Power supply to 0-20 mA / 4-20 mA / 0-10 V transducers (12 VDC, 120 mA max.) |
| **+5 V** | 5 VDC | Stabilised ratiometric transducer power supply 0-5 V (5 VDC, 60 mA max.) |
| **GND** | - | Analogue inputs and dry digital inputs common |
| **DI 1** | N.C. | Compressor breaker alarm |
| **DI 2** | N.C. | Compressor high pressure alarm |
| **GND** | - | Analogue inputs and dry digital inputs common |
| **AI 1** | NTC | Compressor discharge temperature probe |
| **AI 2** | 0-5 V Rat. | Compressor condensation pressure probe |
| **GND** | - | Analogue inputs and dry digital inputs common |
| **AI 3** | NTC | Compressor suction temperature probe |
| **AI 4** | 0-5 V Rat. | Compressor evaporation pressure probe |

## 2.4 DESCRIPTION OF CPY HUMIDIFIER BOARD INPUTS-OUTPUTS

Below is a description of the meanings of the CPY humidifier board inputs and outputs.




| A - M6 - Discharge pump activation | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | - | Digital output common |
| **2** | N.O. | Discharge pump activation control |

| B - M10 - Contactor activation contact for submerged electrode voltage | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | - | Digital output common |
| **2** | N.O. | Contactor activation control for submerged electrode voltage |

| C - M11 - Water charging and discharging solenoid valve control | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | N.O. | Charging solenoid valve activation control |
| **2** | - | Digital output common |
| **3** | N.O. | Discharging solenoid valve activation control |

| D - M14 - Relay indicating humidifier in production | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | N.O. | Humidifier in production indication activation control |
| **2** | - | Digital output common |
| **3** | N.O. | Humidifier in production indication activation control |

| E - M7 - Submerged electrode current measuring amperometric transformer input (TAM) | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | - | Common |
| **2** | 0-2V DC | Amperometric transformer (TAM) |

| F - M3 - Conductivity meter | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | - | Common |
| **2** | - | Conductivity measuring device |

| G - M9 - High water level sensor | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | - | Common |
| **2** | - | Cylinder level sensor |

| H - M8 - Electrical power supply connection | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | 24 V AC | Power supply input |
| **2** | 24 V AC | Power supply input |

| I - J1 - Connection for CPY terminal | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | RJ12 | Connection for CPY terminal |

| J - M12 - tLAN network connection | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | - | tLAN data line |
| **2** | - | tLAN data line common |

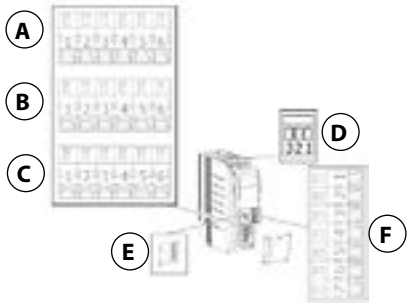
| K - M1 - Modbus RS485 network connection | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **A / +** | - | Signal + Modbus RS485 port |
| **B / -** | - | Signal - Modbus RS485 port |
| **GND** | - | Modbus RS485 port ground |

| L - M2 - Control signals | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | +15 V DC | Active probe power supply |
| **2** | - | Control signal input |
| **3** | - | Active probe power supply and control signal input common |
| **4** | N.C. | Enable for operation |
| **5** | - | Digital input common |
| **6** | N.C. | Manual discharge |
| **7** | N.C. | Reset operating hour counter. |

| M - M5 - Alarm | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | - | Digital output common |
| **2** | N.O. | General humidifier alarm |

## 2.5 DESCRIPTION OF AGILE INVERTER INPUTS-OUTPUTS

Below is a description of the meanings of the Agile inverter inputs and outputs.




| A - X13 - Control terminals | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | 24 V DC | 24 V dc power supply input |
| **2** | - | 24 V dc power supply ground |
| **3** | N.C. | Operation digital input |
| **4** | 0-10 V DC | 0-10 V output |
| **5** | N.O. | Digital inverter operation indicator output |
| **6** | - | Multi-function output |

| B - X12 - Control terminals | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | N.C. | Digital work set editing input |
| **2** | N.C. | Digital error confirmation input |
| **3** | - | Multi-function input |
| **4** | - | Multi-function input |
| **5** | CAN H | Signal + CANbus port |
| **6** | CAN L | Signal - CANbus port |

| C - X11 - Control terminals | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | 24 V DC | 24 V dc power supply output |
| **2** | - | 24 V dc power supply ground |
| **3** | N.C. | Operation digital input |
| **4** | N.C. | Clockwise start-up digital input |
| **5** | N.C. | Anti-clockwise start-up digital input |
| **6** | N.C. | Digital work set editing input |

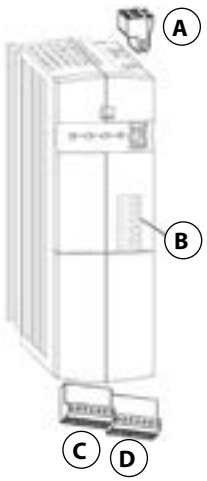
| D - Alarm terminal | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | N.C. | Digital inverter alarm indicator output |
| **2** | - | Digital output common |
| **3** | N.O. | Digital inverter alarm indicator output |

| E - X21 - RJ45 communication interface | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | RJ45 | PC communication interface |

| F - X10 - Control terminals | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | - | Signal + Modbus RS485 port |
| **2** | - | Signal + Modbus RS485 port |
| **3** | - | Signal - Modbus RS485 port |
| **4** | | Signal - Modbus RS485 port |
| **5** | 5 V DC | 5 V dc power supply output |
| **6** | - | Ground |
| **7** | - | Shielding |

### 2.5.1 DESCRIPTION OF ACTIVE INVERTER INPUTS-OUTPUTS

Below is a description of the meanings of the Active inverter inputs and outputs.




| A - X10 - Alarm terminal | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | N.C. | Digital inverter alarm indicator output |
| **2** | - | Digital output common |
| **3** | N.O. | Digital inverter alarm indicator output |

| B - X310 - Modbus communication terminals | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | A | Signal + Modbus RS485 port |
| **2** | A' | Signal + Modbus RS485 port |
| **3** | B | Signal - Modbus RS485 port |
| **4** | B' | Signal - Modbus RS485 port |
| **5** | 5 V DC | 5 V DC power supply output |
| **6** | GND | Ground |
| **7** | PE | Shielding |

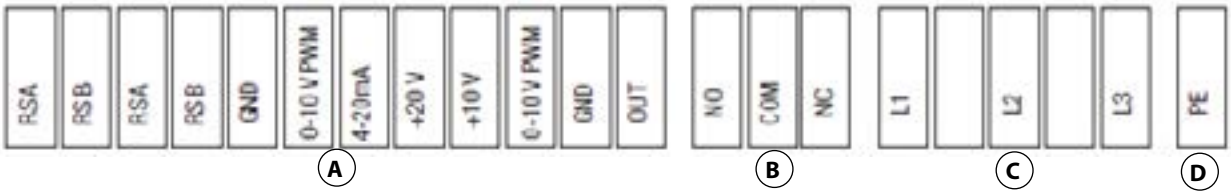
| C - X210A - Control terminals | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | 20 V DC | 20 V DC power supply output |
| **2** | GND | 20 V DC power supply ground |
| **3** | N.C. | STOA (Safety Torque Off) operation digital input |
| **4** | N.C. | S2IND digital input |
| **5** | N.C. | S3IND digital input |
| **6** | N.C. | S4IND digital input |
| **7** | N.C. | S5IND digital input |

| D - X210B - Control terminals | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **1** | N.C. | S5IND digital input |
| **2** | N.C. | STOA (Safety Torque Off) operation digital input |
| **3** | N.O. | S1OUT digital output |
| **4** | - | MFO1 multi-function output |
| **5** | 0-10V DC | 0-10 V DC output |
| **6** | - | MFI1 multi-function input |
| **7** | GND | 0-10 V DC Output Ground |

## 2.6 DESCRIPTION OF ELECTRONIC FAN INPUTS-OUTPUTS

### 2.6.1 ELECTRONIC FANS MODEL 1

Below is a description of the meanings of the inputs and outputs of electronic fans model 1.




| A - Analogue inputs and Modbus Slave RS485 port | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **RSA** | - | Signal + Modbus Slave RS485 port |
| **RSB** | - | Signal - Modbus Slave RS485 port |
| **RSA** | - | Signal + Modbus Slave RS485 port |
| **RSB** | - | Signal - Modbus Slave RS485 port |
| **GND** | - | Modbus Slave RS485 port ground |
| **0-10 V PWM** | 0-10 V/PWM | Analogue control input |
| **4-20 mA** | 4-20 mA | Analogue control input |
| **+20 V** | 20 V DC | Power supply to transducers (50 mA max.) |
| **+ 10 V** | 10 V DC | Power supply for potentiometer (10 mA max.) |
| **0-10 V PWM** | 0-10 V/PWM | Analogue control input |
| **GND** | - | Analogue inputs ground |
| **OUT** | 0-10V DC | Analogue output for slave fan control |

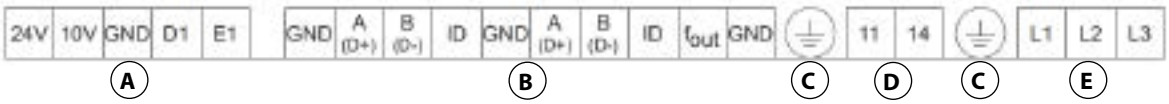
| B - Alarm relay | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **NO** | N.O. | General fan alarm |
| **COM** | - | Digital output common |
| **NC** | N.C. | General fan alarm |

| C - Electrical power supply | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **L1** | 400 V | Electronic motor power supply |
| **L2** | 400 V | Electronic motor power supply |
| **L3** | 400 V | Electronic motor power supply |

| D - Connecting terminal to earth | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **PE** | - | Earthing cable connection |

### 2.6.2 ELECTRONIC FANS MODEL 2

Below is a description of the meanings of the inputs and outputs of electronic fans model 2.




| A - Analogue and digital inputs | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **24 V** | 24 V DC | Digital input power supply (70 mA max.) |
| **10 V** | 10 V DC | Power supply for potentiometer (10 mA max.) |
| **GND** | - | Analogue inputs ground |
| **D1** | - | Operation digital input |
| **E1** | 0-10 V DC | Analogue control input |

| B - Modbus Slave RS485 port | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **GND** | - | Modbus Slave RS485 port ground |
| **A (D+)** | - | Signal + Modbus Slave RS485 port |
| **B (D-)** | - | Signal - Modbus Slave RS485 port |
| **ID** | - | Reference for auto-addressing |
| **GND** | - | Modbus Slave RS485 port ground |
| **A (D+)** | - | Signal + Modbus Slave RS485 port |
| **B (D-)** | - | Signal - Modbus Slave RS485 port |
| **ID** | - | Reference for auto-addressing |
| **FOUT** | Hz | Output in frequency |
| **GND** | - | Output ground in frequency |

| C - Connecting terminal to earth | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **PE** | - | Earthing cable connection |

| D - Alarm relay | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **NO** | N.O. | General fan alarm |
| **COM** | - | Digital output common |

| E - Electrical power supply | | |
|---|---|---|
| **Name** | **Type** | **Description** |
| **L1** | 400 V | Electronic motor power supply |
| **L2** | 400 V | Electronic motor power supply |
| **L3** | 400 V | Electronic motor power supply |

# 3 SySmart SYSTEM USER INTERFACES

## 3.1 VGRAPH USER TERMINAL

### 3.1.1 VGRAPH USER TERMINAL KEYPAD

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

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

### 3.1.2 VGRAPH USER TERMINAL SIGNAL LED

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

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

### 3.1.3 LOCAL OR REMOTE VGRAPH USER TERMINAL DISPLAY

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

The information on unit control is arranged in the following order:

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

2) **MAIN MENU:** This 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 **PARAMETER GROUPS** that can be viewed or edited.

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

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

### 3.1.4 SYMBOLS AND ICONS THAT CAN BE SHOWN ON THE DISPLAY

Various types of icons are used in the software pages. The meanings of the icons are provided in the table below.

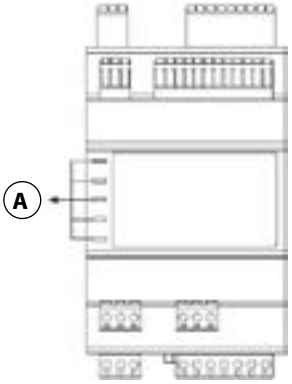
| **Software icons** | | | |
|---|---|---|---|
| **Probes** | | | |
|  |  |  |  |
| Return temperature | Supply temperature | Return humidity | Supply humidity |
| **Components** | | | |
|  |  |  |  |
| Motorised damper | Unit fans | Condenser fans | Dry cooler fans |
|  |  |  |  |
| DC inverter compressor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

| **Statuses** | | | | | |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| Average value | Active alarm | Active key block | Active free cooling | Two sources source 1 | Two sources source 2 |

| **Menu** | | | | | |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| Set-point | Local network | Parameters | Clock | Active alarms | Alarm log |
|  |  |  |  |  |  |
| Operating hours | Information menu | Component status | User Setup | Factory setup | Language setup |

### 3.2 I/O C-PRO3 BASE CONTROL BOARD SIGNAL LEDS

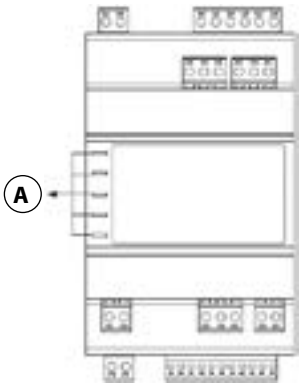
The I/O C-PRO3 base control board features LEDs with special functions as shown in the table below.




| A - Signal LED | | |
|---|---|---|
| **Name** | **Colour** | **Description** |
| **ON** | Green | Power supply LED:<br>• If on, the device is powered<br>• If off, the device is not powered |
| **RUN** | Green | Operation LED:<br>• If on, the application software is running<br>• If off, the application software is not running |
| ⚠ | Red | System alarm LED:<br>• If on, the clock battery is charging or the clock is not set<br>• If it is flashing very slowly, access in external flash memory (USB) is in progress<br>• If it is flashing slowly, a system alarm is in progress with automatic reset<br>• If it is flashing quickly, a system alarm is in progress with manual reset<br>• If it is off, no system alarm is in progress |
| **CAN** | Red | CANbus communication LED:<br>• If on, CANbus communication has not been established<br>• If it is flashing slowly, CANbus communication has communication errors<br>• If it is flashing quickly, CANbus communication is correct<br>• If it is off, there is no CANbus communication |
| **L1** | - | Not used |

### 3.3 EVDRIVE REGULATOR SIGNAL LEDS

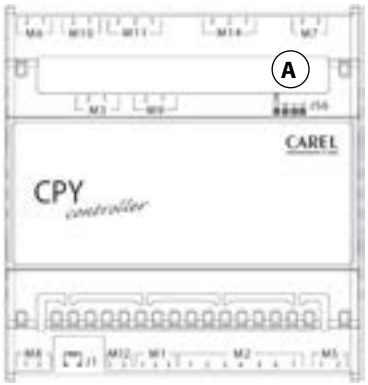
There are LEDs on the EVDrive regulator with special functions as shown in the table below.




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

### 3.4 CPY HUMIDIFIER BOARD SIGNAL LEDS

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

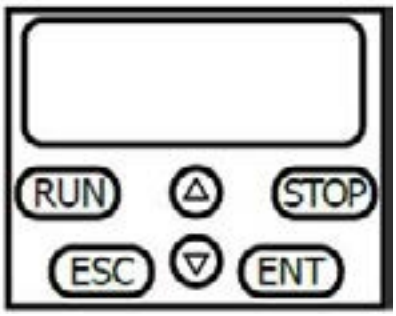



| A - Signal LED | | |
|---|---|---|
| **Name** | **Colour** | **Description** |
|  | Red | Alarm LED:<br>• If it is flashing an alarm is in progress<br>• If it is off, no alarm is in progress |
|  | Yellow | Steam production LED:<br>• If it is on, production is at 100%<br>• If it is flashing, the number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

## 3.5 DC COMPRESSOR INVERTER OPERATOR PANEL

### 3.5.1 AGILE COMPRESSOR INVERTER OPERATOR PANEL

On the Agile inverter there is an operator panel with a screen and 6 keys with special functions, as shown in the table below.




| Key | Name | Description |
|---|---|---|
| RUN | **RUN** | No function. |
| STOP | **STOP** | If pressed, it deletes the active alarms. |
| △ | **UP** | Press to scroll the parameters up; if the cursor is in a setting field, the user can increase the value. |
| ▽ | **DOWN** | Press to scroll the parameters down; if the cursor is in a setting field, the user can decrease the value. |
| ESC | **ESC** | Press to exit the menus and parameter editing procedures. |
| ENT | **ENTER** | Press to edit a parameter and confirm the setting. |

### 3.5.2 ACTIVE COMPRESSOR INVERTER OPERATOR PANEL

On the Active inverter there is an operator panel with a screen and 6 keys with special functions, as shown in the table below.

| Key | Name | Description |
|---|---|---|
|  | **RUN** | No function. |
|  | **STOP** | If pressed, it deletes the active alarms. |
|  | **UP** | Press to scroll the parameters up; if the cursor is in a setting field, the user can increase the value. |
|  | **DOWN** | Press to scroll the parameters down; if the cursor is in a setting field, the user can decrease the value. |
|  | **ESC** | Press to exit the menus and parameter editing procedures. |
|  | **ENTER** | Press to edit a parameter and confirm the setting. |
|  | **FUNCTION** | No function. |

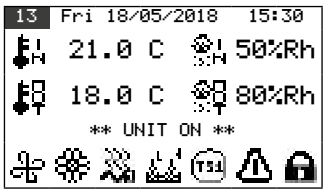
# 4 MAIN BRANCH OF THE REGULATION SOFTWARE

## 4.1 MANAGEMENT OF THE MAIN BRANCH OF THE REGULATION SOFTWARE

This group of pages represents the primary view of the regulation software. The pages are accessed by simply pressing the **LEFT** ( ) and **RIGHT** ( ) keys. Parameters relative to components that are not installed will not be displayed, accordingly some pages might not be visible.

### 4.1.1 MAIN SCREEN

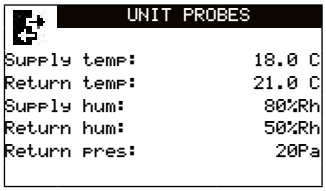
This page represents the view of the primary software. The following can be displayed on this page:




- The unit's network address.
- The set time and date.
- Return temperature (average value, if active).
- Supply temperature (average value, if active).
- Return humidity, if any (average value, if active).
- Supply humidity, if any (average value, if active).
- The status of the unit.
- The presence of any active alarms.
- The icons of the main active components (see previous chapter).

### 4.1.2 UNIT PROBES

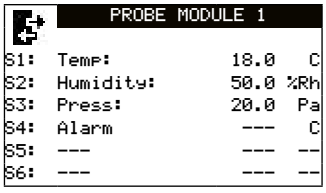
In local network units with the calculation of average values, the actual values of the probes can be viewed on a specific page. The following can be displayed on this page:

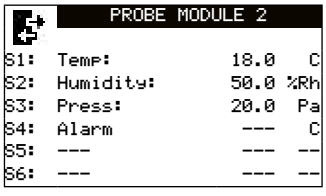


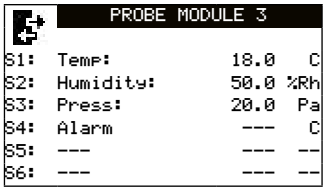

- The actual value of the supply temperature.
- The actual value of the return temperature.
- The actual value of the supply humidity (if present).
- The actual value of the return humidity (if present).
- The actual value of the supply air pressure in Pa.

### 4.1.3 PROBE MODULE

Up to 3 remote probe modules can be connected to the units and the values of the connected probes can be viewed on specific pages. The following can be displayed on this page:



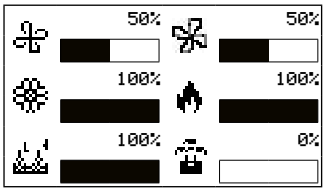

- The type of probe configured for each input
- The value measured for each probe
- Any alarm status of a connected probe

The probes may have the following statuses:

- --- : No probe
- Temperature: Temperature probe
- Humidity: Humidity probe
- Pressure: Pressure probe
- Alarm: Alarm on probe

### 4.1.4 PROGRESS BAR

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

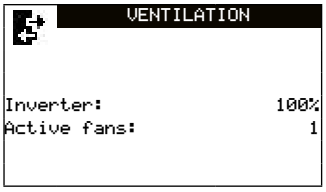



- The status of the supply fans.
- The status of the condenser fans or dry coolers (if any).
- The status of the cooling components.
- The status of the heating components (if present).
- Dehumidification status (if present).
- Humidification status (if present).

### 4.1.5 VENTILATION

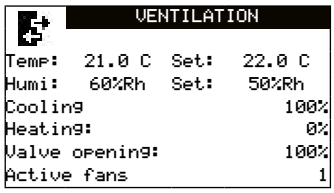
The ventilation status pages show different views depending on the set type of regulation.

If fixed speed regulation is on, the following will be displayed:



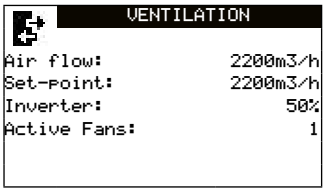

- Fan speed in percentage.
- Number of active fans.

If regulation is running in proportion to the cooling or heating regulation, the following will be displayed:



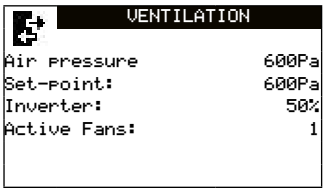

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if there is humidity control).
- The cooling and heating demand.
- The fan speed demand in percentage.
- Number of active fans.

If constant air flow regulation is on, the following will be displayed:



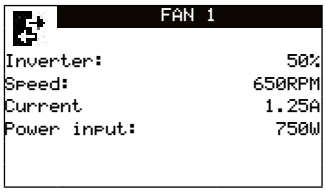

- The current air flow rate in $m^3/h$.
- The air flow rate set-point in $m^3/h$.
- The fan speed demand in percentage.
- Number of active fans.

If constant air pressure regulation is on, the following will be displayed:




- The current air pressure in Pa.
- The air pressure set-point in Pa.
- The fan speed demand in percentage.
- Number of active fans.

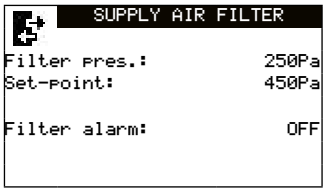
The operating values of each fan in the unit will also be displayed:




- Fan speed in percentage.
- Fan speed in revs per minute (RPM).
- Absorbed current in Ampere.
- Used electrical power in Watt.

### 4.1.6 DIRTY FILTER MANAGEMENT

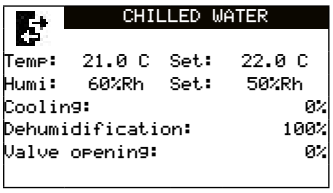
If the unit comes with an analogue air filter differential pressure sensor, the following will be displayed:




- Air filter differential pressure.
- Filter clogging alarm set-point.
- Dirty filter alarm status.

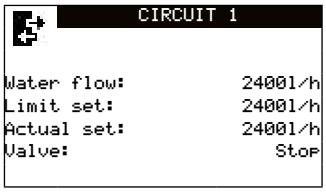
### 4.1.7 CHILLED WATER

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



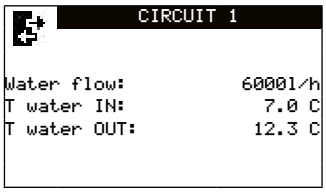

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if there is humidity control).
- The cooling demand.
- The dehumidification demand (if there is humidity control).
- Water valve opening percentage.

If there is water flow rate control, it will be possible to view:



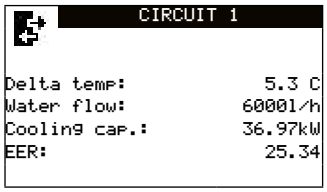

- Current water flow rate in l/h.
- The maximum set water flow rate limit, in l/h.
- The current water flow rate set-point, in l/h.
- The valve regulation status.

If there are inlet and outlet water temperature probes and/or water flow rate measuring device, it will be possible to view:




- The current water flow rate, in l/h.
- The inlet water temperature value.
- The outlet water temperature value.

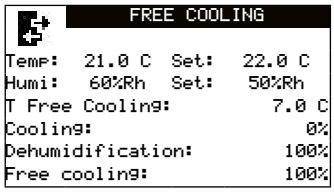
If there is a cooling capacity detection system, it will be possible to view:




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

### 4.1.8 FREE COOLING

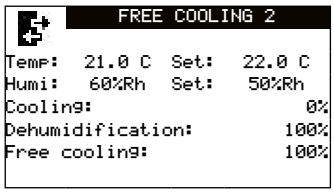
On free cooling units there will be a page displaying the status of the free cooling circuit. The free cooling page will display:




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

### 4.1.9 FREE COOLING - CHILLED WATER SECONDARY CIRCUIT

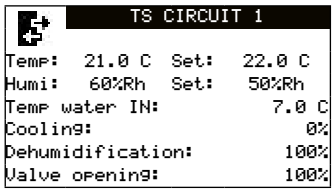
The free cooling system's secondary water circuit page will display:




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

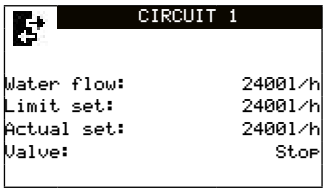
### 4.1.10 TWO SOURCES - PRIMARY WATER CIRCUIT

Two sources units with primary water circuit will display a primary circuit status page. The primary water circuit page will display:



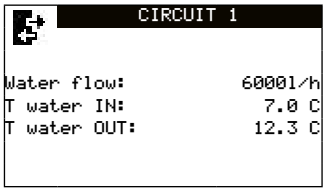

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if there is humidity control).
- Inlet water temperature.
- The cooling demand.
- The dehumidification demand (if there is humidity control).
- Water valve opening percentage.

If there is water flow rate control, it will be possible to view:



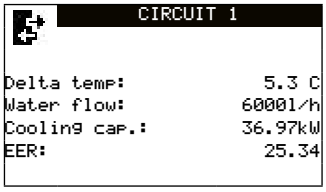

- Current water flow rate in l/h.
- The maximum set water flow rate limit, in l/h.
- Current water flow set-point, in l/h.
- The valve regulation status.

If there are inlet and outlet water temperature probes and/or water flow rate measuring device, it will be possible to view:




- The current water flow rate, in l/h.
- The inlet water temperature value.
- The outlet water temperature value.

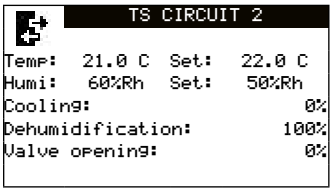
If there is a cooling capacity detection system, it will be possible to view:




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

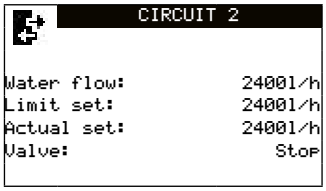
### 4.1.11 TWO SOURCES - SECONDARY WATER CIRCUIT

Two sources units with secondary water circuit will display:



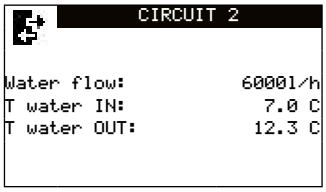

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if there is humidity control).
- The cooling demand.
- The dehumidification demand (if there is humidity control).
- Water valve opening percentage.

If there is water flow rate control, it will be possible to view:



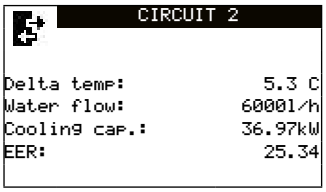

- Current water flow rate in l/h.
- The maximum set water flow rate limit, in l/h.
- Current water flow set-point, in l/h.
- The valve regulation status.

If there are inlet and outlet water temperature probes and/or water flow rate measuring device, it will be possible to view:




- Current water flow rate in l/h.
- The inlet water temperature value.
- The outlet water temperature value.

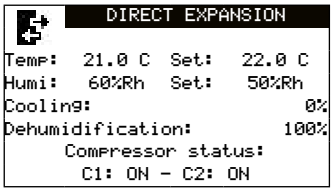
If there is a cooling capacity detection system, it will be possible to view:




- 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.

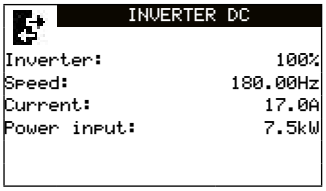
### 4.1.12 DIRECT EXPANSION

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:



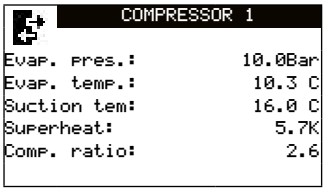

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if there is humidity control).
- The cooling demand.
- The dehumidification demand (if there is humidity control).
- Activation status of the compressors.

If there is a compressor inverter, it will be possible to view:



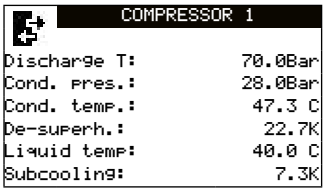

- Compressor speed in percentage.
- Compressor speed in Hertz.
- The current absorbed by the compressor in Ampere.
- The compressor's electrical power in kW.

On the cooling circuit (low pressure) operating page, it will possible to view:



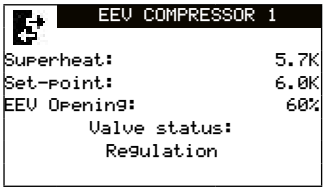

- Current evaporation pressure.
- Current evaporation temperature.
- Current suction temperature.
- Current superheating.
- Current compression ratio

On the cooling circuit (high pressure) operating page, it will possible to view:




- Current discharge temperature.
- Current condensation pressure.
- Current condensation temperature.
- Current de-superheating.
- Current liquid temperature.
- Current sub-cooling.

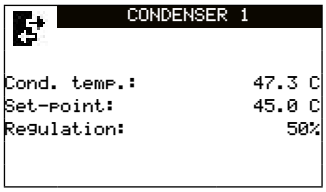
On the expansion valve operating page, it will possible to view:




- Current superheating.
- Current superheating set-point.
- Valve opening in percentage.
- Valve regulation status.

### 4.1.13 CONDENSER REGULATION

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

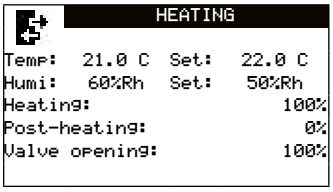



- Current condensation temperature.
- The current condensation set-point.
- The regulation demand in percentage.

### 4.1.14 HEATING

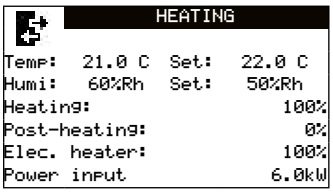
The heating status pages may show different views depending on the type of accessories the unit is fitted with.

If there is a water heating valve, it will be possible to view:



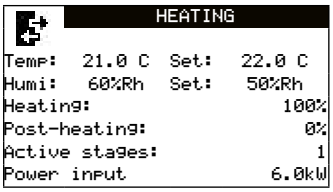

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if there is humidity control).
- The heating demand.
- The post-heating demand (if there is humidity control).
- The heating circuit water valve opening percentage.

If there is a modulating heating electric coil, it will be possible to view:




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

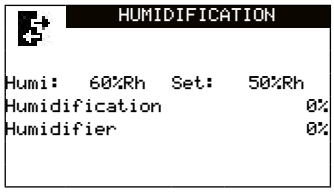
If there is a stage-heating electric coil, it will be possible to view:




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

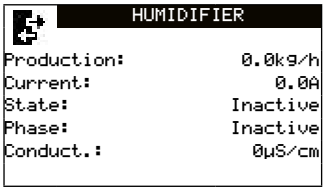
### 4.1.15 HUMIDIFICATION

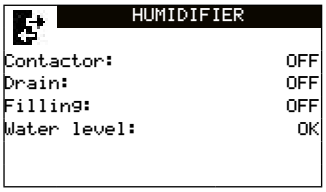
In units with humidification system, the following information will be displayed:




- Controlled humidity and relative set-point.
- The humidification demand.
- The humidifier operation percentage.

Unit with internal submerged electrode humidifier:

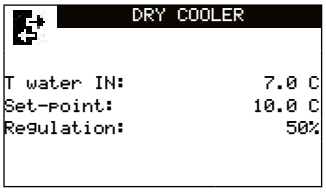



- The requested steam production.
- The current absorbed by the humidifier in Ampere.
- The humidifier operation status.
- The humidification regulation phase.
- Conductivity of the humidifier water in µS/cm.
- The humidifier power contactor status.
- The humidifier discharge valve status.
- The humidifier filling valve status.
- The water level in the humidifier cylinder.

### 4.1.16 DRY COOLER

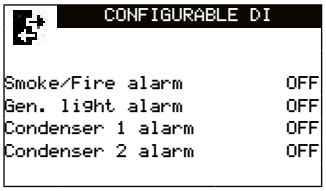
In units with dry cooler control system, the following information will be displayed:




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

### 4.1.17 CONFIGURABLE DIGITAL INPUTS

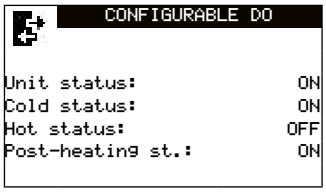
The following information will be displayed depending on configurable digital input settings:




- 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.

### 4.1.18 CONFIGURABLE DIGITAL OUTPUTS

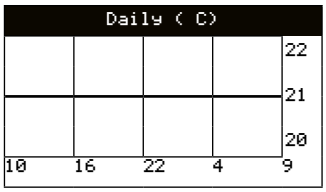
The following information will be displayed depending on the configurable digital output settings:




- 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.

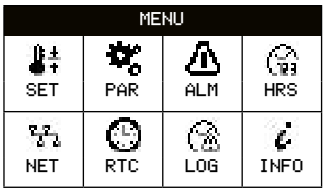
### 4.1.19 GRAPHS

These pages will display graphs related to:




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

# 5 MAIN MENU OF THE REGULATION SOFTWARE

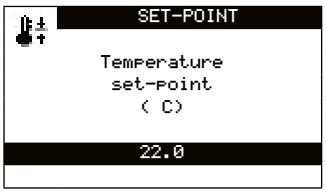



To access the **MAIN MENU** simply press and hold down the **ENTER** key ( ).

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 selected menu.

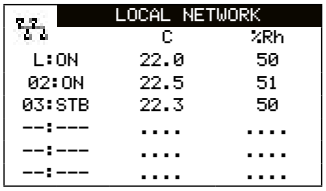
## 5.1 SET - SET-POINT




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 ambient conditions.

## 5.2 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 are you 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.

In addition to the status, for each unit it will be possible to view the current temperature and humidity value (if applicable). The displayed value refers to the controlled temperature and humidity.

## 5.3 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 regulation and operation parameters.
- **FACTORY SETUP:** Unit operating parameter configuration.
- **LANGUAGE:** To change the software language.
- **DELETE LOG:** To clear the alarm log.
- **DELETE HOURS:** To clear the hours of operation.

## 5.4 RTC - CLOCK


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

## 5.5 ALM - ACTIVE ALARMS

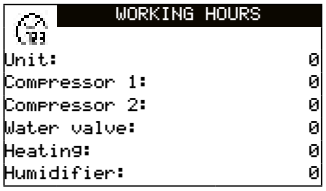

From the **ALM - Active alarms ( )** menu it is possible to view the alarms that are active on the unit: Access this menu by holding down the **ALARM** ( ) key.

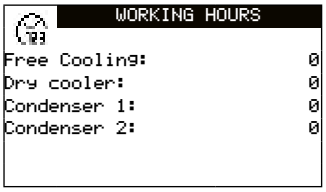
## 5.6 LOG - ALARMS LOG


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

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

## 5.7 HOURS - WORKING HOURS

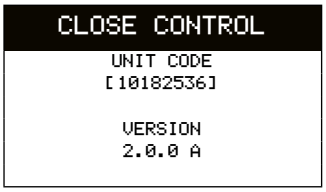



Within the **HOURS - Working hours ( )** menu it is possible to display the operating hours of the following unit components:

- **Working hours:** This tells you the total hours of unit operation (Unit ON).
- **Compressor 1:** This tells you the total hours of operation of compressor 1.
- **Compressor 2:** This tells you the total hours of operation of compressor 2.
- **Water valve:** This tells you the total operating hours of the chilled water valve.
- **Heating:** This tells you the total hours of heating operation.
- **Humidifier:** This tells you the total hours of humidifier operation.
- **Free Cooling:** This tells you the total hours of operation of the free cooling system.
- **Dry cooler:** This tells you the total hours of operation of the dry cooler.
- **Condenser 1:** This tells you the total hours of operation of condenser 1.
- **Condenser 2:** This tells you the total hours of operation of condenser 2.

## 5.8 INFO - INFORMATION




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

# 6 CONTROL SOFTWARE PARAMETERS AND THEIR MODIFICATION

## 6.1 ACCESS TO PASSWORD-PROTECTED MENUS

To access the parameters for the **PROTECTED MENU** (**PAR - Parameters** menu) in the **PARAMETERS MENU,** it is necessary to enter the correct**LOGIN** password:

- **Default password (Editable) USER PARAMETERS: 0123**
- **Default password (Editable) FACTORY PARAMETERS: 0694**

### 6.1.1 LOGIN PASSWORD ENTRY

To enter the password proceed as follows:

- Press **ENTER** ( ) to enable password editing. The field will start flashing and the first digit of the password will be selected.
- The selected digit can be changed using **LEFT** ( ) and **RIGHT** ( ) keys.
- Use the **UP** ( ) and **DOWN** ( ) keys to change the password digit.
- Press **ENTER** ( ) to store the entered value and go to the next digit.
- To exit password editing without saving, simply press **ESC** ( ).


Password entry:

- **Default password (Editable) USER PARAMETERS: 0123**
- **Default password (Editable) FACTORY PARAMETERS: 0694**

## 6.2 ACCESS TO REGULATION PARAMETER MENUS

Proceed as follows to access the regulation software parameters:

- 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 names describe the functions of the parameters they contain.

To access **PARAMETER** editing for each group, just select the **GROUP** you wish to access with the **UP** ( ) and **DOWN**( ) keys and press **ENTER** ( ) to access the **GROUP**.


- **USER SETUP:** Modification of the unit regulation and operation parameters.
- **FACTORY SETUP:** Unit operating parameter configuration.
- **LANGUAGE:** To change the software language.
- **DELETE LOG:** To clear the alarm log.
- **DELETE HOURS:** To clear the hours of operation.

## 6.3 MODIFYING THE REGULATION PARAMETERS

Proceed as follows to modify the regulation software parameters:

- Select the **PARAMETER** you wish to change with the **UP** ( ) and **DOWN** ( ) keys
- Press **ENTER** ( ) to enable the parameter change; the parameter starts flashing.
- 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** ( ).


- **Example of configuration parameter:** Language configuration

## 6.4 EXITING THE GROUPS, MENUS AND MAIN MENU

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

# 7 UNIT USE

## 7.1 REGULATION SOFTWARE LANGUAGE

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

## 7.2 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 (Factory Setup - Key lock) 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)** **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 ( ). When the keys are locked it will **NOT** be possible to:

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

It will nevertheless be possible to:

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

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 would be the **USER** password.

## 7.3 TURNING THE UNIT ON

The unit may be switched on and off by pressing the **ON/OFF** ( esc ) 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 (Factory set-up - Local network), it will be possible to simultaneously switch all the units in a local network on or off.

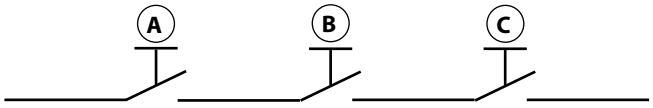
When it is on (**Unit ON**), the unit may be controlled remotely from the digital **OFF input** and from the supervision/BMS Modbus system.

### 7.3.1 OFF FROM REMOTE AND FROM SUPERVISION/BMS MODBUS SYSTEM

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

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/BMS Modbus system.

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




**A On/Off from display**
**B Off from remote**
**C Off from supervision/BMS Modbus system**

**ATTENTION!**

**If the supervision/BMS system sets the unit at OFF, and it is not possible to restore the ON status (for example due to lack of communication), the OFF condition can be reset by interrupting the power supply of the unit 3 consecutive times in 1 minute.**

### 7.3.2 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 an outage on the power supply line, when it is restored SySmart will resume the operation that was running prior to the problem.

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

### 7.3.3 POWER SUPPLY FAILURE ALARM

The control software features an automatic notification function for shut-down in case of power supply failure. If there is a power outage, when the power comes back on SySmart will display an alarm to notify the user of the problem.

From the "**No electrical power supply alarm**" (Factory setup - Alarm management) parameter it is possible to enable the alarm for re-start due to power outage.

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

1) **No:** No alarm is generated in the event of restart due to power failure.
2) **Unit ON**: The alarm will be generated at the next SySmart restart only if the unit was running (**Unit ON**). If the unit was off (**Unit OFF**), no alarm will be generated.
3) **Yes:** The alarm will **ALWAYS** be generated at the next SySmart restart.

When it is configured, a SySmart restart following a power failure will generate the "**Electrical power supply failure alarm**" to alert the user to the problem.

### 7.3.4 MAINTENANCE SYSTEM OF POWER TO UPS - ULTRACAP

The regulation software features a function that keeps the regulation active in case of a power outage, of the control micro-processor only, through a preferential line (UPS).

The Ultracap function (from the word Ultracapacitor) freezes unit regulation as long as the main power supply line is down. When Ultracap is enabled, the unit does not generate alarms relative to inactive components (fans, inverter compressors), perfectly maintaining the rest of the regulation.

To enable this function you need to configure one of the configurable digital inputs to manage Ultracap mode activation.

From the "**Configurable input (1-2-3-4)**" (Factory setup - Digital inputs) parameter it is possible to configure "**Ultracap**" management (see chapters below for more information).

## 7.4 MOTORISED DAMPER CONTROL

The regulation software is able to control motorised dampers, with the function to isolate the unit from the environment when it is switched off.

When it is switched on (Unit ON) SySmart will start opening the dampers. When the digital damper status input (ID2) is **OPEN (Damper open)** the fans will start.

With "**Damper status alarm delay**" (Factory set-up - Alarm management) parameter it is possible to set an alarm trigger delay at switch-on, to allow the motor to open the damper.

If the digital damper status input is **CLOSED (Damper closed),** at the end of the opening periods or during normal unit operation, the "**Motorised damper status alarm**" will be triggered, stopping unit operation.

## 7.5 AIR SUPPLY FAN REGULATION

SySmart has the possibility of controlling one or more air supply fans with various types of control. The type of control is connected to the fan's features and the environment requiring climate-control.

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

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

1) **On-off:** The fans will be controlled by a digital output.
2) **Analogue:** The fans will be controlled by a digital output and a 0-10V analogue output.
3) **Modbus EBM 3PH:** This controls EBM PAPST fans with three-phase power supply through Modbus Master communication protocol.
4) **Modbus EBM 1PH:** This controls EBM PAPST fans with single-phase power supply through Modbus Master communication protocol.
5) **Modbus ZIEHL 3PH:** This controls ZIEHL ABEGG fans with three-phase power supply through Modbus Master communication protocol.
6) **Modbus ZIEHL 1PH:** This controls ZIEHL ABEGG fans with single-phase power supply through Modbus Master communication protocol.

With the "**Regulation type**" parameter (Factory Setup - Ventilation) it is possible to configure fan regulation choosing from the following types:

1) **Set speed:** The fans will be adjusted to a set operating speed.
2) **Cold/Hot reg.:** The fans will the adjusted to variable operating speeds proportionally to the cooling or heating demand.
3) **Constant flow rate:** The fans will be adjusted to variable operating speeds based on the air flow, so as to keep it constant.
4) **Constant pressure:** The fans will be adjusted to variable operating speeds based on the ambient air pressure, so as to keep it constant.

### 7.5.1 FIXED SPEED MODULATING FAN REGULATION

The control software is able to manage fan regulation by a fixed speed value, which is configured through the parameters.

With the "**Regulation type**" parameter (Factory Setup - Ventilation) it is possible to configure the fan regulation by setting a fixed operating speed.

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

**ATTENTION:** Setting the speed at a value below 30% is not recommended because this might prevent correct ambient temperature and humidity readings. With direct expansion and electric coil units the fan speed must be high enough to guarantee optimal operation of the components.


**A Maximum speed (Factory setup - Ventilation)**

### 7.5.2 REGULATION OF MODULATING FANS PROPORTIONALLY TO THE COOLING OR HEATING DEMAND

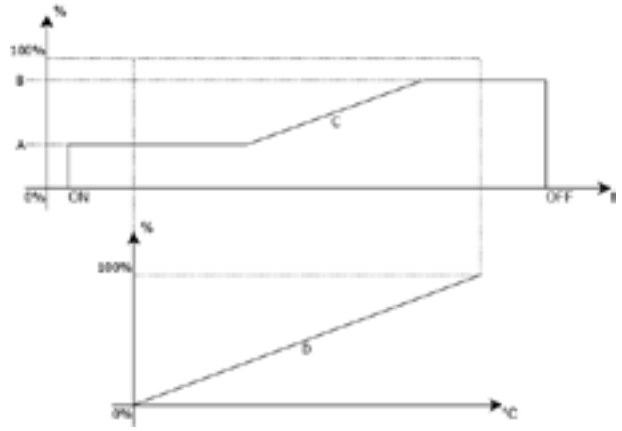
The control software is able to manage fan regulation at a speed value that is proportional to the cooling or heating demand. This can result in significant energy savings and a reduction in noise levels, particularly with partial loads.

With the "**Regulation type**" parameter (Factory Setup - Ventilation) it is possible to configure the fan regulation so as to modulate the speed according to the cooling or heating demand.

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

With the "**Maximum speed**" parameter (Factory Setup - Ventilation) it is possible to configure the maximum operation speed that the fan can regulate at.

**ATTENTION:** Setting the minimum speed at a value below 30% is not recommended because this might prevent correct ambient temperature and humidity reading. With direct expansion units with electric coils the fan speed will be maintained at maximum speed until the component switches off, in order to guarantee optimal operation of the components.

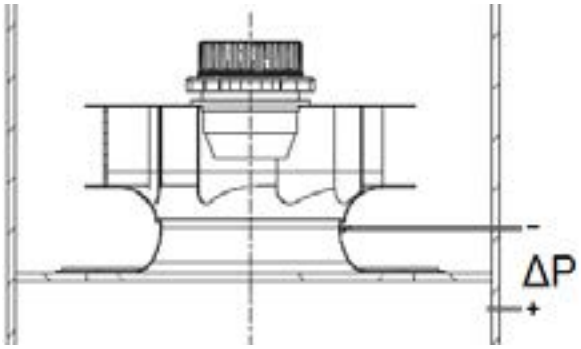



**A Minimum speed (Factory setup - Ventilation)**
**B Maximum speed (Factory setup - Ventilation)**
**C Fan modulation area**
**D Cooling or heating demand**

### 7.5.3 REGULATION OF MODULATING FANS AT CONSTANT AIR FLOW

With the "**Regulation type**" parameter (Factory setup - Ventilation) 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 "**Flow set-point**" (User setup - Ventilation).

In order to calculate air flow rate, the unit requires an analogue differential air pressure probe installed inside the machine and connected to the fan nozzle.




With the "**Differential air pressure**" parameter (Factory setup - Probes) it is possible to configure the presence of the analogue differential air pressure probe.

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

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

Where:

- **V** is the flow rate (volume) in $m^3/h$
- **ΔP** is the measured pressure difference
- **K** is the fan's characteristic coefficient, the "**Air flow calculation coefficient**" parameter (Factory set-up - Ventilation)

Fan speed will be increased or decreased, in order to reach the set-point. A 100 $m^3/h$ dead zone makes it possible to stabilise fan speed.

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

With the "**Maximum speed**" parameter (Factory Setup - Ventilation) it is possible to configure the maximum operation speed that the fan can regulate at.

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

### 7.5.4 REGULATION OF MODULATING FANS AT CONSTANT PRESSURE

With the "**Regulation type**" parameter (Factory setup - Ventilation) it is possible to configure fan regulation so as to modulate the speed according to the ambient pressure, in order to keep it constant with respect to the "**Pressure set-point**" parameter (User setup - Ventilation).

In order to calculate air pressure, the unit requires an analogue differential air pressure probe installed inside the machine.

With the "**Differential air pressure**" parameter (Factory setup - Probes) it is possible to configure the presence of the analogue differential air pressure probe.

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

With the "**Maximum speed**" parameter (Factory Setup - Ventilation) it is possible to configure the maximum operation speed that the fan can regulate at.

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

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

### 7.5.5 STARTING SPEED CONTROL

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

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

With the "**Start-up time**" parameter (Factory set-up - Ventilation) it is possible to configure the duration of the fans' startup period.

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

### 7.5.6 OPERATING SPEED SAVING SYSTEM

In units with constant air flow or constant air pressure regulation, in order to further optimise achieving optimal operating conditions, the control algorithm has an **operating speed saving system**.

As soon as the system reaches the set-point, it saves the speed demand value that made it possible to achieve the set-point. The next time the fans start-up again, they will start up at this saved value.

If start-up speed management is set, the fans will start up at the saved value, ignoring the start-up speed parameter.

If there is no saved value, or if the set-point was never reached, the fans will observe the normal regulation algorithm.

### 7.5.7 FAN ALARM MANAGEMENT

If the fans are controlled via digital 0-10V or On/Off signal, the alarm will be managed via the relevant digital input. If there is an alarm on one or more fans, SySmart will trigger the "**General supply fans alarm**", which will stop unit operation

If the fans are controlled via Modbus connection, SySmart 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)**" specifying the nature of the problem. The following alarm causes are possible:

- **Communication down:** SySmart constantly monitors correct communication with the fans' control module in order to assure their correct operation.
- **No phase alarm:** The fan control electronics constantly check for motor power supply. The check is carried out on every individual motor phase.
- **High inverter temperature:** The fan control electronics constantly check the control module temperature in order to prevent damage due to excessively high temperatures.
- **High motor temperature:** The fan control electronics constantly check the motor temperature in order to prevent damage due to excessively high temperatures.
- **Inverter error:** The fan control electronics constantly check control module status and report any damage.
- **Motor overload:** The fan control electronics constantly check the motor status and report any overload.
- **Low voltage:** The fan control electronics constantly check the control module's status and report any DC power supply reduction.
- **No master-slave communication:** The fan control electronics constantly check the communication status with the slave fans and report any communication failure.
- **Hall sensor error:** The fan control electronics constantly check the status of the Hall sensor and report any damage.

### 7.5.8 ANALOGUE DIFFERENTIAL AIR PRESSURE PROBE ALARM

If the unit is fitted with analogue differential air pressure probe for fan control, said pressure will be constantly monitored.

If the analogue differential air pressure probe is broken or disconnected SySmart will trigger the "**Differential air pressure probe alarm**".

If the analogue differential air pressure probe is broken or disconnected SySmart will stop speed regulation at the last value recorded by the set-point. If the set-point has never been reached the speed is blocked at 50% or at start-up speed, if set.

## 7.6 TEMPERATURE REGULATION

### 7.6.1 TEMPERATURE CONTROL TYPE

All units are fitted with two operating temperature reading 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 setup - Temperature) it is possible to configure which probe is designated for 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:** SySmart will use the return temperature value to regulate the temperature. This setting is ideal for rooms where the thermal loads are uniformly distributed.

- **Supply temperature regulation:** SySmart will use the supply temperature value to regulate the temperature. This setting is ideal for rooms where the thermal loads are not uniform, and the return temperature might not be correct.

### 7.6.2 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 (Factory setup - Set-point limits) it is possible to configure the minimum setting limit of the temperature set-point.

With the "**Maximum temperature set-point limit**" parameter (Factory setup - Set-point limits) it is possible to configure the maximum setting limit of the temperature set-point.

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

### 7.6.3 TEMPERATURE REGULATION DEAD ZONE SETTING

In order to prevent continuous fluctuations in the cooling or heating demand 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 (Factory setup - Dead zone) 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.

### 7.6.4 PROPORTIONAL TEMPERATURE REGULATION

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

This type of regulation is ideal in cases where the "force" of actuators should be directly proportional to the "distance" of the regulation value 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 **regulation error in full production**, i.e. a deviation of the temperature from the set-point. The extent of the deviation will vary according to the correctness of the unit's sizing with respect to the system's thermal load: the more over-sized the unit, the greater the deviation in full production.

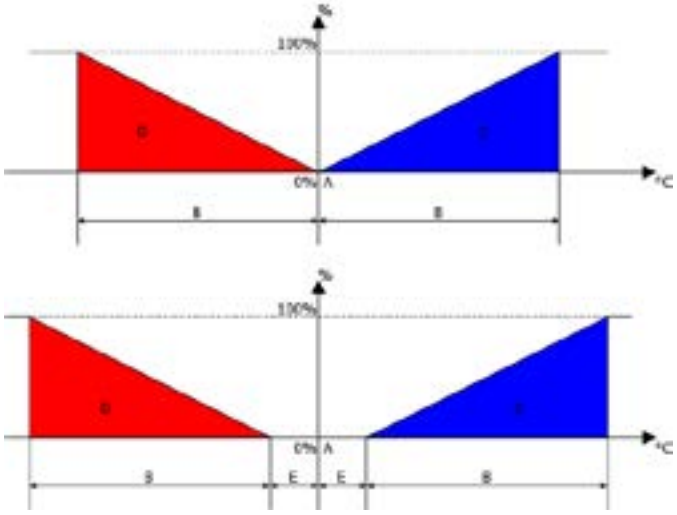
The control output of the components is therefore regulated according to the following function:

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

Where:

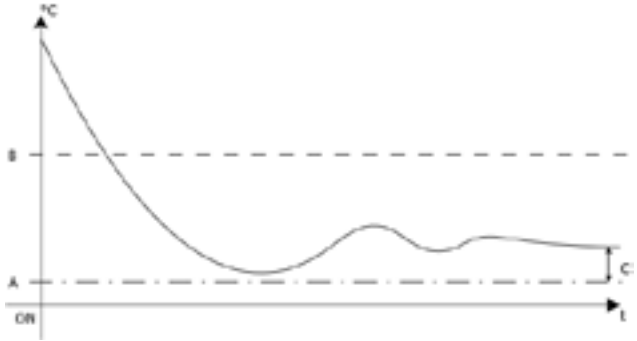
- **Out$_p$** is the proportional error.
- **Bp** is the "**Proportional band**" parameter (User setup - Temperature)
- **In** is the controlled temperature value
- **Set** is the "**Temperature set-point**" parameter (Main menu - Set-point)

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




**A** **Temperature set-point (Main menu - Set-point)**
**B** **Proportional band (User setup - Temperature regulation)**
**C** **Cooling regulation**
**D** **Heating regulation**
**E** **Temperature dead zone (Factory setup - 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** **Temperature set-point (Main menu - Set-point)**
**B** **Proportional band (User setup - Temperature regulation)**
**C** **Regulation error at full production**

### 7.6.5 PROPORTIONAL + INTEGRAL TEMPERATURE REGULATION

With the "**Regulation type**" parameter (User setup - Temperature) 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 **Regulation error in full production**, 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:

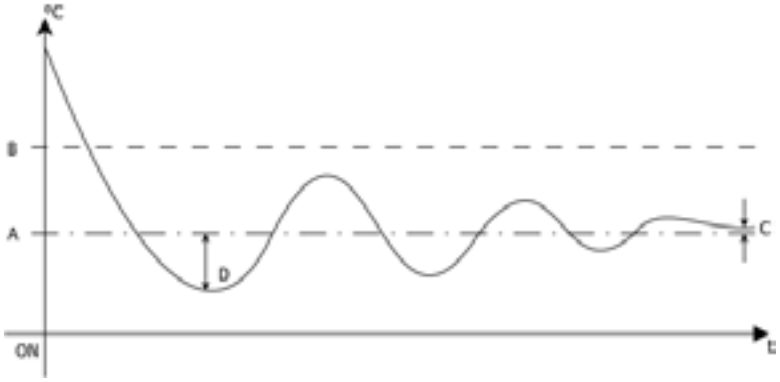
$$Out_{pi} = Out_p + \frac{100}{Bp * Ti} \int (In - Set)\, dt$$

Where:

- **$Out_{pi}$** is the proportional + Integral error
- **$Out_p$** is the proportional error (previous chapter)
- **Bp** is the "**Proportional band**" parameter (User setup - Temperature)
- **Ti** is the "**Integration time**" parameter (User setup - Temperature)
- **In** is the controlled temperature value
- **Set** is the "**Temperature set-point**" parameter (Main menu - Set-point)

Unlike Proportional regulation, where the control output is 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 it is 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** **Temperature set-point (Main menu - Set-point)**
**B** **Proportional band (User setup - Temperature regulation)**
**C** **Regulation error at full production**
**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 started again.

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

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

### 7.6.6 PROPORTIONAL + INTEGRAL + DERIVATIVE TEMPERATURE REGULATION

With the "**Regulation type**" parameter (User setup - Temperature) it is possible to configure the "**PID**" (Proportional + Integral + Derivative) regulation type for the controlled temperature.

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

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

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

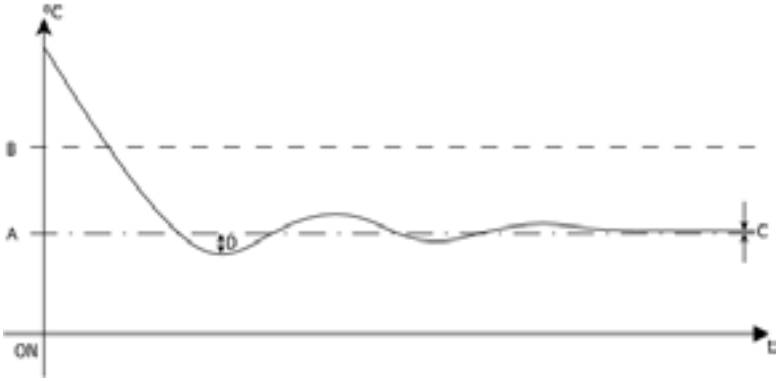
$$Out_{pid} = Out_p + Out_{pi} + \frac{100}{Bp} * Td \ \frac{d(In - Set)}{dt}$$

Where:

- **$Out_{pid}$** is the proportional + Integral + derivative error
- **$Out_p$** is the proportional error (previous chapter)
- **$Out_{pi}$** is the proportional + Integral error (previous chapter)
- **Bp** is the "**Proportional band**" parameter (User setup - Temperature)
- **Td** is the "**Derivation time**" parameter (User setup - Temperature)
- **In** is the controlled temperature value
- **Set** is the "**Temperature set-point**" parameter (Main menu - Set-point)

As with Proportional + Integral regulation, the control output in the Proportional + integral + Derivative regulation will tend to undergo an **Over-regulation**. 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 it is close to 0%.

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




**A** **Temperature set-point (Main menu - Set-point)**
**B** **Proportional band (User setup - Temperature regulation)**
**C** **Regulation error at full production**
**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 started again.

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

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

### 7.6.7 HIGH AND LOW TEMPERATURE ALARMS

With "**High temperature alarm offset**" (User setup - Temperature) and "**Low temperature alarm offset**" (User setup - Temperature regulation) parameters 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 does not pose a shutdown problem for the unit that will continue operating regularly. With the "**Temperature and humidity alarms delay**" parameter (Factory setup - Alarms management) 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)
- **$Offset_{Lt}$** is the "**Low temperature alarm offset**" parameter (User setup - Temperature)

### 7.6.8 AIR TEMPERATURE PROBES ALARM MANAGEMENT

If the return temperature probe is broken or disconnected SySmart will trigger the "**Broken return temperature probe alarm**".

In the same way, in the event the supply temperature probe should be broken or disconnected SySmart will trigger the "**Broken supply temperature probe alarm**".

In order not to interrupt temperature regulation, SySmart will use the working sensor as the valid value. In the event both probes should be broken, temperature regulation will stop.

## 7.7 LIMIT TEMPERATURE REGULATION

### 7.7.1 LIMIT TEMPERATURE

With the "**Regulation sensor**" parameter (User setup - Temperature) it is possible to configure which probe is designated for 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:** If the return temperature is controlled, limits to the supply temperature may be set in order to ensure the intake air into the room is neither too hot nor too cold.

- **Return limit temperature:** If the supply temperature is controlled, limits for the return temperature may be set in order to ensure that the air in the room is neither too hot nor too cold.

### 7.7.2 HIGH AND LOW LIMIT TEMPERATURE MANAGEMENT

With the "**Limit temperature high alarm limit**" (User setup - Limit temperature) and "**Limit temperature low alarm limit**" (User setup - Temperature limit) parameters 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 does not pose a shutdown problem for the unit that will continue operating regularly. With the "**Temperature and humidity alarms delay**" parameter (Factory setup - Alarms) 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:

- $\mathbf{Al_{Hlt}}$ is the high limit temperature alarm
- $\mathbf{Al_{Llt}}$ is the low limit temperature alarm
- **In** is the limit temperature value
- $\mathbf{Limit_{Hlt}}$ is the "**Limit temperature high alarm limit**" parameter (User setup - Limit temperature)
- $\mathbf{Limit_{Llt}}$ is the "**Limit temperature low alarm limit**" parameter (User setup - Limit temperature)

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 setup - Limit temperature) and "**Low limit temperature management**" (User setup - Limit temperature) it is possible to configure the following actions:

- **Alarm only:** When the thresholds are exceeded a warning alarm is triggered.

- **Component stop**: When the thresholds are exceeded 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.

- **Reduction**: Upon exceeding the thresholds, the regulation signal of the regulation components is reduced proportionally to maintain the limit temperature within 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.

## 7.8 HUMIDITY REGULATION

### 7.8.1 SUPPLY AND RETURN HUMIDITY PROBE CONFIGURATION

The units may be fitted with a return humidity probe, "**Return humidity**" parameter (Factory setup - Probes), that lets you view the return air humidity reading.

The units may also be fitted with a return humidity probe, "**Supply humidity**" (Factory setup - Probes) parameter, that lets you view the supply air humidity reading.

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

### 7.8.2 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 (Factory setup - Set-point limits) it is possible to configure the minimum setting limit of the humidity set-point.

With the "**Maximum humidity set-point limit**" parameter (Factory setup - Set-point limits) it is possible to configure the maximum setting limit of the humidity set-point.

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

### 7.8.3 RETURN HUMIDITY REGULATION DEAD ZONE SETTING

In order to prevent continuous fluctuations in the dehumidification and humidification demand 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 (Factory setup - Dead zone) 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.

### 7.8.4 PROPORTIONAL DEHUMIDIFICATION REGULATION

With the "**Dehumidification**" parameter (Factory setup - Humidity) it is possible to enable dehumidification mode. Dehumidification is regulated with the Proportional system.

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

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

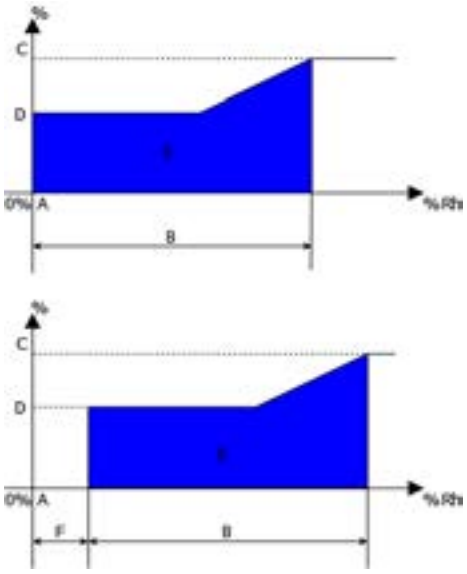
Where:

- **Out$_p$** is the proportional error.
- **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 the "**Dehumidification trigger threshold**" parameter (Factory setup - Humidity).

With the "**Minimum dehumidification limit**" parameter (Factory setup - Humidity) it will be possible to limit regulation to prevent the demand from being too low, and therefore the 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 demand.

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




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

### 7.8.5 PARTIAL DEHUMIDIFICATION

With the "**Partial dehumidification**" parameter (Factory setup - Humidity) it is possible to inhibit activation of both compressors in dehumidification.

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

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

### 7.8.6 DEHUMIDIFICATION LOCK

With the "**Dehumidification lock offset**" parameter (Factory setup - Humidity) it is possible to enter a temperature offset which, when exceeded, interrupts the dehumidification demand to prevent the ambient temperature from dropping too low.

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

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

Dehumidification lock triggering is defined by the following formula:

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

Where:

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

### 7.8.7 HUMIDIFIER PRESENCE SETTING

With the "**Humidifier**" parameter (Factory setup - Humidity) 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 an 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 0-10V analogue signal.

### 7.8.8 HUMIDIFICATION PRODUCTION PERCENTAGE

With the "**Humidification production percentage**" parameter (Factory setup - Humidity) 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.

### 7.8.9 STEAM PRODUCTION DURING COOLING

With the "**Joint humidification and cooling**" parameter (Factory setup - Humidity) 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 the 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 the formation of condensate.

### 7.8.10 HUMIDIFICATION PROPORTIONAL REGULATION

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

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

With 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.

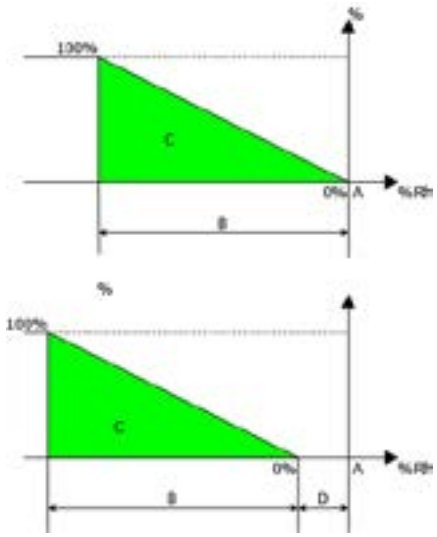
The control output of the components is therefore regulated according to the following function:

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

Where:

- **Out$_p$** is the proportional error
- **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 setup - Humidity)**
**C** **Humidification regulation**
**D** **Humidity dead zone (Factory setup - Dead zone)**

### 7.8.11 MANUAL HUMIDIFIER WATER DISCHARGE

In order to carry out routine humidifier maintenance, it might be necessary to empty water forcibly from the cylinder.

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

### 7.8.12 LINES AND HUMIDIFIER CYLINDER PRE-WASHING MANAGEMENT

The pre-washing function allows cleaning the cylinder and water lines, in particular after having set up 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 contained inside the cylinder and the pipes.

With the "**Cylinder pre-washing**" parameter (User setup - Humidifier) 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.

### 7.8.13 HIGH AND LOW RETURN AND SUPPLY HUMIDITY ALARMS

With the "**High return humidity alarm offset**" (User set-up - Humidity) and "**Low return humidity alarm offset**" (User set-up - Humidity) parameters 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 the "**High supply humidity alarm limit**" (User setup - Humidity) and "**Low supply humidity alarm limit**" (User setup - Humidity) parameters 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 does not pose a shutdown problem for the unit that will continue operating regularly. With the "**Temperature and humidity alarms delay**" parameter (Factory setup - Alarms management) 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 setup - Humidity)
- **$Offset_{Lh}$** is the "**Low return humidity alarm offset**" parameter (User setup - Humidity)
- **$Limit_{Hsh}$** is the "**High supply humidity alarm limit**" parameter (User setup - Humidity)
- **$Limit_{Lsh}$** is the "**Low supply humidity alarm limit**" parameter (User setup - Humidity)

### 7.8.14 AIR HUMIDITY PROBES ALARM MANAGEMENT

If the return humidity probe is broken or disconnected SySmart will trigger the "**Broken return humidity probe alarm**". In the same way, if the supply humidity probe is broken or disconnected SySmart 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.

### 7.8.15 HUMIDIFIER ALARM MANAGEMENT

The CPY humidifier board controls the internal humidifier's alarm detection. With the Modbus Master protocol SySmart receives the humidifier's alarm statuses, triggering the "**Humidifier alarm**" and providing the type of alarm. See the chapter on alarm management for further information.

With the "**Configurable output (1-2-3-4)**" parameter (Factory setup - Digital outputs) 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.

## 7.9 DIRECT EXPANSION UNIT REGULATION

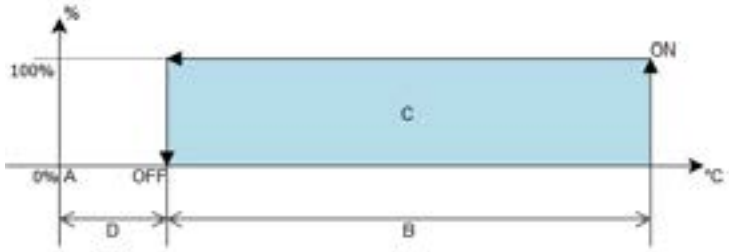
With the "**Machine type**" parameter (Factory setup - Machine type) it is possible to configure the type of temperature regulation with direct expansion system (**Direct Expansion**).

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

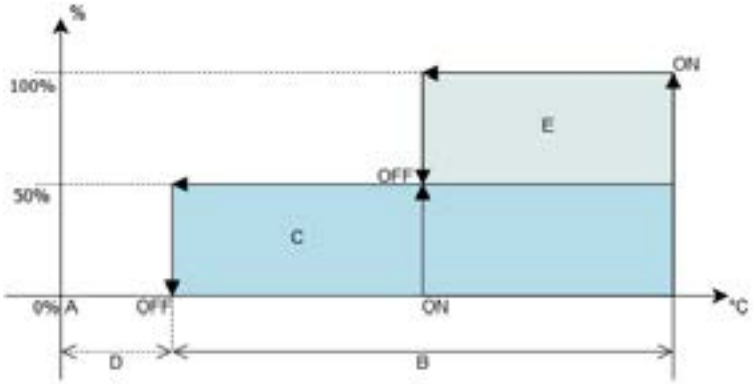
### 7.9.1 COMPRESSOR ON/OFF MANAGEMENT

SySmart 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 (Factory setup - Direct expansion) it is possible to configure the number of compressors installed in the unit.




**Regulation with 1 compressor**




**Regulation with 2 compressors**

**A Temperature Set-point (Main menu - Set-point)**
**B Proportional band (User setup - Temperature)**
**C Compressor 1**
**D Temperature dead zone (Factory setup - Dead zone)**
**E Compressor 2**

### 7.9.2 AUTOMATIC NON REGULATED COMPRESSOR ROTATION

With the "**Type of rotation**" parameter (Factory setup - Direct expansion) 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 that 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 hours of operation as well as number of compressor start-ups. The compressor with the lowest number of operating hours + start-ups will be the first the start.

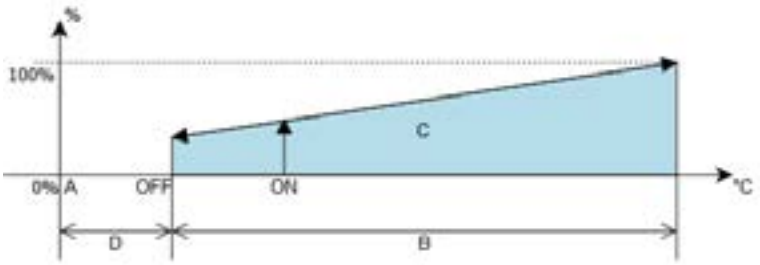
- **LIFO + HS: LIFO** (Last In - First Out) rotation ensures that the last compressor to switch on is always the first to switch off. The first compressor to be switched on is defined with **HS** logic (Hours and Start-up). **HS** logic takes into account hours of operation as well as number of compressor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

### 7.9.3 COMPRESSOR MANAGEMENT WITH INVERTER REGULATION

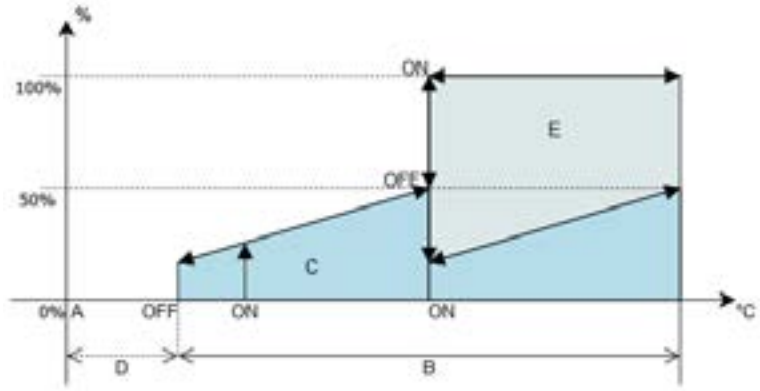
With the "**Enable compressor inverter**" parameter (Factory setup - Direct expansion) it is possible to configure the type of inverter compressor regulation. You can choose between the following types of regulation:

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

The inverter compressor will always be installed on **Circuit 1**, therefore with 2-compressor regulation 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** **Temperature Set-point (Main menu - Set-point)**
**B** **Proportional band (User setup - Temperature)**
**C** **Compressor 1**
**D** **Temperature dead zone (Factory setup - Dead zone)**
**E** **Compressor 2**

### 7.9.4 SUPERHEAT REGULATION WITH ELECTRONIC EXPANSION VALVE

Optimal operation of cooling circuits depends mainly on the refrigerant **Superheat** value regulation on the evaporator outlet. **Superheat**(**SH**) refers to the **difference between compressor evaporation temperature and suction temperature.**

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

In order to achieve optimal **Superheat** (**SH**) regulation all direct expansion units are fitted with **electronic expansion valves** (**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. The **Superheat** (**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 the pressure of the evaporation coil, through which it is possible to calculate the **evaporation temperature**.
- **Suction temperature probe:** This probe reads the compressor suction temperature.

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

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

### 7.9.5 CONDENSATION PRESSURE AND TEMPERATURE READING

The condensation pressure and temperature reading is indispensable for cooling circuit operation. Using a pressure sensor, the SySmart microprocessor constantly reads the condensation pressure value and calculates the equivalent temperature.

### 7.9.6 LIQUID TEMPERATURE DETECTION AND SUB-COOLING CALCULATION

For optimal operation of cooling circuits the liquid refrigerant flowing into the EEV valve must have an optimal **Subcooling (SC)** value. **Subcooling** refers to the **difference between the condensation temperature and the liquid refrigerant temperature**. The SySmart microprocessor constantly reads the liquid refrigerant value and subsequently calculates the relative subcooling value.

### 7.9.7 DE-SUPERHEAT MANAGEMENT

**De-superheat** (**DSH**) refers to the **difference between compressor discharge temperature and compressor condensation temperature.**

In a correctly operating unit the de-superheat value should be between **20.0K and 30.0 K**. SySmart constantly monitors the de-superheat value and implements the following regulations:

- **Should de-superheat drop below 20 K, liquid may flow back to the compressor.** To counter this phenomenon the superheating set-point will be raised to 12.0 K.
- **Should de-superheat rise above 30 K, there is no risk of liquid backflow.** 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 a minimum of 5.0 K.

### 7.9.8 VALVE OPENING CONTROL AT COMPRESSOR START-UP

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

With a 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 start up.

Following compressor start-up, the expansion valve stays open by 50% for 30 seconds to stabilise the operating conditions of the cooling circuit. At the end of the stabilisation time, the control algorithm goes back to regulating the valve normally.

### 7.9.9 LOW SUPERHEAT (LoSH) MANAGEMENT

A **Low Superheat** (**LoSH**) value may indicate a less than optimal operating condition of the cooling circuit, which might cause liquid to flow back to the compressor.

The expansion valve control driver manages an algorithm to monitor low superheat. If the superheat value exceeds the limit value of **3.0 K**, the low superheat status will appear on the controller and the control algorithm will be accelerated to eliminate the problem in the shortest possible amount of time.

### 7.9.10 HIGH SUPERHEAT (HiSH) MANAGEMENT

A **high superheat** (**HiSH**) value may indicate a low refrigerant charge, which does not allow optimal regulation of the **Superheat** (**SH**) value.

The expansion valve control driver manages an algorithm to monitor high superheat. If the superheat value exceeds the limit value of **15.0 K**, the high superheat status will appear on the controller and the control algorithm will be accelerated to eliminate the problem in the shortest possible amount of time.

### 7.9.11 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 values 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 **11.5 Barg (15.0 °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 value, the control algorithm will go back to regulating the valve normally.

### 7.9.12 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 values 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 **4.7 Barg (-10 °C)**, valve opening will be locked at the current value to prevent the pressure from continuing to drop, triggering a low pressure alarm. After restoring an acceptable evaporation pressure value, the control algorithm will go back to regulating the valve normally.

### 7.9.13 LOW EVAPORATION PRESSURE ALARM

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

In order to improve compressor protection, SySmart constantly monitors evaporation pressure. Should the evaporation pressure reading drop 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 delay**" parameter (Factory setup - Alarms management) it is possible to delay alarm triggering.

### 7.9.14 HIGH COMPRESSOR DISCHARGE TEMPERATURE MANAGEMENT

High discharge temperature of the compressor might lead 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 that the discharge temperature does not exceed the compressor's damage threshold.

The 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 demand 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 (Factory setup - Alarm management) it is possible to delay alarm triggering.

### 7.9.15 LOW COMPRESSION RATIO ALARM

Excessively low compression ratio, i.e. the ratio between circuit pressures indicates that the compressor is not compressing the refrigerant correctly. Possible causes are the mechanical rupture of the compressor, incorrect compressor direction of rotation or incorrect operating condition. This causes abnormal overheating of the motor windings in particular, and of the compressor's mechanical parts in general.

In order to improve compressor protection, SySmart constantly controls the compression ratio value, with the following calculation:

$$CR = \frac{P_c}{P_e}$$

Where:

- **CR** is the compression ratio
- $\mathbf{P_c}$ is the condensation pressure in Absolute Bars
- $\mathbf{P_e}$ is the evaporation pressure in Absolute Bars

Should the compression ratio **CR** be less than **1.6**, the compressor will be stopped and the "**Low compression compressor alarm (1-2)**" will be triggered.

In order to prevent false alarms in transient situations, the low compression ratio alarm is delayed. With the "**Low compressor compression alarms delay**" parameter (Factory setup - Alarms management) it is possible to delay alarm triggering.

### 7.9.16 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 of damaging 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, SySmart constantly controls the condensation pressure value. 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)"**.

### 7.9.17 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 breaker alarm (1-2)**".

### 7.9.18 ELECTRONIC VALVE ALARM MANAGEMENT

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

- **Communication:** The alarm indicates failed communication with the SySmart regulator.
- **Evaporation pressure probe:** If the evaporation pressure probe is broken or disconnected, the driver will signal the fault to the SySmart.
- **Condensation pressure probe:** If the condensation pressure probe is broken or disconnected, the driver will signal the fault to the SySmart.
- **Suction temperature probe:** If the suction temperature probe is broken or disconnected, the driver will signal the fault to the SySmart.
- **Discharge temperature probe:** If the discharge temperature probe is broken or disconnected, the driver will signal the fault to the SySmart.

### 7.9.19 LIQUID TEMPERATURE PROBE ALARM MANAGEMENT

The SySmart 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.

### 7.9.20 COMPRESSOR INVERTER ALARM MANAGEMENT

With the Modbus Master protocol SySmart receives the compressor inverter's alarm statuses, triggering the "**DC inverter alarm**" and providing the type of alarm. See the chapter on alarm management for further details.

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

### 7.9.21 COMPRESSOR ALARM SEVERITY MANAGEMENT

With the "**Compressor alarm severity**" (Factory setup - Alarm management) parameter 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 due to critical alarm. In case of unit with 2 circuits, both circuits 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.

## 7.10 CONDENSER REGULATION

With the "**Condenser regulation**" parameter (Factory setup - Condensation) it is possible to enable condenser regulation of the direct expansion units. The following options may be selected:

1) **No:** There is no type of condenser regulation in the unit, hence it will be disabled.
2) **Fixed set-point:** The condensers must be regulated with a fixed set-point.
3) **Autoset-point:** The condensers must be regulated with a variable set-point. The regulation set-point will be calculated automatically based on operating conditions (see following chapters).

With the "**Regulation type**" parameter (Factory setup - Condensation) it is possible to configure the type of condenser regulation of the direct expansion units. You can select from the following types of regulation:

1) **Proportional:** The condensers will be regulated by a proportional 0-10V signal (see chapters below).
2) **Dead zone:** The condensers will be regulated by an increasing 0-10V signal (see chapters below).

### 7.10.1 CONDENSER PROPORTIONAL REGULATION

This type of regulation is ideal in cases where the condensation demand needs to be inversely proportional to the "distance" of the regulation magnitude from the ideal setting (Set-point), with respect to the maximum setting that you wish to obtain (Proportional band).

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

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

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

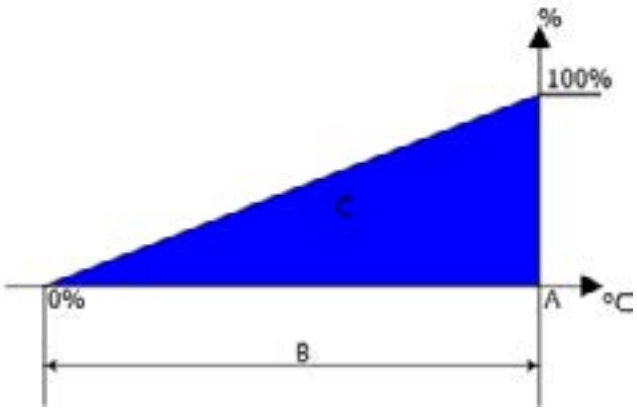
Where:

- **Out$_p$** is the proportional error
- **Bp** the "**Condensation proportional band**" parameter (User setup - Condensers)
- **In** is the condensation temperature value
- **Set** is the "**Condensation set-point**" parameter (User setup - Condensers)

With the "**Minimum condensation demand**" (Factory setup - Condensation) parameter it is possible to configure the minimum operating demand that the condenser may be regulated to.

With the "**Maximum condensation demand**" (Factory setup - Condensation) parameter it is possible to configure the maximum operating demand that the condenser may be regulated to.

The following graph shows proportional regulation:

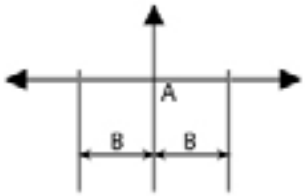



**A** **Condensation set-point (User setup - Condensers)**
**B** **Condensation proportional band (User setup - Condensers)**
**C** **Condenser regulation**

### 7.10.2 CONDENSER DEAD ZONE REGULATION

This type of regulation is excellent for damping any oscillation due to system reactivity, thereby maintaining the condensation temperature within an acceptable regulation margin (dead zone) in relation to the established set-point.

The regulation margin is equal to the **Condensation set-point** (User setup - Condensers) +/- **Condensation proportional band** (User setup - Condensers), as shown in the figure below.




**A Condensation set-point (User setup - Condensers)**
**B Condensation proportional band (User setup - Condensers)**

The value of the condenser control output will be increased (or decreased) based on the value of the condensation temperature in relation to the regulation margin, according to the following logic:

- If the condensation temperature is within the regulation margin, then the output value will not change.
- If the condensation temperature is higher than the regulation margin, then the output value will be increased by 1% every 5 seconds (default) until it reaches the maximum regulation value. The increment time is defined by the "**Standard modulation speed**" (Factory setup - Condensation) parameter.
- If the condensation temperature is lower than the regulation margin, then the output value will be decreased by 1% every 5 seconds (default) until it reaches the minimum regulation value. The increment time is defined by the "**Standard modulation speed**" (Factory setup - Condensation) parameter.

With the "**Minimum condensation demand**" (Factory setup - Condensation) parameter it is possible to configure the minimum operating demand that the condenser may be regulated to.

With the "**Maximum condensation demand**" (Factory setup - Condensation) parameter it is possible to configure the maximum operating demand that the condenser may be regulated to.

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

### 7.10.3 CONDENSER REGULATION WITH AUTOSET-POINT

Low condensation temperature makes it possible to achieve compressor energy savings. Condensation temperature regulation is tied to outdoor temperature (ex. Air or water condensers with dry cooler), therefore 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 condenser operating conditions.

For optimal Autoset-point system regulation it is recommended to set the "**Condensation set-point**" (User set-up - Condensers) parameter at the minimum value that you want the condensers to work at (ex. 35°C).

The set-point is regulated in the following manner:

- **OUTDOOR LOW TEMPERATURE CONDITIONS:** As long as the temperature of the outdoor air (or water) is such that the condenser regulation demand is lower than the "**Maximum condensation demand**" (Factory setup - Condensation), the set-point will not change.

- **INCREASE IN OUTDOOR TEMPERATURE:** When there is an increase in the outdoor air (or water) temperature, the condensation temperature also starts increasing. When the condenser regulation demand reaches the "**Maximum condensation demand**" (Factory setup - Condensation), a timer will start. As soon as the timer exceeds the value of the "**AutoSet-point time**" (Factory setup - Condensation) parameter, the "**Condensation set-point**" (User set-up - Condensers) parameter will be summed with the "**Condensation set increase delta**" (User set-up - Condensers) parameter. The set-point will be increased until the condensation temperature falls within the new regulation range, up to a maximum of the "**Maximum condensation set increase**" (User set-up – Condensers) parameter.

- **REGULATION WITH RAISED SET-POINT:** For as long as the set-point is increased, the condensation demand will be overridden to a minimum value equal to the "**Minimum Autoset-point demand**" (Factory setup - Condensers) parameter. 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, as soon as the condensation temperature drops below the set-point value, a timer will start. As soon as the "**AutoSet-point time**" parameter is exceeded (Factory setup - Condensers), the "**Condensation set increase delta**" (User set-up – Condensers) parameter will be subtracted from the modified set-point. The set-point will decrease until the condensation temperature falls within the regulation range, or until it reaches the "**Condensation set-point**" (User setup – Condensers) parameter.

### 7.10.4 START-UP DEMAND 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 operation.

With the "**Condensation start-up demand**" (Factory setup - Condensation) parameter it is possible to configure the demand that the condenser will be regulated to during the start-up period.

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

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

### 7.10.5 REGULATION DEMAND SAVING SYSTEM

In order to further optimise achieving optimal operating conditions, the control algorithm has a **regulation demand saving system**.

With the "**Condensation demand memory**" (Factory setup - Condensation) parameter it is possible to enable the regulation demand saving system.

As soon as the system reaches the set-point, it saves the regulation demand value that made it possible to achieve the set-point. At the next start-up, regulation will start from the saved value.

If start-up demand management is set, the condensers will start up at the saved regulation value, ignoring the start-up demand parameter.

If there is no saved regulation value, or if the set-point was never reached, the condensers will observe the normal regulation algorithm.

### 7.10.6 QUICK MODULATION MANAGEMENT AT START-UP

In order to improve condenser regulation it is possible to configure a quick modulation period for the demand signal. During the quick modulation period, the increment (or decrement) time of the signal will be quicker. At the end of the quick modulation period, the increment time will go back to the value defined by the "**Standard modulation speed**" parameter (Factory setup - Condensation).

With the "**Quick modulation speed**" parameter (Factory set-up - Condensation) it is possible to configure the quick modulation period increment time.

With the "**Quick modulation time**" parameter (Factory set-up - Condensation) it is possible to configure the duration of the quick modulation period.

This function is excellent for rapidly reaching the operating condition more quickly, at condenser start-up.

### 7.10.7 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 to a pre-set value.

With the "**Override with probe error**" parameter (Factory setup - Condensation) it is possible to configure the percentage that the demand will be overridden at with "**Condensation pressure sensor EEV (1-2) Alarm**".

### 7.10.8 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 (Factory setup - Digital inputs) 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 the "**Compressor alarms severity**" parameter (Factory setup - Alarm management), triggering may also stop the unit.

## 7.11 EVAPORATING UNIT REGULATION FOR CONNECTION TO REMOTE CONDENSING UNIT

With the "**Machine type**" parameter (Factory setup - Machine type) 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.

### 7.11.1 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 (Factory setup - Digital outputs) 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 demand regulation output (AO 2 - External inverter) will make it possible to drive a condensing unit with inverter compressor.

The cooling demand will take place as explained in the previous chapters (Direct expansion).

### 7.11.2 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 (Factory setup - Digital inputs) 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 the "**Compressor alarms severity**" parameter (Factory setup - Alarm management), triggering the alarm may also stop the unit.

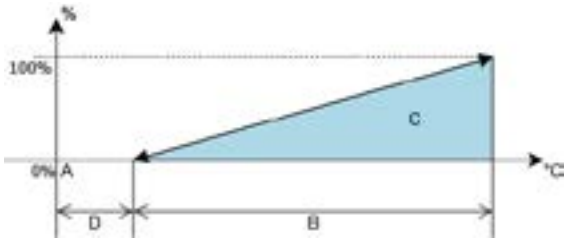
## 7.12 CHILLED WATER UNITS REGULATION

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

With the "**Machine type**" parameter (Factory setup - Machine type) it is possible to configure the type of temperature regulation with chilled water system (**Chilled water**)

### 7.12.1 CHILLED WATER CIRCUIT MANAGEMENT

SySmart is able to manage a water circuit with regulation from 0-10 V control signal. The figures below illustrate the diagram of valve control with Proportional temperature regulation:




**A Temperature Set-point (Main menu - Set-point)**
**B Proportional band (User setup - Temperature)**
**C Valve Regulation**
**D Temperature dead zone (Factory setup - Dead zone)**

## 7.13 TWO SOURCES UNIT REGULATION

**ATTENTION!**

**The two sources units cannot have both cooling sources with direct expansion.**

**With direct expansion circuits, one of the circuits will always be chilled water.**

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.

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

With the "**IN 1/ Free cooling water temperature**" parameter (Factory setup - Probe configuration) it is possible to configure the water temperature detection probe on the chilled water circuit inlet.

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

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

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

### 7.13.1 TWO SOURCES SYSTEM REGULATION WITH CHILLED WATER PRIMARY COOLING

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

With the "**IN 1/ Free cooling water temperature**" parameter (Factory setup - Probes) it is possible to configure the water temperature detection probe on the primary circuit inlet.

SySmart will use the primary source for temperature regulation, for as long as the inlet water temperature remains below parameter "**Two sources water set-point**" (User set-up - FC & TS) plus parameter "**Two sources water proportional band**" (User set-up - Free cooling & Two sources).

If the temperature of the inlet water is higher than the "**Two sources water set-point**" (User set-up - FC & TS) parameter plus the "**Two sources water proportional band**" (User set-up - FC & TS) parameter, SySmart stops the primary source to switch to the secondary source.

It will go back to the primary source when the water temperature is equal to the "**Two sources water set-point**" (user setup - FC & TS) parameter.

The operating logic of the chilled water and/or direct expansion circuits are described in the chapters above.

### 7.13.2 WATER TEMPERATURE PROBE ALARM MANAGEMENT

If the primary circuit water temperature probe is broken or disconnected SySmart will trigger the "**Broken IN 1/ Free cooling water temperature probe alarm**".

This alarm stops primary circuit operation and activates the components of the secondary circuit.

### 7.13.3 TWO SOURCES SYSTEM REGULATION WITH DIRECT EXPANSION PRIMARY COOLING

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

SySmart will use the primary source for temperature regulation, for as long as there are no alarms affecting cooling circuit operation.

Should the cooling circuit no longer be operative, SySmart 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.

The operating logic of the chilled water and/or direct expansion circuits are described in the chapters above.

### 7.13.4 SECONDARY COOLING SOURCE OVERRIDING

With the "**Two sources source exchange**" parameter (User set-up - FC & TS) it is possible to override secondary source operation.

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

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

## 7.14 WATER CIRCUIT ACCESSORY MANAGEMENT

SySmart is able to manage some water circuit accessories, such as water temperature reading, water flow reading and power valve system.

Some accessories may not be available for all types of units.

### 7.14.1 WATER CIRCUIT TEMPERATURE READING

**This accessory is only available in chilled water or two sources units with chilled water primary or secondary water circuit.**

Through the installation of two temperature probes, SySmart is able to read the water circuit inlet and outlet water temperatures.

With the "**IN 1/ Free cooling water temperature**" parameter (Factory setup - Probes) it is possible to configure the water detection probe on the water circuit inlet.

With the "**Outlet water temperature 1**" parameter (Factory setup - Probes) it is possible to configure the water detection probe on the water circuit outlet.

For units with double water circuit it is possible to enable temperature reading on the secondary circuit as well.

With the "**Water temperature inlet 2**" parameter (Factory setup - Probes) it is possible to configure the water detection probe on the water circuit inlet.

With the "**Outlet water temperature 2**" parameter (Factory setup - Probes) it is possible to configure the water detection probe on the water circuit outlet.

### 7.14.2 WATER CIRCUIT FLOW RATE READING

**This accessory is only available in chilled water or two sources units with chilled water primary or secondary water circuit.**

By installing a water flow rate measurement device, SySmart is able to detect the instantaneous water flow rate on water circuit outlet.

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

With very large water circuits, water flow rate is measured with the installation of two water flow rate measuring devices, in this case the "**Water flow rate 2**" (Factory setup - Probes) parameter also needs to be enabled. The water flow rate will be the result of the sum of the flow rates of both sensors.

For units with double water circuit it is possible to enable the water flow reading of the secondary circuit from the "**Water flow rate 2**" parameter (Factory setup - Probes).

From the "**Water flow sensor diameter 1**" (Factory setup - Chilled water) and "**Water flow sensor diameter 2**" (Factory setup - Chilled water) parameters is it possible to configure the diameter of the water flow reading sensor installed on the water circuits.

From the "**Water flow measurement**" (Factory setup - Chilled water) parameter, which is only available if both water flow measuring devices are enabled, it is possible to configure whether the measured water flow needs to be summed (**unit control**) or separated (**separate control**).

### 7.14.3 CALCULATION OF TOTAL COOLING CAPACITY OF THE WATER CIRCUIT AND UNIT EER

**This accessory is only available in chilled water or two sources units with chilled water primary or secondary water circuit.**

If both the water temperature probes and the water flow sensor should be installed in the unit, SySmart 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, SySmart is also able to provide the **EER** (**Energy Efficiency Ratio**) reading

### 7.14.4 WATER CIRCUIT FLOW RATE MANAGEMENT OF THE WATER CIRCUIT WITH POWER VALVE SYSTEM

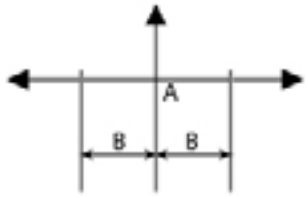
**This accessory is only available in chilled water or two sources units with chilled water primary or secondary water circuit.**

Through the water flow rate meter, SySmart is able to ensure that the water circuit flow rate does not exceed the unit's nominal one. This type of control, referred to as power valve, makes it possible to avoid an excessive water flow rate which might cause issues with valve operation and lead to problems on the water circuit.

With the "**Water flow rate regulation**" parameter (Factory setup - Chilled water) it is possible to enable the unit's water flow rate regulation. For units with double water circuit, the regulation parameters will be separate for each circuit.

With flow rate regulation enabled, SySmart will modulate valve opening to maintain the water flow rate within an acceptable margin (dead zone) in relation to the established set-point.

The regulation margin is equal to "**Set-point (1-2)**" (Factory setup - Chilled water) parameter +/- the "**Dead zone (1-2)**" (Factory setup - Chilled water) parameter, as shown in the figure below.




**A** **Set-point (1-2) (Factory setup - Chilled water)**
**B** **Dead zone (1-2)" (Factory setup - Chilled water)**

The value of the valve opening output will be increased (or decreased) based on the value of the water flow rate in relation to the regulation margin, according to the following logic:

- If the water flow rate is within the regulation margin, then the output value will not change.
- If the water flow rate is lower than the regulation margin, then the output value will be increased by 1% every 3 seconds (default) until it reaches the maximum regulation value. The increment time is defined by the "**Modulation time (1-2)**" parameter (Factory setup - Chilled water).
- If the water flow rate is higher than the regulation margin, then the output value will be decreased by 1% every 3 seconds (default) until it reaches the minimum regulation value. The increment time is defined by the "**Modulation time (1-2)**" parameter (Factory setup - Chilled water).

### 7.14.5 WATER TEMPERATURE AND FLOW RATE PROBES ALARMS MANAGEMENT

If the temperature probe for the circuit 1 inlet water is broken or disconnected SySmart will trigger the "**IN 1/ Free cooling water temperature probe alarm**".

If the temperature probe for the circuit 1 outlet water is broken or disconnected SySmart will trigger the "**Broken OUT 1 water temperature probe alarm**".

If the temperature probe for the circuit 2 inlet water is broken or disconnected SySmart will trigger the "**Broken IN 2 water temperature probe alarm**".

If the temperature probe for the circuit 2 outlet water is broken or disconnected SySmart will trigger the "**Broken OUT 2 water temperature probe alarm**".

If the water flow rate sensor 1 is broken or disconnected SySmart will trigger the "**Water flow rate sensor 1 alarm**".

If the water flow rate sensor 2 is broken or disconnected SySmart will trigger the "**Water flow rate sensor 2 alarm**".

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

## 7.15 WATER PUMP MANAGEMENT

SySmart is able to control the activation of a water circulation pump feeding the unit's circuits.

With the "**Pump regulation type**" parameter (Factory setup - Water pump) it is possible to configure the type of pump activation. You can select from the following types of regulation:

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 that the unit is switched ON.
3) **Cooling demand:** The pump will only be activated with cooling demand.

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

### 7.15.1 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 the "**Pump switch off delay**" parameter (Factory setup - Water pump) it is possible to configure a pump switch-off delay.

### 7.15.2 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 a general water pump alarm.

With the "**Configurable input (1-2-3-4)**" parameter (Factory setup - Digital inputs) 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 the "**Water pump alarm severity**" parameter (Factory setup - Alarm Management), triggering the alarm may also stop the unit.

## 7.16 FREE COOLING UNIT REGULATION

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

The units with free cooling system use outdoor air to cool the room free of charge, when possible, and ensure safe operation through a secondary cooling circuit.

The Free Cooling system can be direct (outdoor air intake) or indirect (via water circuit). The secondary circuit can be direct expansion with integrated air-cooled or water-cooled condenser (**Free Cooling DX**) or with chilled water with modulating regulation valve (**Free Cooling CW**).

### 7.16.1 FREE COOLING SYSTEM REGULATION

The free cooling system is managed through the temperature reading of outdoor air or water flowing into the unit. With the "**IN 1/ Free cooling water temperature**" parameter (Factory setup - Probes) it is possible to configure the free cooling temperature detection probe.

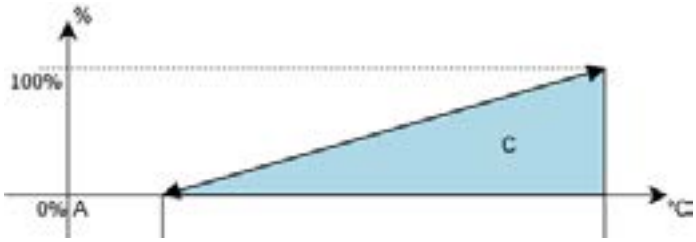
Regulation will activate free cooling operation when the following function is valid:

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

Where:

- $T_{Reg}$ is the regulated temperature
- $T_{Fc}$ is the free cooling temperature
- $\Delta_{Fc}$ is the "**Free cooling activation delta**" (User setup -FC & TS) parameter

When the free cooling system is active, temperature is regulated by regulating the damper or free cooling valve with 0-10 V control signal. The following pictures show the control diagram of the free cooling component with Proportional temperature regulation:




**A** **Temperature Set-point (Main menu - Set-point)**
**B** **Proportional band (User setup - Temperature)**
**C** **Free cooling regulation**
**D** **Temperature dead zone (Factory setup - Dead zone)**

If the free cooling system is not sufficient for temperature regulation, and the cooling demand reaches 100%, SySmart will activate the secondary circuit. Secondary circuit activation will be delayed to prevent unnecessary work.

Once it is activated, the secondary circuit will regulate the temperature as detailed in the previous chapters (direct expansion or chilled water), while the free cooling signal remains at 100%. After reaching the set-point the secondary circuit will be stopped, while the damper, or the free cooling valve, will be overridden to 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 by adjusting the secondary circuit. See the previous chapters for further information (direct expansion or with chilled water).

### 7.16.2 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 (Factory setup - Digital inputs) it is possible to configure one of the four digital inputs in order to override free cooling operation, both always on and always off.

### 7.16.3 FREE COOLING TEMPERATURE PROBE ALARM MANAGEMENT

In the event the free cooling temperature probe should be broken or disconnected SySmart will trigger the "**IN 1/ Free cooling water temperature probe alarm**".

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

## 7.17 DRY COOLER REGULATION

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

With the "**IN 1/ Free cooling water temperature**" parameter (Factory setup - Probes) it is possible to configure the water detection probe on the water circuit inlet.

With the "**Dry cooler regulation**" parameter (Factory setup - Dry cooler) it is possible to enable dry cooler regulation. The following options may be selected:

1) **No:** There is no type of dry cooler regulation in the unit, hence it will be disabled.
2) **Fixed set-point:** The dry cooler will be regulated with a fixed set-point.
3) **Autoset-point:** The dry cooler will be regulated with a variable set-point. The regulation set-point will be calculated automatically based on operating conditions (see following chapters).

With the "**Regulation type**" parameter (Factory setup - Dry cooler) it is possible to configure the type of dry cooler regulation. You can select from the following types of regulation:

1) **Proportional:** The dry cooler will be regulated by a proportional 0-10V signal (see chapters below).
2) **Dead zone:** The dry cooler will be regulated by an incremental 0-10V signal (see chapters below).

### 7.17.1 DRY COOLER PROPORTIONAL REGULATION

This type of regulation is ideal in cases where the fan speed needs to be inversely 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).

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

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

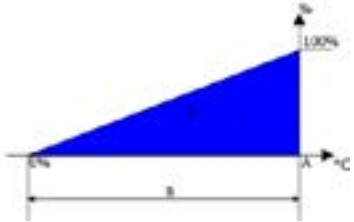
Where:

- **$Out_p$** is the proportional error
- **Bp** the "**Proportional dry cooler band**" parameter (User set-up - Dry cooler)
- **In** is the unit inlet water temperature value
- **Set** is the "**Dry cooler set-point**" parameter (User set-up - Dry cooler)

With the "**Minimum fan speed**" parameter (Factory setup - Dry cooler) it is possible to configure the minimum operating demand that the dry cooler will be regulated to.

With the "**Maximum fan speed**" parameter (Factory setup - Dry cooler) it is possible to configure the maximum operating demand that the dry cooler will be regulated to.

The following graph shows proportional regulation:

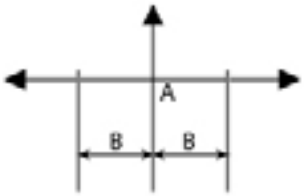



**A** **Dry cooler set-point (User setup - Dry cooler)**
**B** **Dry cooler Proportional band (User setup - Dry cooler)**
**C** **Dry cooler regulation**

### 7.17.2 DRY COOLER DEAD ZONE REGULATION

This type of regulation is excellent for damping any oscillation due to system reactivity, thereby maintaining the water temperature within an acceptable regulation margin (dead zone) in relation to the established set-point.

The regulation margin is equal to the **Dry cooler set-point** (User setup - Dry cooler) +/- **Dry cooler proportional band** (User setup - Dry cooler), as shown in the figure below.




**A** **Dry cooler set-point (User setup - Dry cooler)**
**B** **Dry cooler proportional band (User setup - Dry cooler)**

The value of the dry cooler control output will be increased (or decreased) based on the value of the water temperature in relation to the regulation margin, according to the following logic:

- If the water temperature is within the regulation margin, then the output value will not change.
- If the water temperature is higher than the regulation margin, then the output value will be increased by 1% every 5 seconds (default) until it reaches the maximum regulation value. The increment time is defined by the "**Standard modulation speed**" parameter (Factory setup - Dry cooler).
- If the water temperature is lower than the regulation margin, then the output value will be increased by 1% every 5 seconds (default) until it reaches the maximum regulation value. The increment time is defined by the "**Standard modulation speed**" parameter (Factory setup - Dry cooler).

With the "**Minimum fan speed**" parameter (Factory setup - Dry cooler) it is possible to configure the minimum operating demand that the dry cooler will be regulated to.

With the "**Maximum fan speed**" parameter (Factory setup - Dry cooler) it is possible to configure the maximum operating demand that the dry cooler will be regulated to.

### 7.17.3 DRY COOLER REGULATION WITH AUTOSET-POINT

Low water temperature makes it possible to achieve system energy savings. Water temperature regulation is tied to outdoor temperature, therefore during the cold season it is possible to reduce the regulation set-point in order to increase energy savings.

Through dry cooler regulation with **Autoset-point** it is possible, with a suitable algorithm, to achieve the best possible regulation set-point for dry cooler operating conditions.

For optimal Autoset-point system regulation it is recommended to set the "**Dry cooler set-point**" parameter (User set-up - Dry cooler) at the minimum value that one wants the dry coolers to work at (ex. 7.0 °C).

The set-point is regulated in the following manner:

- **OUTDOOR LOW TEMPERATURE CONDITIONS:** As long as the temperature of the outdoor air is such that the dry cooler regulation demand is lower than the "**Maximum fan speed**" (Factory setup - Dry cooler), then the set-point will not change.
- **INCREASE IN OUTDOOR TEMPERATURE:** When there is an increase in the outdoor air temperature, the water temperature also starts increasing. When dry cooler regulation demand reaches "**Maximum fan speed**" (Factory setup - Dry cooler), a timer will start up. As soon as the timer exceeds the "**AutoSet-point time**" parameter (Factory setup - Dry cooler), the "**Dry cooler set-point**" parameter (User set-up - Dry cooler) will be added to the "**Dry cooler set- increase delta**" parameter (User set-up - Dry cooler). The set-point will be increased until the water temperature falls within the new regulation range, up to the maximum equal to the "**Maximum dry cooler set increase**" parameter (User setup – Dry cooler).

- **REGULATION WITH RAISED SET-POINT:** For as long as the set-point is increased, the dry cooler demand will be overridden to a minimum value equal to the "**Minimum Autoset-point demand**" parameter (Factory setup - Dry cooler). 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, as soon as the water temperature drops below the set-point value, a timer will start. As soon as the "**Autoset-point time**" parameter is exceeded (Factory setup - Dry cooler), the "**Dry cooler set increase delta**" (User setup – Dry cooler) parameter 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 "**Set-point dry cooler**" parameter (User setup - Dry cooler).

### 7.17.4 START-UP DEMAND 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 request. At the end of the start-up time, regulation will go back to normal operation.

With the "**Fan start-up speed**" (Factory setup - Dry cooler) parameter it is possible to configure the demand that the dry cooler will be regulated to during the start-up period.

With the "**Fan start-up time**" parameter (Factory setup - Dry cooler) it is possible to configure the duration of the dry cooler regulation start-up period.

This function is optimal for reaching the operating condition at dry cooler start-up more quickly, without having to wait for the modulation period required to reach the set-point.

### 7.17.5 REGULATION DEMAND SAVING SYSTEM

In order to further optimise achieving optimal operating conditions, the control algorithm has a **regulation demand saving system**.

With the "**Fan speed memory**" parameter (Factory setup - Condensation) it is possible to enable the regulation demand saving system.

As soon as the system reaches the set-point, it saves the regulation demand value that made it possible to achieve the set-point. At the next start-up, regulation will start from the saved value.

If start-up demand management is set, the dry cooler will start up at the saved value, ignoring the start-up demand parameter.

If there is no saved value, or if the set-point was never reached, the dry cooler will observe the normal regulation algorithm.

### 7.17.6 QUICK MODULATION MANAGEMENT AT START-UP

In order to improve dry cooler regulation it is possible to configure a quick modulation period for the regulation signal. During the quick modulation period, the increment (or decrement) time of the signal will be quicker. At the end of the quick modulation period, the increment time will go back to the value defined by the "**Standard modulation speed**" parameter (Factory setup - Dry cooler).

With the "**Quick modulation speed**" parameter (Factory set-up - Dry cooler) it is possible to configure the quick modulation period increment time.

With the "**Quick modulation time**" parameter (Factory set-up - Dry cooler) it is possible to configure the duration of the quick modulation period.

This function is excellent for rapidly reaching the operating condition more quickly, at dry cooler start-up.

### 7.17.7 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 regulation.

With the "**Fans cut-off**" parameter (Factory setup - Dry cooler) it is possible to configure a cut-off temperature for the dry cooler fans. When water temperature reaches the set-point - cut-off, dry cooler regulation stops.

### 7.17.8 DRY COOLER REGULATION MANAGEMENT WITH BROKEN PROBE

In order not to interrupt dry cooler regulation, if a water temperature sensor breaks it is possible to override the demand to a pre-set value.

With the "**Speed with probe error**" parameter (Factory setup - Dry cooler) it is possible to configure the percentage that the demand will be overridden at when there is "**IN1/Free cooling water sensor alarm**".

### 7.17.9 DRY COOLER ALARM MANAGEMENT

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

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

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

## 7.18 HEATING COMPONENTS REGULATION

With the "**Heating**" parameter (Factory setup - Heating) it is possible to configure the type of temperature regulation during winter heating and summer post-heating (with dehumidification enabled). You can select from the following types of regulation:

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

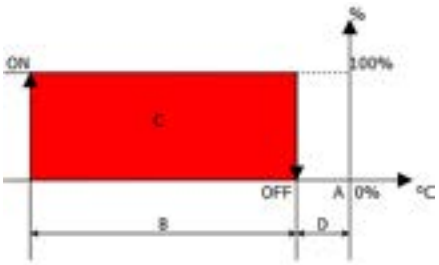
### 7.18.1 HEATING WITH STAGE ELECTRIC COILS

SySmart is able to control electric stage coils with a maximum of 2 stages. The following pictures show the start-up diagram of the stages with Proportional temperature regulation:

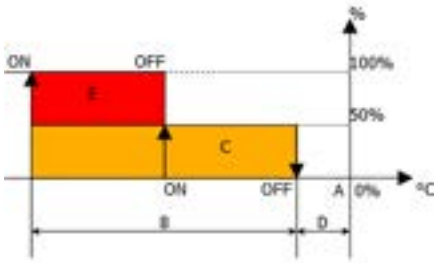
With the "**Number of electric coil stages**" parameter (Factory setup - Heating) it is possible to configure the number of stages that the unit's electric coil consists of (Maximum 2).

With the "**Type of stage activation**" parameter (Factory setup - Heating) it is possible to configure the type of stage switch-on by choosing between **Linear** and **Stepped**. See the following graphs for further information.

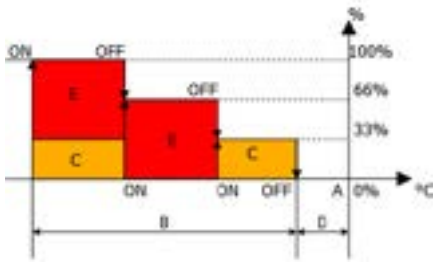
With the "**Electric coil power**" parameter (Factory setup - Heating) it is possible to configure the electrical power of the installed coils.




**Regulation with 1 stage**




**Regulation with 2 stages (Linear)**



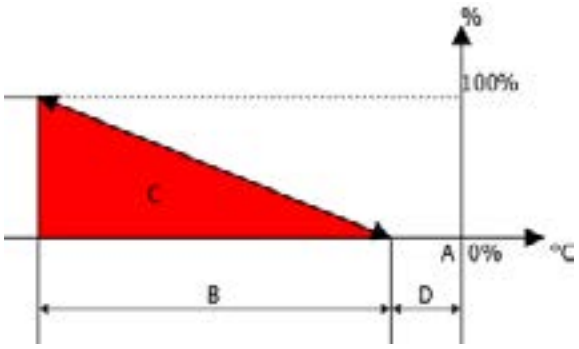

**Regulation with 2 stages (Stepped)**

- **A Temperature set-point (Main menu - Set-point)**
- **B Proportional band (User setup - Temperature)**
- **C Stage 1**
- **D Temperature dead zone (Factory setup - Dead zone)**
- **E Stage 2**

### 7.18.2 HEATING WITH ELECTRIC OR WATER MODULATING COILS

SySmart is able to manage modulating electric or water coils through a 0-10 V signal. The figures below illustrate the diagram of modulation with proportional temperature regulation:

With the "**Electric coil power**" parameter (Factory setup - Heating) it is possible to configure the electrical power of the installed coils.




**A Temperature set-point (Main menu - Set-point)**
**B Proportional band (User setup - Temperature)**
**C Heating**
**D Temperature dead zone (Factory setup - Dead zone)**

### 7.18.3 ELECTRIC COIL ALARMS MANAGEMENT

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

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

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

## 7.19 CONFIGURABLE DIGITAL INPUTS

SySmart is able to control up to four digital inputs freely configurable by the user.

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

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

### 7.19.1 CONFIGURABLE DIGITAL INPUTS MANAGEMENT

With the "**Configurable input (1-2-3-4)**" parameter (Factory setup - Digital inputs) it is possible to configure one of the following types of control:

| TYPES OF CONFIGURABLE DIGITAL INPUTS | |
|---|---|
| **Management** | **Software reaction** |
| **Smoke/Fire 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 general alarm** | Cooling OFF |
| **Non-critical generic alarm** | Alarm only |
| **Critical generic alarm** | Unit OFF |
| **STOP Cooling** | Cooling OFF |
| **STOP Compressor 1** | Compressor 1 OFF |
| **STOP Compressor 2** | Compressor 2 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** | Free cooling OFF |
| **Override free cooling** | Free cooling ON |
| **Override 2nd source of two sources** | 2nd Source of two sources ON |
| **Ultracap** | Ultracap function activation |

## 7.20 CONFIGURABLE DIGITAL OUTPUTS

SySmart is able to control up to four digital outputs freely configurable by the user.

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

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

### 7.20.1 CONFIGURABLE DIGITAL OUTPUTS MANAGEMENT

With the "**Configurable output (1-2-3-4)**" parameter (Factory setup - Digital inputs) 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 discharge alarm signal** |
| **No electrical power supply alarm** |

## 7.21 AIR FILTER MANAGEMENT

### 7.21.1 AIR FILTER ALARM MANAGEMENT WITH DIGITAL DIFFERENTIAL PRESSURE PROBE

SySmart is able to manage an air filter alarm, to signal the presence of dirty filters, with a digital differential pressure probe with manually-calibrated trigger threshold.

If a filter is dirty, the differential pressure value will exceed the trigger threshold, accordingly the digital pressure probe will react by opening a contact located on the digital dirty filter alarm input.

The SySmart regulator will then generate the "**Clogged air filter alarm**". The clogged air filters alarm does not stop normal unit operation.

### 7.21.2 AIR FILTER ALARM MANAGEMENT WITH ANALOGUE DIFFERENTIAL PRESSURE PROBE

SySmart is able to manage an air filter alarm, to signal the presence of dirty filters, with an analogue differential pressure probe.

With the "**Filter differential pressure**" parameter (Factory setup - Probes) it is possible to configure the presence of the analogue dirty filter differential pressure probe.

Through the "**Dirty filter set-point**" (User setup - Dirty filters) parameter it is possible to set the dirty filter alarm trigger threshold.

Through the "**Dirty filter differential**" (User setup - Dirty filters) parameter it is possible to configure the dirty filter alarm reset differential.

If a filter is dirty, the differential pressure value will exceed the trigger threshold, the SySmart regulator will generate the "**Clogged air filter alarm**". The clogged air filters alarm does not stop normal unit operation.

When the filter is changed, the differential pressure value will drop below the trigger threshold - filter differential, accordingly it will be possible to delete the dirty filter alarm.

### 7.21.3 ANALOGUE AIR FILTER DIFFERENTIAL PRESSURE PROBE ALARM MANAGEMENT

The analogue differential pressure probe is managed through Modbus Master communication, accordingly SySmart is able to detect the probe condition, generating the "**Filter differential pressure probe alarm**" which specifies the nature of the problem. The following alarm causes are possible:

- **Communication down:** The alarm indicates failed communication with the SySmart regulator.
- **Breakage:** The pressure probe is damaged.
- **Wiring:** The probe is wired incorrectly.
- **Pressure range:** The probe's pressure reading field is calibrated incorrectly.
- **ADC overload:** The probe's internal power supply module is damaged.
- **Calibration:** The pressure probe is calibrated incorrectly.
- **DCO:** There is an error inside the probe's electronic board.
- **Watchdog:** The probe has switched to watchdog mode due to communication problems.

## 7.22 INTERNAL COMPONENTS ALARMS MANAGEMENT

### 7.22.1 WATER PRESENCE/CONDENSATE DISCHARGE PUMP ALARM MANAGEMENT

SySmart is able to control a water presence alarm, to signal the presence of water in the unit or in the vicinity.

The water alarm is controlled by a detector fitted with a water presence probe, to be installed by the user. If there is a condensate discharge pump, the pump alarm will be inserted in series to the water detector alarm.

Should water or a pump alarm be detected, SySmart will trigger the "**Water sensor/Condensate pump alarm**".

Depending on the "**Water presence alarm severity**" (Factory setup - Alarm management) parameter setting, triggering the alarm may also stop the unit.

### 7.22.2 REFRIGERANT GAS LEAKS DETECTION ALARM MANAGEMENT

SySmart 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 (Factory setup - Digital inputs) 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 relative sensor will act on the digital alarm input. SySmart will trigger the "**Refrigerant gas leak detector alarm"**. The air filters alarm does not stop normal unit operation.

### 7.22.3 SMOKE/FIRE ALARM MANAGEMENT

SySmart is able to control a smoke or fire presence alarm, to switch off the unit.

With the "**Configurable input (1-2-3-4**)" parameter (Factory setup - Digital inputs) it is possible to configure one of the four digital inputs in order to control the smoke/fire alarm.

By acting on the alarm digital input, SySmart will trigger the "**Smoke/fire presence alarm**" which stops normal unit operation.

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

### 7.22.4 NON CRITICAL AND CRITICAL GENERIC ALARM MANAGEMENT

SySmart 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 (Factory setup - Digital inputs) it is possible to configure one of the four digital inputs in order to control the generic critical or non-critical alarm.

By acting on the digital alarm input, SySmart 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.

## 7.23 PROBE CALIBRATION MANAGEMENT

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

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

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

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

With the "**Supply humidity**" parameter (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 the "**Filter differential pressure**" parameter (User Set-up - Probe calibration) it is possible to calibrate the dirty filter differential pressure sensor.

With the "**IN 1 water/ Free cooling temperature**" parameter (User set-up - Probe calibration) it is possible to calibrate the inlet water 1/ free cooling temperature probe.

With the "**Outlet water temperature 1**" parameter (User set-up - Probe calibration) it is possible to calibrate the outlet water temperature probe 1.

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

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

With the "**Inlet water temperature 2**" parameter (User set-up - Probe calibration) it is possible to calibrate the inlet water temperature probe 2.

With the "**Outlet water temperature 2**" parameter (User set-up - Probe calibration) it is possible to calibrate the outlet water temperature probe 1.

## 7.24 MODBUS RTU SLAVE SERIAL COMMUNICATION MANAGEMENT

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

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

## 7.25 CHANGING ACCESS PASSWORDS

The parameter management menus are password-protected. It is possible to change these passwords according to user requirements. If modified, the original passwords will no longer be valid.

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

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

## 7.26 CLEARING THE ALARM LOG AND OPERATING HOURS .

### 7.26.1 CLEARING THE ALARM LOG

During unit maintenance operations it might be necessary to clear the alarm log stored in the SySmart.

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

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

### 7.26.2 CLEARING OPERATING HOURS

During unit maintenance operations it might be required to clear the operating hours of the main components, stored in the SySmart.

With parameter "**Unit hours**" (Clearing the hours) it is possible to delete the unit's operating hours.

With parameter "**Compressor 1**" (Clearing the hours) it is possible to delete compressor 1's operating hours.

With parameter "**Compressor 2**" (Clearing the hours) it is possible to delete compressor 2's operating hours.

With parameter "**Water valve**" (Clearing the hours) it is possible to delete the water valve's operating hours.

With parameter "**Heating**" (Clearing the hours) it is possible to delete the electrical heater's operating hours.

With parameter "**Humidifier**" (Clearing the hours) it is possible to delete the humidifier's operating hours. With an internal humidifier, the operating hours on the CPY board will also be cleared.

With parameter "**Free cooling**" (Clearing the hours) it is possible to delete the operating hours in free cooling.

With parameter "**Dry cooler**" (Clearing the hours) it is possible to delete the operating hours of the dry cooler.

With parameter "**Condenser 1**" (Clearing the hours) it is possible to delete the operating hours of condenser 1.

With parameter "**Condenser 2**" (Clearing the hours) it is possible to delete the operating hours of condenser 2.

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

## 7.27 REMOTE PROBE MODULES MANAGEMENT

SySmart is capable of managing up to 3 remote probe modules, connected via CANbus network, to monitor up to 16 ambient temperature, humidity or pressure values.

The parameter "**Number of remote modules**" (Manufacturer setup - Remote probes) allows you to set up to a maximum of 3 modules connected to the unit.

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 the average values detected by the remote probe modules connected to the unit.

The parameter "**Temperature values for regulation**" (Manufacturer setup - Remote probes) allows you to use the average temperature values detected by the modules to regulate the units.

The parameter "**Humidity values for regulation**" (Manufacturer setup - Remote probes) allows you to use the average humidity values detected by the modules to regulate the units.

The parameter "**Pressure values for regulation**" (Manufacturer setup - Remote probes) allows you to use the average pressure values detected by the modules to regulate the units.

### 7.27.1 REMOTE PROBE MODULES ALARM MANAGEMENT

SySmart is capable of detecting the alarm conditions of the connected probe modules, triggering the "**Module (1-2-3) alarm**" where the nature of the problem is specified. The following alarm causes are possible:

- **Communication down:** The alarm indicates failed communication between the module and the SySmart regulator.
- **Probe 1:** Probe 1 is damaged.
- **Probe 2** Probe 2 is damaged.
- **Probe 3** Probe 3 is damaged.
- **Probe 4:** Probe 4 is damaged.
- **Probe 5:** Probe 5 is damaged.
- **Probe 6:** Probe 6 is damaged.

When a probe triggers an alarm, the relative value will be removed from the calculation of the average. If the entire probe module is disconnected, the values of all the probes connected to it will be removed from the calculation of the average.

If all the values of the modules are in alarm status, the unit will use the local probes to regulate temperature, humidity and pressure.

**ATTENTION!**

**For further information on the probe module, see the relative technical installation, use and maintenance manual.**

# 8 COMPONENT CONTROL MODBUS MASTER NETWORK

SySmart 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 submerged 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):

## 8.1 MODBUS MASTER NETWORK DEVICE ADDRESSING

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

In case 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 addressing configuration will take place through an auto-addressing function.

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

| Modbus Master network addressing | |
|---|---|
| **Device** | **Address** |
| **EVDrive compressor 1** | 2 |
| **EVDrive compressor 2** | 3 |
| **CPY** | 4 |
| **AGILE inverter BLDC** | 5 |
| **Fan 1** | 6 |
| **Fan 2** | 7 |
| **Fan 3** | 8 |
| **Fan 4** | 9 |
| **Fan 5** | 10 |
| **Filter differential pressure** | 15 |

### 8.1.1 FAN AUTO-ADDRESSING IN CASE OF REPLACEMENT

In the event of fans replacement, the SySmart microprocessor features a check and auto-addressing function of the Modbus master network.

In the event of a communication alarm of one or more fans the SySmart microprocessor will start checking whether there are new fans in the network.

If the SySmart microprocessor finds a non configured fan (new) in the network, it will change the address to that of the faulty one. If there is an alarm on several fans, this fan will be given the first free address.

**During the auto-addressing process the NEW FANS will have to be connected ONE AT A TIME.**

# 9 UNIT CONTROL CANBUS NETWORK

SySmart 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 synch 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 one unit that sets the actions of the others. All the units in the network have the task of monitoring the general condition, acting in synch in the required regulation.

## 9.1 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**" (Factory setup - Local network) it is possible to select the unit's network address, according to the following logic:

| SySmart network addressing | | | | |
|---|---|---|---|---|
| **Unit Address** | **Type** | **SySmart 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 SySmart 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**

## 9.2 LOCAL NETWORK TYPES

With the "**Local network operation**" (Factory setup - Local network) parameter it is possible to select the type of local network that you wish to manage. You can select from the following types of local networks:

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

## 9.3 LOCAL NETWORK REGULATION WITH DUTY/STAND-BY SYSTEM

Duty/Stand-by regulation is the conventional regulation method for 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 waiting to start up in case of need (Stand-by).

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

With parameter "**Number of stand-by units**" (Factory setup - Local network) 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 need be running.

### 9.3.1 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 role of the units.

With parameter "**Enable automatic unit rotation**" (Factory setup - Local network) it is possible to enable unit role rotation.

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

### 9.3.2 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.

Accordingly if one of the two Duty units stops due to a critical alarm, one of the Stand-by units will be switched on to make up for it.

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.

### 9.3.3 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**" (Factory setup - Local network) it is possible to enable support switch-on of stand-by units.

With parameter "**Support activation time**" (Factory setup - Local network) it is possible to set the time interval for supporting unit activation.

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 that 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 requested activation. In order to improve regulation it is possible to use the operation described in the following chapters.

When the set-point is reached the units will stop and go back to Stand-by.

## 9.4 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 to 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 accurate 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 operating safety:** Units in stand-by may feature problems upon start-up that might prevent them from actively working in regulation. As they are always on, Smartnet networked units are not subject to switching on issues.

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

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

## 9.5 ACTIVATION 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 the switching on times of the entire local network it is possible to choose whether to switch all the units on or off simultaneously.

With parameter "**Dynamic On/Off**" (Factory setup - Local network) 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.

### 9.5.1 UNIT NETWORK ENTRY

If the Dynamic On/Off system is not present, when one or more units enter the network, component 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 temperature regulation will be recalculated if a proportional + integral + derivative system is set.

## 9.6 DYNAMIC SET-POINT SYSTEM

In all local network units, the temperature set-point may be individually changed, as is the case with stand-alone units. If 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**" (Factory setup - Local network) 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.

## 9.7 AIR TEMPERATURE, HUMIDITY AND PRESSURE AVERAGES 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 read by the networked units.

Using the averaging function makes it possible to achieve consistent components regulation of the 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**" (Factory setup - Local network) it is possible to enable the calculation of the average temperatures read by the unit, in relation to temperature regulation.

With parameter "**Humidity average**" (Factory setup - Local network) it is possible to enable the calculation of the average humidities read by the unit, in relation to humidity regulation.

With parameter "**Pressure average**" (Factory setup - Local network) it is possible to enable the calculation of the average ambient pressures detected by the unit, in relation to constant air pressure regulation.

### 9.7.1 EXCLUSION FROM AVERAGING CALCULATION

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

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

When the unit's normal operating conditions are restored, it will automatically be included again in the averaging calculation.

## 9.8 DELAY SYSTEM FOR NETWORKED UNIT START-UP

To avoid simultaneously turning on all of the networked units, it is possible to set a start-up delay on the networked units.

With the "**Networked unit start-up delay**" (Factory setup - Local network) parameter it is possible to set the start-up delay for the units.

When set, the units will start up with a delay established by the parameter value. The delay will apply to every unit in the network.

## 9.9 FAILED LOCAL NETWORK COMMUNICATION ALARM MANAGEMENT

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

If there is an alarm the unit will continue operating regularly as if it were in stand-alone, without interrupting component regulation at all.

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

# 10 LIST OF REGULATION SOFTWARE PARAMETERS

## 10.1 SET-POINT MENU: SET-POINT EDITING

### 10.1.1 SET-POINT

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Temperature set-point | 18.0 - 40.0 | 22.0 | °C |
| Humidity set-point | 20 - 75 | 50 | %Rh |

## 10.2 USER SETUP: OPERATING PROGRAM SETTINGS

### 10.2.1 LANGUAGE

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Language | * | English | - |
| * Version A: Italian - English - German - French | | | |
| * Version B: Italian - English - Spanish - Dutch | | | |
| * Version C: Italian - English - Russian - Polish | | | |

### 10.2.2 VENTILATION SET-POINT

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Flow rate set-point | 500 - 99,000 | 2,200 | $m^3/h$ |
| Pressure set-point | -900 - 900 | 20 | Pa |

### 10.2.3 TEMPERATURE

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Regulation sensor | Return - Supply | Return | - |
| Regulation type | P - PI - PID | P | - |
| Proportional band | 0.1 - 60.0 | 2.0 | °C |
| Integration time | 0 - 9,999 | 0 | s |
| Derivation time | 0 - 9,999 | 0 | s |
| High temperature alarm offset | 0.0 - 20.0 | 10.0 | °C |
| Low temperature alarm offset | 0.0 - 20.0 | 10.0 | °C |

### 10.2.4 LIMIT TEMPERATURE

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| High limit temperature alarm limit | -15.0 - 90.0 | 30.0 | °C |
| High limit temperature management | * | Alarm Only | - |
| Low limit temperature alarm limit | -15.0 - 90.0 | 8.0 | °C |
| Low limit temperature management | ** | Alarm Only | - |
| * Alarm only - Stop component - Reduction - Cold activation | | | |
| ** Alarm only - Stop component - Reduction - Hot activation | | | |

### 10.2.5 HUMIDITY

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Dehumidification proportional band | 1 - 50 | 10 | %Rh |
| Humidification proportional band | 1 - 50 | 10 | %Rh |
| High return humidity alarm offset | 0 - 100 | 20 | %Rh |
| Low return humidity alarm offset | 0 - 100 | 20 | %Rh |
| High supply humidity alarm limit | 0 - 100 | 95 | %Rh |
| Low supply humidity alarm limit | 0 - 100 | 20 | %Rh |

### 10.2.6 HUMIDIFIER

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Enable humidification | No - Yes | Yes | - |
| Manual cylinder discharge | No - Yes | No | - |
| Cylinder pre-wash | No - Yes | No | - |

### 10.2.7 FREE COOLING AND TWO SOURCES

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Free cooling activation delta | 1.0 - 30.0 | 4.0 | °C |
| Two sources water set-point | 1.0 - 30.0 | 7.0 | °C |
| Two sources water proportional band | 0.1 - 20.0 | 0.5 | °C |
| Two sources source exchange | No - Yes | No | - |

### 10.2.8 CONDENSERS

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Condensation set-point | 30.0 - 65.0 | 45.0 | °C |
| Condensation proportional band | 1.0 - 40.0 | 2.0 | °C |
| Condensation set-point increase | 0.1 - 50.0 | 1.0 | °C |
| Maximum condensation set-point | 30.0 - 65.0 | 55.0 | °C |

### 10.2.9 DRY COOLER

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Dry cooler set-point | 1.0 - 65.0 | 10.0 | °C |
| Dry Cooler proportional band | 0.5 - 20.0 | 5.0 | °C |
| Dry Cooler set-point increase | 0.1 - 50.0 | 1.0 | °C |
| Maximum dry Cooler set-point | 0.1 - 65.0 | 50.0 | °C |

### 10.2.10 DIRTY FILTERS

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Dirty filter set-point | 0 - 5000 | 250 | Pa |
| Dirty filter differential | 1 - 100 | 10 | Pa |

### 10.2.11 PROBE CALIBRATION

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Return temperature | -10.0 - 10.0 | 0.0 | °C |
| Supply temperature | -10.0 - 10.0 | 0.0 | °C |
| Return humidity | -10 - 10 | 0 | %Rh |
| Supply humidity | -10 - 10 | 0 | %Rh |
| Air differential pressure | -10 - 10 | 0 | Pa |
| Filter differential pressure | -10 - 10 | 0 | Pa |
| IN1 / Free cooling water temperature | -10.0 - 10.0 | 0.0 | °C |
| Outlet water temperature 1 | -10.0 - 10.0 | 0.0 | °C |
| Water flow rate 1 | -10 - 10 | 0 | l/h |
| Water flow rate 2 | -10 - 10 | 0 | l/h |
| Water temperature inlet 2 | -10.0 - 10.0 | 0.0 | °C |
| Water temperature outlet 2 | -10.0 - 10.0 | 0.0 | °C |

### 10.2.12 SUPERVISOR

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Modbus Address | 1 - 247 | 1 | - |
| Modbus Baudrate | * | 19200 | Baud |
| * 1200 - 2400 - 4800 - 9600 - 19200 - 28800 - 38400 - 57600 | | | |

### 10.2.13 PASSWORD

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| User Password | 0 - 9999 | 0123 | - |

## 10.3 FACTORY SETUP LOOP: COMPONENT CONFIGURATION

### 10.3.1 PROBES

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Return humidity | No - Yes | No | - |
| Supply humidity | No - Yes | No | - |
| Air differential pressure | No - Yes | No | - |
| Filter differential pressure | No - Yes | No | - |
| IN 1 / Free cooling water temperature | No - Yes | No | - |
| Outlet water temperature 1 | No - Yes | No | - |
| Water flow rate 1 | No - Yes | No | - |
| Water flow rate 2 | No - Yes | No | - |
| Water temperature inlet 2 | No - Yes | No | - |
| Water temperature outlet 2 | No - Yes | No | - |

### 10.3.2 REMOTE PROBES

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Number of remote modules | 0 - 3 | 0 | - |
| Temperature values for regulation | No - Yes | No | - |
| Humidity values for regulation | No - Yes | No | - |
| Pressure values for regulation | No - Yes | No | - |

### 10.3.3 DIGITAL INPUTS

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Configurable input 1 | * | No | - |
| Configurable input logic 1 | N.O. - N.C. | N.O. | - |
| Configurable input 2 | * | No | - |
| Configurable input logic 2 | N.O. - N.C. | N.O. | - |
| Configurable input 3 | * | No | - |
| Configurable input logic 3 | N.O. - N.C. | N.O. | - |
| Configurable input 4 | * | No | - |
| Configurable input logic 4 | N.O. - N.C. | N.O. | - |
| * No - Smoke/Fire - Water pump alarm - External humidifier alarm - General fan alarm - Condenser 1 alarm - Condenser 2 alarm - Dry Cooler alarm - Generic non-critical alarm - Generic critical alarm - Condensing unit alarm - Refrigerant gas leak alarm - No phase alarm - STOP cold - STOP Compressor 1 - STOP Compressor 2 - STOP hot - STOP humidification - STOP dehumidification - STOP hot + humidification - STOP cold+hot+humidification - STOP free cooling - Override free cooling - Override two sources - Ultracap | | | |

### 10.3.4 DIGITAL OUTPUTS

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Configurable output 1 | * | No | - |
| Configurable output logic 1 | N.O. - N.C. | N.O. | - |
| Configurable output 2 | * | No | - |
| Configurable output logic 2 | N.O. - N.C. | N.O. | - |
| Configurable output 3 | * | No | - |
| Configurable output logic 3 | N.O. - N.C. | N.O. | - |
| Configurable output 4 | * | No | - |
| Configurable output logic 4 | N.O. - N.C. | N.O. | - |
| * No - Water pump control - Condensing unit control - Unit status - Cold status - Hot status - Humidification status - Dehumidification status - Free cooling status - General alarm - Non-critical alarm - Critical alarm - Filter alarm - Cold alarm - Hot alarm - Fan alarm - Temperature alarm - Humidity alarm - Flooding alarm - No power supply alarm | | | |

### 10.3.5 VENTILATION

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Number of fans | 1 - 5 | 1 | - |
| Fan type | * | Modbus EBM 3PH | - |
| Regulation type | ** | Cold/Hot Reg. | - |
| Maximum speed | 10 - 100 | 100 | % |
| Minimum speed | 10 - 100 | 40 | % |
| Startup speed | 0 - 100 | 60 | % |
| Startup time | 0 - 9999 | 0 | s |
| Air flow calculation coefficient | 0 - 1000 | 72 | - |
| * On-off - Analogues - Modbus EBM 3PH - Modbus EBM 1PH - Modbus ZIEHL 3PH - Modbus ZIEHL 1PH | | | |
| ** Set speed - Cold/Hot Reg. - Constant flow - Constant pressure | | | |

### 10.3.6 MACHINE TYPE

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Machine Type | * | Direct Expansion | - |
| Primary source selection | DX - CW | CW | - |
| Secondary source selection | DX - CW | DX | - |
| * Direct expansion - Evaporator - Chilled water - Free Cooling DX - Free Cooling CW - Two Sources | | | |

### 10.3.7 DIRECT EXPANSION

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Number of compressors | 1 - 2 | 1 | - |
| Enable compressor inverter | * | No | - |
| Rotation type | FIFO+HS - LIFO+HS | FIFO+HS | - |
| * No - Internal (Agile) - Internal (Active) - External (Analogue) | | | |

### 10.3.8 CHILLED WATER

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Water flow rate sensor diameter 1 | * | DN6 | - |
| Water flow rate sensor diameter 2 | * | DN6 | - |
| Water flow rate measurement | Single - Sum | Single | - |
| Water flow rate regulation | No - Yes | No | - |
| Set-point 1 | 1 - 30000 | 2400 | l/h |
| Dead zone 1 | 1 - 65000 | 50 | l/h |
| Modulation time 1 | 1 - 100 | 3 | s |
| Set-point 2 | 1 - 30000 | 2400 | l/h |
| Dead zone 2 | 1 - 65000 | 50 | l/h |
| Modulation time 2 | 1 - 100 | 3 | s |
| * DN6 - DN8 - DN10 - DN15 - DN20 - DN25 - DN32 | | | |

### 10.3.9 HEATING

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Heating | * | No | - |
| Electric coil power | 1.0 - 50.0 | 6.0 | kW |
| Number of electric coil stages | 1 - 2 | 1 | - |
| Type of stage switch | Linear - Steps | Steps | - |
| * No - Stage-heaters - Modulating coil - Water valve | | | |

### 10.3.10 HUMIDITY

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Humidifier | * | No | - |
| Humidification production percentage | 0 - 100 | 100 | % |
| Humidification and cold together | No - Yes | Yes | - |
| Dehumidification | No - Yes | Yes | - |
| Dehumidification trigger threshold | 0 - 100 | 100 | % |
| Minimum dehumidification limit | 0 - 100 | 60 | % |
| Partial dehumidification | No - Yes | No | - |
| Dehumidification lock offset | 0.1 - 20.0 | 4.0 | °C |
| * No - Internal (Modbus) - External (Analogue) | | | |

### 10.3.11 CONDENSATION REGULATION

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Condenser regulation | * | No | - |
| Regulation type | ** | Dead zone | - |
| Minimum condensation demand | 0 - 100 | 0 | % |
| Maximum condensation demand | 0 - 100 | 100 | % |
| Condensation startup request | 0 - 100 | 50 | % |
| Condensation startup time | 0 - 999 | 30 | s |
| Fast modulation speed | 1 - 100 | 2 | s |
| Fast modulation time | 0 - 999 | 20 | s |
| Standard modulation speed | 1 - 100 | 5 | s |
| Override with probe error | 0 - 100 | 100 | % |
| Autoset-point time | 1 - 900 | 5 | Min |
| Minimum Autoset-point demand | 0 - 50 | 20 | % |
| Condensation demand memory | No - Yes | No | - |
| * No - Fixed Set-point - Autoset-point | | | |
| ** Proportional - Dead zone | | | |

### 10.3.12 DRY COOLER REGULATION

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Dry cooler regulation | * | No | - |
| Regulation type | ** | Dead zone | - |
| Minimum fan speed | 0 - 100 | 0 | % |
| Maximum fan speed | 0 - 100 | 100 | % |
| Fan startup speed | 0 - 100 | 50 | % |
| Fan startup time | 0 - 999 | 30 | s |
| Fast modulation speed | 1 - 100 | 2 | s |
| Fast modulation time | 0 - 999 | 20 | s |
| Standard modulation speed | 1 - 100 | 5 | s |
| Speed with probe error | 0 - 100 | 100 | % |
| Autoset-point time | 1 - 900 | 5 | Min |
| Minimum Autoset-point speed | 0 - 50 | 20 | % |
| Fan cut-off | 0.0 - 50.0 | 2.0 | °C |
| Fan speed memory | No - Yes | Yes | - |
| * No - Fixed Set-point - Autoset-point | | | |
| ** Proportional - Dead zone | | | |

### 10.3.13 WATER PUMP

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Regulation type | * | No | - |
| Pump switch off delay | 0 - 999 | 60 | s |
| * No - Unit ON - Cold Demand | | | |

### 10.3.14 SET-POINT LIMITS

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Minimum temperature set-point limit | - 40.0 - 150.0 | 18.0 | °C |
| Maximum temperature set-point limit | - 40.0 - 150.0 | 40.0 | °C |
| Minimum humidity set-point limit | 0 - 100 | 20 | %Rh |
| Maximum humidity set-point limit | 0 - 100 | 75 | %Rh |

### 10.3.15 DEAD ZONE

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Temperature dead zone | 0.0 - 10.0 | 0.2 | °C |
| Humidity dead zone | 0 - 20 | 2 | % |

### 10.3.16 LAN

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Network address | 1 - 13 | 13 | - |
| Network operation | * | No | - |
| Number of networked units | 2 - 12 | 2 | - |
| Number of units in standby | 0 - 99 | 0 | - |
| Enable unit rotation | No - Yes | No | - |
| Time period for rotation | 1 - 9999 | 12 | h |
| Enable support | No - Yes | No | - |
| Support switch on time | 0 - 9999 | 60 | s |
| Dynamic On/Off | No - Yes | Yes | - |
| Dynamic set-point | No - Yes | Yes | - |
| Temperature average | No - Yes | No | - |
| Humidity average | No - Yes | No | - |
| Ambient pressure average | No - Yes | No | - |
| Networked unit startup delay | 0 - 99 | 0 | s |
| * No - Duty/Stand-by - Smartnet | | | |

### 10.3.17 ALARMS

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Temperature and humidity alarm delay | 0 - 9999 | 300 | s |
| Damper status alarm delay | 0 - 9999 | 150 | s |
| Compressor low pressure alarm delay | 0 - 9999 | 120 | s |
| Compressor discharge high temperature alarms delay | 0 - 9999 | 60 | s |
| Compressor low compression alarms delay | 0 - 9999 | 60 | s |
| Smoke/fire alarm reset type | * | Manual | - |
| Compressor alarms severity | Critical - Non-critical | Critical | - |
| Water detection alarm severity | Critical - Non-critical | Non-critical | - |
| Water pump alarm severity | Critical - Non-critical | Non-critical | - |
| No electrical power supply alarm | No - Unit ON - Yes | Unit ON | - |
| Alarm reset after power supply failure | No - Yes | No | - |
| Water flow rate sensor alarm delay | 0 - 9999 | 150 | s |
| * Automatic - Manual | | | |

### 10.3.18 KEY LOCK

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Enable key lock | * | No | - |
| * No - Yes - Password | | | |

### 10.3.19 PASSWORD

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Factory password | 0 - 9999 | 0694 | - |

### 10.3.20 DELETE ALARM LOG

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Delete log | No - Yes | No | - |

### 10.3.21 DELETE OPERATING HOURS

| Description | Limits | Default | Unit of measure |
|---|---|---|---|
| Unit | - | Reset | - |
| Compressor 1 | - | Reset | - |
| Compressor 2 | - | Reset | - |
| Water valve | - | Reset | - |
| Electric heater | - | Reset | - |
| Humidifier | - | Reset | - |
| Free cooling | - | Reset | - |
| Dry cooler | - | Reset | - |
| Condenser 1 | - | Reset | - |
| Condenser 2 | - | Reset | - |

# 11 UNIT ALARMS MANAGEMENT

## 11.1 SIGNALLING, CHECK AND CLEARANCE OF ALARM CONDITIONS

### 11.1.1 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 (  ) appears on the program's main page.
- If the alarm is **CRITICAL**, and therefore blocks unit operation, the **GREEN LED** (  ) starts flashing.

### 11.1.2 ALARM CONDITION CHECK

Press and hold the **ALARM** key (  ) to display on the user terminal the message relative to the active alarm. The **Buzzer** stops.

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

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

### 11.1.3 REMOVING AN ALARM CONDITION

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 cleared.

## 11.2 DESCRIPTION OF SySmart MICROPROCESSOR ALARMS

### 11.2.1 CRITICAL ALARMS

| | |
|---|---|
| **Name:** | **Motorised damper status alarm** |
| **Cause:** | The unit's motorised dampers are closed |
| **Delay:** | At startup: Second parameter - In operation: 5 s |
| **Effect:** | Tripping causes the unit to shut off. All devices will stop without complying with the operating times |
| **Solutions:** | Check the damper motor<br>Check the damper motor's electrical connection<br>Check the damper status |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **General supply fans alarm** |
| **Cause:** | The unit's fans are blocked by the tripped air flow sensor or the fan's electrical protection |
| **Delay:** | At startup: 40 s - In operation: 5 s |
| **Effect:** | Tripping causes the unit to shut off<br>All devices will stop without complying with the operating times |
| **Solutions:** | Check for any problems on the aeraulic circuit that might reduce the unit's air flow.<br>Check the electrical connection of the air flow sensor and of the fan's electrical protection.<br>Check fan speed<br>Check the status of the fan |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Fan 1 alarm** |
| **Cause:** | The fan has one of the following problems:<br>**Communication down**<br>**No phase alarm**<br>**High inverter temperature**<br>**Inverter error**<br>**Motor overload**<br>**Low DC voltage**<br>**No master-slave communication**<br>**Hall sensor error**<br>**High motor temperature** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | Tripping causes the unit to shut off<br>All devices will stop without complying with the operating times |
| **Solutions:** | Check Modbus communication cable wiring<br>Check the fan's electrical connection<br>Check the power supply voltage of the electrical line<br>Check the fan regulation module<br>Check the status of the fan |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Fan 2 alarm** |
| **Cause:** | The fan has one of the following problems:<br>**Communication down**<br>**No phase alarm**<br>**High inverter temperature**<br>**Inverter error**<br>**Motor overload**<br>**Low DC voltage**<br>**No master-slave communication**<br>**Hall sensor error**<br>**High motor temperature** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | Tripping causes the unit to shut off<br>All devices will stop without complying with the operating times |
| **Solutions:** | Check Modbus communication cable wiring<br>Check the fan's electrical connection<br>Check the power supply voltage of the electrical line<br>Check the fan regulation module<br>Check the status of the fan |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Fan 3 alarm** |
| **Cause:** | The fan has one of the following problems:<br>**Communication down**<br>**No phase alarm**<br>**High inverter temperature**<br>**Inverter error**<br>**Motor overload**<br>**Low DC voltage**<br>**No master-slave communication**<br>**Hall sensor error**<br>**High motor temperature** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | Tripping causes the unit to shut off<br>All devices will stop without complying with the operating times |
| **Solutions:** | Check Modbus communication cable wiring<br>Check the fan's electrical connection<br>Check the power supply voltage of the electrical line<br>Check the fan regulation module<br>Check the status of the fan |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Fan 4 alarm** |
| **Cause:** | The fan has one of the following problems:<br>**Communication down**<br>**No phase alarm**<br>**High inverter temperature**<br>**Inverter error**<br>**Motor overload**<br>**Low DC voltage**<br>**No master-slave communication**<br>**Hall sensor error**<br>**High motor temperature** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | Tripping causes the unit to shut off<br>All devices will stop without complying with the operating times |
| **Solutions:** | Check Modbus communication cable wiring<br>Check the fan's electrical connection<br>Check the power supply voltage of the electrical line<br>Check the fan regulation module<br>Check the status of the fan |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Fan 5 alarm** |
| **Cause:** | The fan has one of the following problems:<br>**Communication down**<br>**No phase alarm**<br>**High inverter temperature**<br>**Inverter error**<br>**Motor overload**<br>**Low DC voltage**<br>**No master-slave communication**<br>**Hall sensor error**<br>**High motor temperature** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | Tripping causes the unit to shut off<br>All devices will stop without complying with the operating times |
| **Solutions:** | Check Modbus communication cable wiring<br>Check the fan's electrical connection<br>Check the power supply voltage of the electrical line<br>Check the fan regulation module<br>Check the status of the fan |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Smoke/fire detection alarm** |
| **Cause:** | The digital smoke/fire alarm input is open |
| **Delay:** | At startup: 10 - In operation: 5 s |
| **Effect:** | Tripping causes the unit to shut off<br>All devices will stop without complying with the operating times. |
| **Solutions:** | Check for the presence of smoke or fire inside the room<br>Check the electrical connection of the digital input |
| **Restore:** | Second parameter |

| | |
|---|---|
| **Name:** | **Critical generic alarm** |
| **Cause:** | The digital critical generic alarm input is open |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | Tripping causes the unit to shut off<br>All devices will stop without complying with the operating times |
| **Solutions:** | Check the electrical connection of the digital input |
| **Restore:** | The alarm needs to be reset manually |

### 11.2.2 PROBE ALARMS

| | |
|---|---|
| **Name:** | **Broken return temperature probe alarm** |
| **Cause:** | Broken or disconnected return temperature probe |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Broken supply temperature probe alarm** |
| **Cause:** | The supply temperature probe is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Broken return humidity probe alarm** |
| **Cause:** | The return humidity probe is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | Humidity regulation stops |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Broken supply humidity probe alarm** |
| **Cause:** | The supply humidity probe is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | Alarm limit regulation is stopped |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **IN 1/Free cooling water temperature probe alarm** |
| **Cause:** | The IN 1/Free cooling water temperature probe is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Broken OUT 1 water temperature probe alarm** |
| **Cause:** | The OUT temperature probe is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Broken IN 2 water temperature probe alarm** |
| **Cause:** | The IN 2 water temperature probe is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Broken OUT 2 water temperature probe alarm** |
| **Cause:** | The OUT 2 temperature probe is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Water flow rate sensor alarm 1** |
| **Cause:** | The water flow rate sensor is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the sensor's electrical connection<br>Check the sensor signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Water flow rate sensor alarm 2** |
| **Cause:** | The water flow rate sensor is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the sensor's electrical connection<br>Check the sensor signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Liquid temperature probe alarm 1** |
| **Cause:** | The liquid temperature probe for compressor 1 is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | Signalling only. Sub-cooling calculation will stop. |
| **Solutions:** | Check the sensor's electrical connection<br>Check the sensor signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Liquid temperature probe alarm 2** |
| **Cause:** | The liquid temperature probe for compressor 1 is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | Signalling only. Sub-cooling calculation will stop. |
| **Solutions:** | Check the sensor's electrical connection<br>Check the sensor signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Differential air pressure probe alarm** |
| **Cause:** | The differential air pressure probe is broken or disconnected |
| **Delay:** | At startup: 10 s - In operation: 10 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Filter differential pressure probe alarm** |
| **Cause:** | The filter differential pressure probe has one of the following problems:<br>**Breakage**<br>**Wiring**<br>**Pressure Range**<br>**ADC overload**<br>**Calibration**<br>**DCO**<br>**Watchdog**<br>**Communication** |
| **Delay:** | At startup: 60 s - In operation: 60 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe's electrical connection<br>Check the probe signal<br>Check probe calibration<br>Check the position of the configuration dip-switches |
| **Restore:** | The alarm resets automatically |

### 11.2.3 COMPRESSOR ALARMS

| | |
|---|---|
| **Name:** | **Compressor 1 breaker alarm** |
| **Cause:** | There is an alarm on the compressor breaker |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the compressor's electrical connection<br>Check the current absorbed by the compressor |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Compressor 2 breaker alarm** |
| **Cause:** | There is an alarm on the compressor breaker |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the compressor's electrical connection<br>Check the current absorbed by the compressor |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Compressor 1 high pressure alarm** |
| **Cause:** | There is an alarm on the compressor's high pressure breaker |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the condensation pressure<br>Check the status of the condenser<br>Check the condenser regulator<br>Check the condenser's power supply line |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Compressor 2 high pressure alarm** |
| **Cause:** | There is an alarm on the compressor's high pressure breaker |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the condensation pressure<br>Check the status of the condenser<br>Check the condenser regulator<br>Check the condenser's power supply line |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Compressor 1 low pressure alarm** |
| **Cause:** | There is an alarm on the compressor's low pressure breaker |
| **Delay:** | At startup: Second parameter - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the evaporation pressure<br>Check the status of the electronic expansion valve<br>Check the cooling circuit |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Compressor 2 low pressure alarm** |
| **Cause:** | There is an alarm on the compressor's low pressure breaker |
| **Delay:** | At startup: Second parameter - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the evaporation pressure<br>Check the status of the electronic expansion valve<br>Check the cooling circuit |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Compressor 1 discharge high temperature alarm** |
| **Cause:** | There is an alarm on the compressor's discharge high temperature breaker |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | See chapters above |
| **Solutions:** | Check the compressor's discharge temperature<br>Check the evaporation pressure<br>Check the cooling circuit |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Compressor 2 discharge high temperature alarm** |
| **Cause:** | There is an alarm on the compressor's discharge high temperature breaker |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | See chapters above |
| **Solutions:** | Check the compressor's discharge temperature<br>Check the evaporation pressure<br>Check the cooling circuit |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Compressor 1 low compression alarm** |
| **Cause:** | The compressor's compression ratio is too low |
| **Delay:** | At startup: Second parameter - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the direction of rotation of the compressor<br>Check the evaporation pressure<br>Check the cooling circuit |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Compressor 2 low compression alarm** |
| **Cause:** | The compressor's compression ratio is too low |
| **Delay:** | At startup: Second parameter - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the direction of rotation of the compressor<br>Check the evaporation pressure<br>Check the cooling circuit |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **DC inverter alarm** |
| **Cause:** | There is an alarm on the compressor inverter due to an anomaly<br>The alarms are identified with an alphanumerical code (ex. F0102)<br>See the chapters below for the description of the alarms |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | See chapters above |
| **Solutions:** | See the chapters below |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **EEV 1 alarm** |
| **Cause:** | The valve driver has one of the following problems:<br>**Communication**<br>**Evaporation pressure probe**<br>**Condensation pressure probe**<br>**Suction temperature probe**<br>**Discharge temperature probe** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the valve drive connection<br>Check the probe connection<br>Check the probe signal |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **EEV 2 alarm** |
| **Cause:** | The valve driver has one of the following problems:<br>**Communication**<br>**Evaporation pressure probe**<br>**Condensation pressure probe**<br>**Suction temperature probe**<br>**Discharge temperature probe** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the valve drive connection<br>Check the probe connection<br>Check the probe signal |
| **Restore:** | The alarm needs to be reset manually |

### 11.2.4 INTERNAL HUMIDIFIER ALARMS

| | |
|---|---|
| **Name:** | **Internal humidifier alarm** |
| **Cause:** | The internal humidifier has one of the following problems:<br>**Communication**<br>**Internal memory error**<br>**Parameter error**<br>**High electrode current**<br>**Low steam flow rate**<br>**Failed discharge**<br>**Hours of maintenance**<br>**No water**<br>**Cylinder maintenance**<br>**Cylinder burnt out**<br>**Foam presence**<br>**Life timer expired**<br>**High water level**<br>**High conductivity**<br>**Connection error**<br>See the chapters below for the description of the alarms |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | Humidification will stop |
| **Solutions:** | See the chapters below |
| **Restore:** | The alarm needs to be reset manually |

### 11.2.5 COMPONENT ALARMS

| | |
|---|---|
| **Name:** | **Water sensor/Condensate pump alarm** |
| **Cause:** | There is an alarm on the water presence detection system<br>There is an alarm on the condensate discharge pump |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | Second parameter |
| **Solutions:** | Check the connection of the water detection probe<br>Check for water on the water detection probe<br>Check the connection of the condensate discharge pump<br>Check the status of the condensate discharge pump |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Electric coil thermostat alarm** |
| **Cause:** | The electric coil over-heated thereby tripping the safety thermostat |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | The electric coil stops |
| **Solutions:** | Check fan speed<br>Check fan air flow<br>Check the aeraulic circuit |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Clogged air filter alarm** |
| **Cause:** | The dirty filter differential pressure sensor detected excessive pressure |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | Signalling only |
| **Solutions:** | Check air filter status<br>Check pressure sensor calibration<br>Check the pressure sensor connection<br>Check the aeraulic circuit |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Dry cooler general alarm** |
| **Cause:** | There is an alarm on the dry cooler |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the status of the dry cooler |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **External humidifier general alarm** |
| **Cause:** | There is an alarm on the external humidifier |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | Humidification will stop |
| **Solutions:** | Check the status of the external humidifier |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **General water pump alarm** |
| **Cause:** | There is an alarm on the water pump |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the status of the water pump |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Condenser 1 general alarm** |
| **Cause:** | There is an alarm on the external condenser |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the status of the external condenser |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Condenser 2 general alarm** |
| **Cause:** | There is an alarm on the external condenser |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the status of the external condenser |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Condensing unit general alarm** |
| **Cause:** | There is an alarm on the external condensing unit |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the status of the external condensing unit |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Refrigerant gas leak detector alarm** |
| **Cause:** | There is an alarm on the refrigerant gas leak detector |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the status of the refrigerant gas leak detector |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **No electrical power supply alarm** |
| **Cause:** | There is an electrical power supply outage on the unit |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the status of the unit's electrical power supply line |
| **Restore:** | The alarm needs to be reset manually |

| | |
|---|---|
| **Name:** | **Non-critical generic alarm** |
| **Cause:** | The digital generic non-critical alarm input is open |
| **Delay:** | At startup: 10 s - In operation: 5 s |
| **Effect:** | Signalling only |
| **Solutions:** | Check the status of the digital input |
| **Restore:** | The alarm needs to be reset manually |

#### 11.2.6 LAN ALARMS

| | |
|---|---|
| **Name:** | **Local network communication alarm** |
| **Cause:** | The unit cannot find other units on the local network |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the connection of the local network<br>Check the configuration of the local network parameters |
| **Restore:** | The alarm resets automatically |

### 11.2.7 TEMPERATURE AND HUMIDITY ALARMS

| | |
|---|---|
| **Name:** | **High temperature regulation alarm** |
| **Cause:** | The regulated temperature has exceeded the alarm threshold |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | Signalling only |
| **Solutions:** | Check the unit's operating status |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Low temperature regulation alarm** |
| **Cause:** | The regulated temperature has exceeded the alarm threshold |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | Signalling only |
| **Solutions:** | Check the unit's operating status |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **High limit temperature alarm** |
| **Cause:** | The limit temperature has exceeded the alarm threshold |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | Second parameter (See chapters above) |
| **Solutions:** | Check the unit's operating status |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Low limit temperature alarm** |
| **Cause:** | The limit temperature has exceeded the alarm threshold |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | Second parameter (See chapters above) |
| **Solutions:** | Check the unit's operating status |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Return high humidity alarm** |
| **Cause:** | The return humidity has exceeded the alarm threshold |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | Signalling only |
| **Solutions:** | Check the unit's operating status |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Return low humidity alarm** |
| **Cause:** | The return humidity has exceeded the alarm threshold |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | Signalling only |
| **Solutions:** | Check the unit's operating status |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Supply high humidity alarm** |
| **Cause:** | The supply humidity has exceeded the alarm threshold |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | Signalling only |
| **Solutions:** | Check the unit's operating status |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Supply low humidity alarm** |
| **Cause:** | The supply humidity has exceeded the alarm threshold |
| **Delay:** | At startup: Second parameter - In operation: Second parameter |
| **Effect:** | Signalling only |
| **Solutions:** | Check the unit's operating status |
| **Restore:** | The alarm resets automatically |

#### 11.2.8 PROBE MODULE ALARMS

| | |
|---|---|
| **Name:** | **Module 1 alarm** |
| **Cause:** | The probe module has one of the following problems:<br>**Communication**<br>**Probe 1 broken or disconnected**<br>**Probe 2 broken or disconnected**<br>**Probe 3 broken or disconnected**<br>**Probe 4 broken or disconnected**<br>**Probe 5 broken or disconnected**<br>**Probe 6 broken or disconnected** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe module connection<br>Check the probe connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Module 2 alarm** |
| **Cause:** | The probe module has one of the following problems:<br>**Communication**<br>**Probe 1 broken or disconnected**<br>**Probe 2 broken or disconnected**<br>**Probe 3 broken or disconnected**<br>**Probe 4 broken or disconnected**<br>**Probe 5 broken or disconnected**<br>**Probe 6 broken or disconnected** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe module connection<br>Check the probe connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

| | |
|---|---|
| **Name:** | **Module 1 alarm** |
| **Cause:** | The probe module has one of the following problems:<br>**Communication**<br>**Probe 1 broken or disconnected**<br>**Probe 2 broken or disconnected**<br>**Probe 3 broken or disconnected**<br>**Probe 4 broken or disconnected**<br>**Probe 5 broken or disconnected**<br>**Probe 6 broken or disconnected** |
| **Delay:** | At startup: 30 s - In operation: 30 s |
| **Effect:** | See chapters above |
| **Solutions:** | Check the probe module connection<br>Check the probe connection<br>Check the probe signal |
| **Restore:** | The alarm resets automatically |

## 11.3 DESCRIPTION OF INTERNAL HUMIDIFIER CPY BOARD ALARMS

| Description | Cause | Solution |
|---|---|---|
| **High electrode current** | Electrode overcurrent.<br>The current is greater than the maximum limits due to:<br>• Excessively high water conductivity.<br>• Water level high due to leakage in filling valve.<br>• Water level high due to malfunctioning of discharge valve/header.<br>• Electrode malfunction (for example, a bridge of hard water build-up between electrodes or touching electrodes).<br>• TAM electrical circuit not configured properly.<br>• TAM electrical circuit failure. | • The conductivity level of the water must be between 125-1250 µS/cm.<br>• Check for leakage in the filling valve and clean it or have it replaced.<br>• Check that the discharge valve is working properly.<br>• Replace the cylinder.<br>• Refer to the wiring diagram.<br>• Replace the TAM. |
| **Internal memory error** | The software or configuration parameters are corrupted | Contact the Manufacturer |
| **Parameter error** | The configuration parameters are corrupted | Contact the Manufacturer |
| **High water conductivity** | High supply water conductivity. The possible cause could depend on:<br>• Short-circuited conductivity probes.<br>• Water conductivity exceeding maximum limit. | • Clean the conductivity reading electrodes.<br>• 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.<br>The problem could depend on low mains water pressure or no 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.<br>The steam flow rate is estimated by the TAM wiring diagram. The problem could depend on:<br>• Network water conductivity too low.<br>• Too much foam inside the cylinder.<br>• High amount of limescale inside the cylinder.<br>• TAM electrical circuit not configured properly.<br>• TAM electrical circuit failure. | • The conductivity level of the water must be between 125-1250 µS/cm.<br>• Clean the cylinder and restart.<br>• Clean/replace the cylinder.<br>• Refer to the wiring diagram.<br>• Replace the TAM. |
| **Failed discharge** | The water inside the cylinder is unable to flow away correctly. The problem could depend on:<br>• Clogged/malfunctioning discharge valve.<br>• Clogged header<br>• Clogged cylinder filter | • Check that the discharge valve is working properly.<br>• Remove the cylinder and the discharge valve and clean the header.<br>• Replace the cylinder. |
| **Cylinder maintenance** | The cylinder requires maintenance due to limescale 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 demand.<br>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.<br>• Check the quality of the water. |
| **Cylinder burnt out** | Cylinder burnt out.<br>The alarm is displayed when production does not meet the demand within 3 hours of the "Cylinder Maintenance" display. | Scheduled maintenance: change the cylinder. |

## 11.4 DESCRIPTION OF BLDC COMPRESSOR INVERTER ALARMS

| Description of BLDC compressor inverter alarms | | | | |
|---|---|---|---|---|
| **Code** | | **Description** | **Cause** | **Solution** |
| **F00** | **00** | Communication down | Communication with inverter down. | Check the serial connection to the inverter. |
| **F01** | **02** | Inverter overload (60 s) | During normal operation the current absorbed by the motor exceeded the rated current by 150% for more than 60 seconds.<br><br>The compressor is working with an excessively high load (high condensation temperature - high discharge temperature). | Check the compressor's operating conditions. |
| | **03** | Brief inverter overload (1 s) | During normal operation the current absorbed by the motor exceeded the rated current by 200% for more than 1 second.<br><br>The compressor is working with an excessively high load (high condensation temperature - high discharge temperature-high compression ratio).<br><br>The inverter is damaged and is not able to provide enough current to the motor. | Check the compressor's operating conditions.<br><br>Check the starter circuit pressures.<br><br>Change the inverter. |
| **F02** | **00** | Inverter heat sink over-temperature | The temperature of the inverter heat sink has exceeded the alarm threshold.<br><br>Heat sink ventilation has stopped. | Check inverter ventilation. |
| **F03** | **00** | Internal inverter over-temperature | The internal temperature of the inverter has exceeded the alarm threshold.<br><br>Heat sink ventilation has stopped. | Check inverter ventilation. |
| | **03** | Inverter condenser over-temperature | The temperature of the inverter condenser has exceeded the alarm threshold.<br><br>Heat sink ventilation has stopped. | Check inverter ventilation. |
| **F04** | **01** | Tripped magneto-thermal motor protection | The inverter has detected a short circuit on the electrical connection to the compressor. | Check the electrical connection to the compressor.<br><br>Check the compressor motor. |
| | **02** | No load to the inverter | The inverter does not detect any connected load. | Check the electrical connection to the compressor. |
| | **03** | No phases | The inverter has detected that one or more phases of the connection to the motor are missing. | Check the compressor's electrical connection. |

| Description of BLDC compressor inverter alarms | | | | |
|---|---|---|---|---|
| **Code** | | **Description** | **Cause** | **Solution** |
| **F05** | **00** | Overload | At start-up, the current absorbed by the motor exceeded the rated current by 200% for less than 1 second.<br><br>The compressor motor is mechanically locked. | Check the status of the compressor and change it. |
| | **06** | Motor phase overcurrent | The motor phases are unbalanced. One or more of the motor phases is/are absorbing more current than the others.<br><br>The compressor motor is damaged. | Check the status of the compressor and change it. |
| | **07** | No phase 1 | Motor phase 1 is missing. | Check the compressor's motor and electrical connection. |
| | **08** | No phase 2 | There is no motor phase 2. | Check the compressor's motor and electrical connection. |
| | **09** | No phase 3 | There is no motor phase 3. | Check the compressor's motor and electrical connection. |
| **F06** | **XX** | Internal inverter error | There is an internal error on the inverter. | Contact the manufacturer. |
| **F07** | **00** | DC circuit surge | The voltage on the DC circuit is too high.<br><br>The compressor motor decelerated suddenly. | Check the temperature regulation settings and the compressor operating demand. |
| | **01** | DC circuit undervoltage | The voltage of the DC circuit is too low.<br><br>The voltage of the power supply line is too low. | Check the power supply line |
| | **02** | No power supply | The power supply line is missing or down. | Check the power supply line |
| | **03** | No power supply phases | The inverter has detected that one or more phases of the power supply is/are missing. | Check the power supply line |
| **F08** | **06** | Communication module undervoltage | The communication module is not powered regularly.<br><br>The connections to the communication module are not correct. | Check the connections to the communication module.<br><br>Replace the communication module. |
| **F11** | **00** | Excessively high output frequency | The inverter has detected an excessively high output frequency.<br><br>The compressor motor decelerated suddenly. | Check the compressor regulation parameters.<br><br>Check the temperature regulation settings and the compressor operating demand. |

| Description of BLDC compressor inverter alarms | | | | |
|---|---|---|---|---|
| **Code** | | **Description** | **Cause** | **Solution** |
| **F12** | **01** | STO shut-down error | The inverter has detected an incorrect shut-down sequence on the STO (Safety Torque Off) module contacts.<br><br>The STO contacts were not controlled to standard. | Check the control wiring of the STO contacts. |
| | **02** | STO diagnosis error | The inverter has detected a diagnosis problem of the STO (Safety Torque Off) module. | Reset the inverter.<br><br>If the problem persists, contact the manufacturer. |
| | **04** | Internal STO error | The inverter has detected an internal error of the STO (Safety Torque Off) module. | Reset the inverter.<br><br>If the problem persists, contact the manufacturer. |
| | **05** | STO activation error | The inverter has detected an incorrect start-up sequence on the STO (Safety Torque Off) module contacts.<br><br>The STO contacts were not controlled to standard. | Check the control wiring of the STO contacts. |
| | **06** | The power supply voltage of the STO contacts is too low | The inverter has detected that the voltage on the contacts of the STO (Safety Torque Off) module is lower than 24 V | Check the control wiring of the STO contacts.<br><br>Check the inverter's power supply line. |
| | **07** | STO control edge not read correctly. | The inverter does not read the control edge on the contacts of the STO (Safety Torque Off) module.<br><br>The 0-24V switch of the contacts is not clean or delectable. | Check the control wiring of the STO contacts.<br><br>Check the inverter's power supply line. |
| | **08** | The STO module contacts present contrasting signals | The inverter has detected that the voltage on the contacts of the STO (Safety Torque Off) module is not the same for both A and B contacts. | Check the control wiring of the STO contacts.<br><br>Check the inverter's power supply line. |
| | **09** | The power supply voltage of the STO contacts is too high | The inverter has detected that the voltage on the contacts of the STO (Safety Torque Off) module is higher than 24 V | Check the control wiring of the STO contacts.<br><br>Check the inverter's power supply line. |
| **F13** | **00** | Fault on earth | The inverter has detected a fault on earth on the compressor power supply line. | Check the compressor's electrical connection. |
| **F20** | **7X** | Internal inverter error | There is an internal error on the inverter. | Contact the manufacturer. |
| **F0B** | **XX** | Communication board error | The inverter has detected a problem pertaining to serial communication | Check the serial connection.<br><br>Contact the manufacturer. |

## 12 SUPERVISION THROUGH MODBUS RTU SLAVE PROTOCOL

SySmart microprocessors may be fitted as part of a supervision and/or BMS (Building Management System) network that adopts the standard Modbus® RTU through a RS485 serial circuit board.

The serial communication protocol 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** | Variable between 1200 and 38400 Baud |
| **Word Length** | 8 |
| **Parity** | Even |
| **Stop Bits** | 1 |
| **Function code** | 03 (03 hex) - Read analog output holding registers |
| | 06 (06 hex) - Write single analog output holding registers |
| | 16 (10 hex) - Write multiple analog output holding registers |

### 12.1 CLOSE CONTROL SySmart MICROPROCESSOR SUPERVISOR VARIABLES (SOFTWARE VERSION 2.2)

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Address** | | **Data type** | **Bit** | **Description** | **Unit of measure** | **Limits** | | **Decimals** | **Mode** |
| **Base 0 HEX** | **Base 1 DEC** | | | | | **Min** | **Max** | | |
| **Digital input status** | | | | | | | | | |
| 100 | 257 | 16 bit unsigned | 0 | Motorised damper status | - | 0 | 65535 | 0 | R |
| | | | 1 | Dirty filter alarm | | | | | |
| | | | 2 | Remote OFF status | | | | | |
| | | | 3 | Electric coil thermostat alarm | | | | | |
| | | | 4 | Water sensor/Condensate pump alarm | | | | | |
| | | | 5 | Configurable input 1 | | | | | |
| | | | 6 | Configurable input 2 | | | | | |
| | | | 7 | Configurable input 3 | | | | | |
| | | | 8 | Configurable input 4 | | | | | |
| | | | 9 | Compressor 1 breaker alarm | | | | | |
| | | | 10 | Compressor 1 high pressure alarm | | | | | |
| | | | 11 | Compressor 1 low pressure alarm | | | | | |
| | | | 12 | Compressor 2 breaker alarm | | | | | |
| | | | 13 | Compressor 2 high pressure alarm | | | | | |
| | | | 14 | Compressor 2 low pressure alarm | | | | | |
| **Digital output status** | | | | | | | | | |
| 180 | 385 | 16 bit unsigned | 0 | Fan control | - | 0 | 65535 | | R |
| | | | 1 | Motorised dampers control | | | | | |
| | | | 2 | Electric heating coil stage 1 | | | | | |
| | | | 3 | Electric heating coil stage 2 | | | | | |
| | | | 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 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| **Analogue inputs** | | | | | | | | | |
| 200 | 513 | 16 bit unsigned | - | Return humidity | %Rh | -32768 | 32767 | 0 | R |
| 201 | 514 | 16 bit signed | - | Return temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 202 | 515 | 16 bit unsigned | - | Supply humidity | %Rh | -32768 | 32767 | 0 | R |
| 203 | 516 | 16 bit signed | - | Supply temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 204 | 517 | 16 bit unsigned | - | Air pressure | Pa | -32768 | 32767 | 0 | R |
| 205 | 518 | 16 bit signed | - | Water inlet 1 temperature/Free cooling | °C | -3276.8 | 3276.7 | 1 | R |
| 206 | 519 | | - | Water outlet temperature 1 | °C | -3276.8 | 3276.7 | 1 | R |
| 207 | 520 | | - | Compressor 1 condensation pressure | BarG | -3276.8 | 3276.7 | 1 | R |
| 208 | 521 | | - | Compressor 2 condensation pressure | BarG | -3276.8 | 3276.7 | 1 | R |
| 209 | 522 | | - | Compressor 1 condensation temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 20A | 523 | | - | Compressor 2 condensation temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 20B | 524 | | - | Compressor 1 discharge temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 20C | 525 | | - | Compressor 2 discharge temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 20D | 526 | | - | Compressor 1 suction temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 20E | 527 | | - | Compressor 2 suction temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 20F | 528 | | - | Compressor 1 evaporation pressure | BarG | -327.68 | 327.67 | 1 | R |
| 210 | 529 | | - | Compressor 2 evaporation pressure | BarG | -327.68 | 327.67 | 1 | R |
| 211 | 530 | | - | Compressor 1 evaporation temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 212 | 531 | | - | Compressor 2 evaporation temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 213 | 532 | | - | Compressor 1 liquid temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 214 | 533 | | - | Compressor 2 liquid temperature | °C | -3276.8 | 3276.7 | 1 | R |
| 215 | 534 | 32 bit unsigned | - | Water flow rate 1 (Low) | l/h | 0 | 4294967295 | 0 | R |
| 216 | 535 | | - | Water flow rate 1 (High) | | | | | |
| 217 | 536 | 32 bit unsigned | - | Water flow rate 2 (Low) | l/h | 0 | 4294967295 | 0 | R |
| 218 | 537 | | - | Water flow rate 2 (High) | | | | | |
| 219 | 538 | 32 bit unsigned | - | Total water flow rate (Low) | l/h | 0 | 4294967295 | 0 | R |
| 21A | 539 | | - | Total water flow rate (High) | | | | | |
| 21B | 540 | 16 bit unsigned | - | Return humidity (local network average) | %Rh | -32768 | 32767 | 0 | R |
| 21C | 541 | 16 bit signed | - | Return temperature (local network average) | °C | -3276.8 | 3276.7 | 1 | R |
| 21D | 542 | 16 bit unsigned | - | Supply humidity (local network average) | %Rh | -32768 | 32767 | 0 | R |
| 21E | 543 | 16 bit signed | - | Supply temperature (local network average) | °C | -3276.8 | 3276.7 | 1 | R |
| 21F | 544 | 16 bit unsigned | - | Air pressure (local network average) | Pa | -32768 | 32767 | 0 | R |
| 220 | 545 | 16 bit signed | - | Water inlet temperature 2 | °C | -3276.8 | 3276.7 | 1 | R |
| 221 | 546 | 16 bit signed | - | Water outlet temperature 2 | °C | -3276.8 | 3276.7 | 1 | R |
| 589 | 1418 | 16 bit unsigned | - | Dirty filter differential pressure | Pa | -32768 | 32767 | 0 | R |

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| **Remote module probes** | | | | | | | | | |
| 222 | 547 | 16 bit signed | - | Probe 1 module 1 value | - | -3276.8 | 3276.7 | 1 | R |
| 223 | 548 | | - | Probe 2 module 1 value | - | -3276.8 | 3276.7 | 1 | R |
| 224 | 549 | | - | Probe 3 module 1 value | - | -3276.8 | 3276.7 | 1 | R |
| 225 | 550 | | - | Probe 4 module 1 value | - | -3276.8 | 3276.7 | 1 | R |
| 226 | 551 | | - | Probe 5 module 1 value | - | -3276.8 | 3276.7 | 1 | R |
| 227 | 552 | | - | Probe 6 module 1 value | - | -3276.8 | 3276.7 | 1 | R |
| 228 | 553 | | - | Probe 1 module 2 value | - | -3276.8 | 3276.7 | 1 | R |
| 229 | 554 | | - | Probe 2 module 2 value | - | -3276.8 | 3276.7 | 1 | R |
| 22A | 555 | | - | Probe 3 module 2 value | - | -3276.8 | 3276.7 | 1 | R |
| 22B | 556 | | - | Probe 4 module 2 value | - | -3276.8 | 3276.7 | 1 | R |
| 22C | 557 | | - | Probe 5 module 2 value | - | -3276.8 | 3276.7 | 1 | R |
| 22D | 558 | | - | Probe 6 module 2 value | - | -3276.8 | 3276.7 | 1 | R |
| 22E | 559 | | - | Probe 1 module 3 value | - | -3276.8 | 3276.7 | 1 | R |
| 22F | 560 | | - | Probe 2 module 3 value | - | -3276.8 | 3276.7 | 1 | R |
| 230 | 561 | | - | Probe 3 module 3 value | - | -3276.8 | 3276.7 | 1 | R |
| 231 | 562 | | - | Probe 4 module 3 value | - | -3276.8 | 3276.7 | 1 | R |
| 232 | 563 | | - | Probe 5 module 3 value | - | -3276.8 | 3276.7 | 1 | R |
| 233 | 564 | | - | Probe 6 module 3 value | - | -3276.8 | 3276.7 | 1 | R |
| 234 | 565 | | - | Modules temperature probes average | °C | -3276.8 | 3276.7 | 1 | R |
| 235 | 566 | 16 bit unsigned | - | Modules humidity probes average | %Rh | -32768 | 32767 | 0 | R |
| 236 | 567 | | - | Modules pressure probes average | Pa | -32768 | 32767 | 0 | R |
| **Remote module probes status** | | | | | | | | | |
| 58D | 1422 | 16 bit unsigned | - | Probe 1 module 1 status * | - | 0 | 4 | 0 | R |
| 58E | 1423 | | - | Probe 2 module 1 status * | - | 0 | 4 | 0 | R |
| 58F | 1424 | | - | Probe 3 module 1 status * | - | 0 | 4 | 0 | R |
| 590 | 1425 | | - | Probe 4 module 1 status * | - | 0 | 4 | 0 | R |
| 591 | 1426 | | - | Probe 5 module 1 status * | - | 0 | 4 | 0 | R |
| 592 | 1427 | | - | Probe 6 module 1 status * | - | 0 | 4 | 0 | R |
| 593 | 1428 | | - | Probe 1 module 2 status * | - | 0 | 4 | 0 | R |
| 594 | 1429 | | - | Probe 2 module 2 status * | - | 0 | 4 | 0 | R |
| 595 | 1430 | | - | Probe 3 module 2 status * | - | 0 | 4 | 0 | R |
| 596 | 1431 | | - | Probe 4 module 2 status * | - | 0 | 4 | 0 | R |
| 597 | 1432 | | - | Probe 5 module 2 status * | - | 0 | 4 | 0 | R |
| 598 | 1433 | | - | Probe 6 module 2 status * | - | 0 | 4 | 0 | R |
| 599 | 1434 | | - | Probe 1 module 3 status * | - | 0 | 4 | 0 | R |
| 59A | 1435 | | - | Probe 2 module 3 status * | - | 0 | 4 | 0 | R |
| 59B | 1436 | | - | Probe 3 module 3 status * | - | 0 | 4 | 0 | R |
| 59C | 1437 | | - | Probe 4 module 3 status * | - | 0 | 4 | 0 | R |
| 59D | 1438 | | - | Probe 5 module 3 status * | - | 0 | 4 | 0 | R |
| 59E | 1439 | | - | Probe 6 module 3 status * | - | 0 | 4 | 0 | R |
| * 0 = Disabled; 1 = Temperature; 2 = Humidity; 3 = Pressure; 4 = Alarm | | | | | | | | | |
| **Analogue outputs** | | | | | | | | | |
| 280 | 641 | 16 bit signed | - | Supply Fan / Dry cooler modulation | % | 0.00 | 100.00 | 2 | R |
| 281 | 642 | | - | Cold valve / Free cooling / External inverter | % | 0.00 | 100.00 | 2 | R |
| 282 | 643 | | - | Heating valve / Modulating electric coil | % | 0.00 | 100.00 | 2 | R |
| 283 | 644 | | - | Two sources water valve | % | 0.00 | 100.00 | 2 | R |
| 284 | 645 | | - | Condenser 1 | % | 0.00 | 100.00 | 2 | R |
| 285 | 646 | | - | Condenser 2 / External humidifier | % | 0.00 | 100.00 | 2 | R |

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| **Unit Status** | | | | | | | | | |
| 500 | 1281 | 16 bit unsigned | - | Unit status* | - | 0 | 6 | 0 | R |
| * 0 = Unit OFF - 1 = OFF Remote - 2 = OFF from supervisor - 3 = Off from alarm - 4 = Stand-by - 5 = Unit ON - 6 = Ultracap | | | | | | | | | |
| **Supply air flow** | | | | | | | | | |
| 516 | 1303 | 16 bit unsigned | - | Air flow (Low) | $m^3/h$ | 0 | 4294967295 | 0 | R |
| 517 | 1304 | | - | Air flow (High) | | | | | |
| **Working hours** | | | | | | | | | |
| 57A | 1403 | 16 bit unsigned | - | Unit (Low) | h | 0 | 100000 | 0 | R |
| 57B | 1404 | | - | Unit ( High ) | | | | | |
| 51F | 1312 | | - | Compressor 1 (Low) | h | 0 | 100000 | 0 | R |
| 520 | 1313 | | - | Compressor 1 ( High ) | | | | | |
| 521 | 1314 | | - | Compressor 2 (Low) | h | 0 | 100000 | 0 | R |
| 522 | 1315 | | - | Compressor 2 ( High ) | | | | | |
| 52B | 1324 | | - | Heating (Low) | h | 0 | 100000 | 0 | R |
| 52C | 1325 | | - | Heating (High) | | | | | |
| 52D | 1326 | | - | Dry cooler( Low ) | h | 0 | 100000 | 0 | R |
| 52E | 1327 | | - | Dry cooler ( High ) | | | | | |
| 52F | 1328 | | - | Humidifier (Low) | h | 0 | 100000 | 0 | R |
| 530 | 1329 | | - | Humidifier (High) | | | | | |
| 531 | 1330 | | - | Cooling valve (Low) | h | 0 | 100000 | 0 | R |
| 532 | 1331 | | - | Cooling valve (High) | | | | | |
| 533 | 1332 | | - | Condenser 1 (Low) | h | 0 | 100000 | 0 | R |
| 534 | 1333 | | - | Condenser 1 (High) | | | | | |
| 535 | 1334 | | - | Condenser 2 (Low) | h | 0 | 100000 | 0 | R |
| 536 | 1335 | | - | Condenser 2 (High) | | | | | |
| 547 | 1352 | | - | Free Cooling ( Low ) | h | 0 | 100000 | 0 | R |
| 548 | 1353 | | - | Free Cooling ( High ) | | | | | |
| **Electronic expansion valves state** | | | | | | | | | |
| 53B | 1340 | 16 bit signed | - | Current EEV1 superheat set-point | K | -3276.8 | 3276.7 | 1 | R |
| 53C | 1341 | | - | Current EEV2 superheat set-point | K | -3276.8 | 3276.7 | 1 | R |
| 53D | 1342 | | - | Current EEV1 superheat | K | -3276.8 | 3276.7 | 1 | R |
| 53E | 1343 | | - | Current EEV2 superheat | K | -3276.8 | 3276.7 | 1 | R |
| 53F | 1344 | | - | Current EEV1 position | % | 0.00 | 100.00 | 2 | R |
| 540 | 1345 | | - | Current EEV2 position | % | 0.00 | 100.00 | 2 | R |
| 57C | 1405 | | - | Current EEV1 de-superheat | K | -3276.8 | 3276.7 | 1 | R |
| 57D | 1406 | | - | Current EEV2 de-superheat | K | -3276.8 | 3276.7 | 1 | R |
| 57E | 1407 | | - | Current EEV1 sub-cooling | K | -3276.8 | 3276.7 | 1 | R |
| 57F | 1408 | | - | Current EEV2 sub-cooling | K | -3276.8 | 3276.7 | 1 | R |
| 587 | 1416 | | - | Current compression ratio 1 | - | -3276.8 | 3276.7 | 1 | R |
| 588 | 1417 | | - | Current compression ratio 2 | - | -3276.8 | 3276.7 | 1 | R |

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| **Internal humidifier status** | | | | | | | | | |
| 541 | 1346 | 16 bit signed | - | Current humidifier production | kg/h | 0.0 | 6553.5 | 1 | R |
| 542 | 1347 | 16 bit unsigned | - | Supply water conductivity | µS/cm | 0 | 65535 | 0 | R |
| 543 | 1348 | 16 bit signed | - | Absorbed humidifier current | A | 0.0 | 6553.5 | 1 | R |
| 545 | 1350 | 16 bit unsigned | - | Humidifier operating mode * | - | 0 | 7 | 0 | R |
| * 0 = Not active; 1 = Soft-start; 2 = Start full production after reduced production; 3 = Full production; 4 = Reduced production; 5, 6, 7 = Soft-start | | | | | | | | | |
| 546 | 1351 | 16 bit unsigned | - | Humidifier operating status * | - | 0 | 11 | 0 | R |
| * 0 = Not active (no demand or blocked or disabled); 1 = Start evaporation cycle; 2 = Water charging in progress; 3 = Evaporation in progress; 4 = DCW discharge; 5 = Water discharge (through dilution or manual); 6 = End of water discharge; 7 = Full discharge for long period of downtime; 8 = Full discharge from manual or network request; 9 = No water control; 10 = Pre-wash; 11 = Periodic discharge | | | | | | | | | |
| 549 | 1354 | 16 bit unsigned | - | Humidifier control | - | 0 | 1 | 0 | R |
| 54A | 1355 | | - | Discharge valve | - | 0 | 1 | 0 | R |
| 54B | 1356 | | - | Charging valve | - | 0 | 1 | 0 | R |
| 54C | 1357 | | - | High water level | - | 0 | 1 | 0 | R |
| **Fan status** | | | | | | | | | |
| 54D | 1358 | 16 bit unsigned | - | Fan 1 speed | RPM | 0 | 65535 | 0 | R |
| 54E | 1359 | | - | Fan 2 speed | RPM | 0 | 65535 | 0 | R |
| 54F | 1360 | | - | Fan 3 speed | RPM | 0 | 65535 | 0 | R |
| 550 | 1361 | | - | Fan 4 speed | RPM | 0 | 65535 | 0 | R |
| 551 | 1362 | | - | Fan 5 speed | RPM | 0 | 65535 | 0 | R |
| 552 | 1363 | 16 bit signed | - | Fan 1 speed | % | 0.00 | 100.00 | 2 | R |
| 553 | 1364 | | - | Fan 2 speed | % | 0.00 | 100.00 | 2 | R |
| 554 | 1365 | | - | Fan 3 speed | % | 0.00 | 100.00 | 2 | R |
| 555 | 1366 | | - | Fan 4 speed | % | 0.00 | 100.00 | 2 | R |
| 556 | 1367 | | - | Fan 5 speed | % | 0.00 | 100.00 | 2 | R |
| 557 | 1368 | | - | Fan 1 absorbed current | A | 0.0 | 6553.5 | 1 | R |
| 558 | 1369 | 16 bit unsigned | - | Fan 1 absorbed electrical power | W | 0 | 65535 | 0 | R |
| 559 | 1370 | 16 bit signed | - | Fan 2 absorbed current | A | 0.0 | 6553.5 | 1 | R |
| 55A | 1371 | 16 bit unsigned | - | Fan 2 absorbed electrical power | W | 0 | 65535 | 0 | R |
| 55B | 1372 | 16 bit signed | - | Fan 3 absorbed current | A | 0.0 | 6553.5 | 1 | R |
| 55C | 1373 | 16 bit unsigned | - | Fan 3 absorbed electrical power | W | 0 | 65535 | 0 | R |
| 55D | 1374 | 16 bit signed | - | Fan 4 absorbed current | A | 0.0 | 6553.5 | 1 | R |
| 55E | 1375 | 16 bit unsigned | - | Fan 4 absorbed electrical power | W | 0 | 65535 | 0 | R |
| 55F | 1376 | 16 bit signed | - | Fan 5 absorbed current | A | 0.0 | 6553.5 | 1 | R |
| 560 | 1377 | 16 bit unsigned | - | Fan 5 absorbed electrical power | W | 0 | 65535 | 0 | R |

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| **DC compressor inverter status** | | | | | | | | | |
| 56E | 1391 | 16 bit signed | - | Current compressor speed (Low) | Hz | -21474836.48 | 21474836.47 | 2 | R |
| 56F | 1392 | | - | Current compressor speed (High) | | | | | |
| 571 | 1394 | | - | Current compressor electrical power (Low) | kW | -21474836.48 | 21474836.47 | 2 | R |
| 572 | 1395 | | - | Current compressor electrical power (High) | | | | | |
| 573 | 1396 | | - | Current compressor absorbed current (Low) | A | -21474836.48 | 21474836.47 | 2 | R |
| 574 | 1397 | | - | Current compressor absorbed current (High) | | | | | |
| **Water cooling capacity** | | | | | | | | | |
| 567 | 1384 | 16 bit signed | - | Chilled water cooling capacity 1 ( Low ) | kW | 0.00 | 42949672.95 | 2 | R |
| 568 | 1385 | | - | Chilled water cooling capacity 1 ( High ) | | | | | |
| 56B | 1388 | | - | EER 1 | - | 0.00 | 655.35 | 2 | R |
| 583 | 1412 | | - | Chilled water cooling capacity 2 ( Low ) | kW | 0.00 | 42949672.95 | 2 | R |
| 584 | 1413 | | - | Chilled water cooling capacity 2 ( High ) | | | | | |
| 585 | 1414 | | - | EER 2 | - | 0.00 | 655.35 | 2 | R |
| **Electric coil status** | | | | | | | | | |
| 50D | 1294 | 16 bit unsigned | - | Number of active stages | - | 0 | 255 | 0 | R |
| 580 | 1409 | 16 bit signed | - | Electrical power requirement | kW | 0.0 | 6553.5 | 1 | R |

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| **On/Off from supervision** | | | | | | | | | |
| 53A | 1339 | 16 bit unsigned | - | On/Off from supervisor | - | 0 | 1 | 0 | R/W |
| **Set-point** | | | | | | | | | |
| 600 | 1537 | 16 bit signed | - | Temperature set-point | °C | -40.0 | 302.0 | 1 | R/W |
| 601 | 1538 | 16 bit unsigned | - | Humidity set-point | %Rh | 0 | 100 | 0 | R/W |
| **Ventilation set-point** | | | | | | | | | |
| 602 | 1539 | 32 bit unsigned | - | Supply air flow rate set-point (Low) | $m^3/h$ | 500 | 99000 | 0 | R/W |
| 603 | 1540 | | - | Supply air flow rate set-point (High) | | | | | |
| 604 | 1541 | 16 bit unsigned | - | Air pressure set-point | Pa | -900 | 900 | 0 | R/W |
| **Temperature Regulation** | | | | | | | | | |
| 606 | 1543 | 16 bit unsigned | - | Regulation sensor * | - | 0 | 1 | 0 | R/W |
| * 0 = Return; 1 = Supply | | | | | | | | | |
| 605 | 1542 | 16 bit unsigned | - | Regulation type * | - | 0 | 2 | 0 | R/W |
| * 0 = Proportional (P); 1 = Proportional + Integral (PI); 2 = Proportional + Integral + Derivative (PID) | | | | | | | | | |
| 607 | 1544 | 16 bit signed | - | Proportional Band | °C | 0.1 | 108.0 | 1 | R/W |
| 608 | 1545 | 16 bit unsigned | - | Integration Time | s | 0 | 9999 | 0 | R/W |
| 609 | 1546 | | - | Derivative time | s | 0 | 9999 | 0 | R/W |
| 60A | 1547 | 16 bit signed | - | High temperature alarm offset | °C | 0.0 | 36.0 | 1 | R/W |
| 60B | 1548 | | - | Low temperature alarm offset | °C | 0.0 | 36.0 | 1 | R/W |
| **Limit temperature regulation** | | | | | | | | | |
| 613 | 1556 | 16 bit signed | - | Upper limit temperature limit | °C | -15.0 | 194.0 | 1 | R/W |
| 614 | 1557 | 16 bit unsigned | - | High limit temperature management * | - | 0 | 3 | 0 | R/W |
| * 0 = Alarm only; 1 = Stop component; 2 = Reduction; 3 = Cold activation | | | | | | | | | |
| 615 | 1558 | 16 bit signed | - | Lower limit temperature limit | °C | -15.0 | 194.0 | 1 | R/W |
| 616 | 1559 | 16 bit unsigned | - | Low limit temperature management * | - | 0 | 3 | 0 | R/W |
| * 0 = Alarm only; 1 = Stop component; 2 = Reduction; 3 = Hot activation | | | | | | | | | |
| **Humidity regulation** | | | | | | | | | |
| 60F | 1552 | 16 bit unsigned | - | Dehumidification proportional band | %RH | 1 | 50 | 0 | R/W |
| 60C | 1549 | | - | Humidification proportional band | %RH | 1 | 50 | 0 | R/W |
| 611 | 1554 | | - | High return humidity alarm offset | %RH | 0 | 100 | 0 | R/W |
| 612 | 1555 | | - | Low return humidity alarm offset | %RH | 0 | 100 | 0 | R/W |
| 729 | 1834 | | - | Upper supply humidity limit | %RH | 0 | 100 | 0 | R/W |
| 72A | 1835 | | - | Lower supply humidity limit | %RH | 0 | 100 | 0 | R/W |
| **Humidifier regulation** | | | | | | | | | |
| 60E | 1551 | 16 bit unsigned | - | Humidification enabling | - | 0 | 1 | 0 | R/W |
| 74F | 1872 | | - | Manual discharge | - | 0 | 1 | 0 | R/W |
| 750 | 1873 | | - | Cylinder pre-wash | - | 0 | 1 | 0 | R/W |
| **Free cooling and two sources regulation** | | | | | | | | | |
| 618 | 1561 | 16 bit signed | - | Free cooling delta | °C | 1.0 | 54.0 | 1 | R/W |
| 619 | 1562 | | - | Two sources water set-point | °C | 1.0 | 86.0 | 1 | R/W |
| 6D2 | 1747 | | - | Two sources water band | °C | 0.1 | 36.0 | 1 | R/W |
| 61A | 1563 | 16 bit unsigned | - | Two sources source exchange | - | 0 | 1 | 0 | R/W |

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| **Condenser regulation** | | | | | | | | | |
| 56C | 1389 | 16 bit signed | - | Current condenser 1 set-point | °C | -3276.8 | 3276.7 | 1 | R |
| 56D | 1390 | | - | Current condenser 2 set-point | °C | -3276.8 | 3276.7 | 1 | R |
| 645 | 1606 | | - | Condensation set-point | °C | 30.0 | 149.0 | 1 | R/W |
| 646 | 1607 | | - | Condensation proportional band | °C | 1.0 | 72.0 | 1 | R/W |
| 6D7 | 1752 | | - | Condensation set-point increase | °C | 0.1 | 90.0 | 1 | R/W |
| 6D8 | 1753 | | - | Maximum condensation set-point | °C | 0.1 | 149.0 | 1 | R/W |
| **Dry cooler regulation** | | | | | | | | | |
| 537 | 1336 | 16 bit signed | - | Current dry cooler set-point | °C | -3276.8 | 3276.7 | 1 | R |
| 61B | 1564 | | - | Dry cooler set-point | °C | 1.0 | 149.0 | 1 | R/W |
| 61C | 1565 | | - | Dry Cooler proportional band | °C | 0.5 | 36.0 | 1 | R/W |
| 61D | 1566 | | - | Dry Cooler set-point increase | °C | 0.1 | 90.0 | 1 | R/W |
| 61E | 1567 | | - | Maximum dry Cooler set-point | °C | 0.1 | 149.0 | 1 | R/W |
| **Dirty filter regulation** | | | | | | | | | |
| 76B | 1900 | 16 bit unsigned | - | Dirty filter set-point | Pa | 0 | 5000 | 0 | R/W |
| 76C | 1901 | | - | Dirty filter differential | Pa | 1 | 100 | 0 | R/W |

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| Alarms | | | | | | | | | |
| 300 | 769 | 16 bit unsigned | 0 | Broken return humidity probe alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Broken return temperature probe alarm | | | | | |
| | | | 2 | Broken air differential pressure sensor alarm | | | | | |
| | | | 3 | Broken supply temperature probe alarm | | | | | |
| | | | 4 | Broken IN 1 water temperature probe alarm<br>Broken free cooling temperature probe alarm | | | | | |
| | | | 5 | Broken OUT 1 water temperature probe alarm | | | | | |
| | | | 6 | Broken water flow rate 1 sensor alarm<br>Broken liquid 1 temperature probe alarm | | | | | |
| | | | 7 | Broken supply humidity probe alarm | | | | | |
| | | | 8 | Broken water flow rate 2 sensor alarm<br>Broken liquid 2 temperature probe alarm | | | | | |
| | | | 9 | Water presence sensor alarm<br>Condensate discharge pump alarm | | | | | |
| | | | 10 | Electric coil safety thermostat | | | | | |
| | | | 11 | Damper status alarm | | | | | |
| | | | 12 | Clogged air filter alarm | | | | | |
| | | | 13 | Compressor 1 thermal magnetic protection alarm | | | | | |
| | | | 14 | Compressor 2 thermal magnetic protection alarm | | | | | |
| | | | 15 | Compressor 1 high pressure alarm | | | | | |
| 301 | 770 | 16 bit unsigned | 0 | Compressor 2 high pressure alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Compressor 1 low pressure alarm | | | | | |
| | | | 2 | Compressor 2 low pressure alarm | | | | | |
| | | | 3 | Compressor 1 discharge high temperature alarm | | | | | |
| | | | 4 | Compressor 2 discharge high 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| 302 | 771 | 16 bit unsigned | 0 | Low temperature regulation alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | High return humidity alarm | | | | | |
| | | | 2 | Low return humidity alarm | | | | | |
| | | | 3 | High supply 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 | | | | | |
| 303 | 772 | 16 bit unsigned | 0 | Critical generic alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Condensing unit general alarm | | | | | |
| | | | 2 | No power supply alarm | | | | | |
| | | | 3 | Compressor 1 low compression alarm | | | | | |
| | | | 4 | Compressor 2 low compression alarm | | | | | |
| | | | 5 | Broken IN 2 water temperature probe alarm | | | | | |
| | | | 6 | Broken OUT 2 water temperature probe alarm | | | | | |
| | | | 7 | Dirty filter pressure sensor alarm | | | | | |
| 304 | 773 | 16 bit unsigned | 0 | EEV1 communication down alarm | - | 0 | 65535 | 0 | 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 | | | | | |
| 305 | 774 | 16 bit unsigned | 0 | EEV2 communication down alarm | - | 0 | 65535 | 0 | 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 | | | | | |
| 306 | 775 | 16 bit unsigned | 0 | CPY communication down alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Internal memory error | | | | | |
| | | | 2 | Parameter error | | | | | |
| | | | 3 | High electrode current | | | | | |
| | | | 4 | Low steam flow rate | | | | | |
| | | | 5 | Failed 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| 307 | 776 | 16 bit unsigned | 0 | Fan 1 no phase/power supply alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Fan 1 communication down alarm | | | | | |
| | | | 2 | Fan 1 regulation module high temperature | | | | | |
| | | | 3 | Fan 1 no master-slave communication | | | | | |
| | | | 4 | Fan 1 regulation module failure | | | | | |
| | | | 5 | Fan 1 high motor temperature | | | | | |
| | | | 6 | Fan 1 Hall sensor error | | | | | |
| | | | 7 | Fan 1 motor overload | | | | | |
| | | | 8 | Not used | | | | | |
| | | | 9 | Not used | | | | | |
| | | | 10 | Not used | | | | | |
| | | | 11 | Not used | | | | | |
| | | | 12 | Fan 1 low DC power supply | | | | | |
| 308 | 777 | 16 bit unsigned | 0 | Fan 2 no phase/power supply alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Fan 2 communication down alarm | | | | | |
| | | | 2 | Fan 2 regulation module high temperature | | | | | |
| | | | 3 | Fan 2 no master-slave communication | | | | | |
| | | | 4 | Fan 2 regulation module failure | | | | | |
| | | | 5 | Fan 2 high motor temperature | | | | | |
| | | | 6 | Fan 2 Hall sensor error | | | | | |
| | | | 7 | Fan 2 motor overload | | | | | |
| | | | 8 | Not used | | | | | |
| | | | 9 | Not used | | | | | |
| | | | 10 | Not used | | | | | |
| | | | 11 | Not used | | | | | |
| | | | 12 | Fan 2 low DC power supply | | | | | |
| 309 | 778 | 16 bit unsigned | 0 | Fan 3 no phase/power supply alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Fan 3 communication down alarm | | | | | |
| | | | 2 | Fan 3 regulation module high temperature | | | | | |
| | | | 3 | Fan 3 no master-slave communication | | | | | |
| | | | 4 | Fan 3 regulation module failure | | | | | |
| | | | 5 | Fan 3 high motor temperature | | | | | |
| | | | 6 | Fan 3 Hall sensor error | | | | | |
| | | | 7 | Fan 3 motor overload | | | | | |
| | | | 8 | Not used | | | | | |
| | | | 9 | Not used | | | | | |
| | | | 10 | Not used | | | | | |
| | | | 11 | Not used | | | | | |
| | | | 12 | Fan 3 low DC power supply | | | | | |

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| 30A | 779 | 16 bit unsigned | 0 | Fan 4 no phase/power supply alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Fan 4 communication down alarm | | | | | |
| | | | 2 | Fan 4 regulation module high temperature | | | | | |
| | | | 3 | Fan 4 no master-slave communication | | | | | |
| | | | 4 | Fan 4 regulation module failure | | | | | |
| | | | 5 | Fan 4 high motor temperature | | | | | |
| | | | 6 | Fan 4 Hall sensor error | | | | | |
| | | | 7 | Fan 4 motor overload | | | | | |
| | | | 8 | Not used | | | | | |
| | | | 9 | Not used | | | | | |
| | | | 10 | Not used | | | | | |
| | | | 11 | Not used | | | | | |
| | | | 12 | Fan 4 low DC power supply | | | | | |
| 30B | 780 | 16 bit unsigned | 0 | Fan 5 no phase/power supply alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Fan 5 communication down alarm | | | | | |
| | | | 2 | Fan 5 regulation module high temperature | | | | | |
| | | | 3 | Fan 5 no master-slave communication | | | | | |
| | | | 4 | Fan 5 regulation module failure | | | | | |
| | | | 5 | Fan 5 high motor temperature | | | | | |
| | | | 6 | Fan 5 Hall sensor error | | | | | |
| | | | 7 | Fan 5 motor overload | | | | | |
| | | | 8 | Not used | | | | | |
| | | | 9 | Not used | | | | | |
| | | | 10 | Not used | | | | | |
| | | | 11 | Not used | | | | | |
| | | | 12 | Fan 5 low DC power supply | | | | | |
| 30C | 781 | 16 bit unsigned | - | DC compressor inverter communication alarm | - | 0 | 1 | 0 | R |
| 30D | 782 | | - | DC compressor inverter alarm code [0] * | - | 0 | 255 | 0 | R |
| 30E | 783 | | - | DC compressor inverter alarm code [1] * | - | 0 | 255 | 0 | R |
| 30F | 784 | | - | DC compressor inverter alarm code [2] * | - | 0 | 255 | 0 | R |
| 310 | 785 | | - | DC compressor inverter alarm code [3] * | - | 0 | 255 | 0 | R |
| 311 | 786 | | - | DC compressor inverter alarm code [4] * | - | 0 | 255 | 0 | R |
| * 48 = 0; 49 = 1; 50 = 2; 51 = 3; 52 = 4; 53 = 5; 54 = 6; 55 = 7; 56 = 8; 57 = 9; 70 = F | | | | | | | | | |
| 58A | 1419 | 16 bit unsigned | 0 | Broken dirty filter pressure sensor alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Dirty filter pressure sensor wiring alarm | | | | | |
| | | | 2 | Dirty filter pressure sensor pressure range alarm | | | | | |
| | | | 3 | Dirty filter pressure sensor overload ADC alarm | | | | | |
| | | | 4 | Dirty filter pressure sensor calibration alarm | | | | | |
| | | | 5 | Dirty filter pressure sensor DCO alarm | | | | | |
| | | | 6 | Dirty filter pressure sensor watchdog alarm | | | | | |
| | | | 7 | Dirty filter pressure sensor communication alarm | | | | | |
| 337 | 824 | 16 bit unsigned | 0 | Module 1 communication alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Probe 1 module 1 alarm | | | | | |
| | | | 2 | Probe 2 module 1 alarm | | | | | |
| | | | 3 | Probe 3 module 1 alarm | | | | | |
| | | | 4 | Probe 4 module 1 alarm | | | | | |
| | | | 5 | Probe 5 module 1 alarm | | | | | |
| | | | 6 | Probe 6 module 1 alarm | | | | | |

| HOLDING REGISTER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| 338 | 825 | 16 bit unsigned | 0 | Module 2 communication alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Probe 1 module 2 alarm | | | | | |
| | | | 2 | Probe 2 module 2 alarm | | | | | |
| | | | 3 | Probe 3 module 2 alarm | | | | | |
| | | | 4 | Probe 4 module 2 alarm | | | | | |
| | | | 5 | Probe 5 module 2 alarm | | | | | |
| | | | 6 | Probe 6 module 2 alarm | | | | | |
| 339 | 826 | 16 bit unsigned | 0 | Module 3 communication alarm | - | 0 | 65535 | 0 | R |
| | | | 1 | Probe 1 module 3 alarm | | | | | |
| | | | 2 | Probe 2 module 3 alarm | | | | | |
| | | | 3 | Probe 3 module 3 alarm | | | | | |
| | | | 4 | Probe 4 module 3 alarm | | | | | |
| | | | 5 | Probe 5 module 3 alarm | | | | | |
| | | | 6 | Probe 6 module 3 alarm | | | | | |

| HOLDING REGISTER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Address | | Data type | Bit | Description | Unit of measure | Limits | | Decimals | Mode |
| Base 0 HEX | Base 1 DEC | | | | | Min | Max | | |
| **Alarms reset** | | | | | | | | | |
| 312 | 787 | 16 bit unsigned | - | Water presence sensor alarm reset<br>Condensate discharge pump alarm reset | - | 0 | 1 | 0 | R/W |
| 313 | 788 | | - | Electr. coil safety thermostat alarm reset | | | | | |
| 314 | 789 | | - | Damper status alarm reset | | | | | |
| 315 | 790 | | - | Clogged air filter alarm reset | | | | | |
| 316 | 791 | | - | Compressor 1 thermal magnetic protection alarm reset | | | | | |
| 317 | 792 | | - | Compressor 2 thermal magnetic protection alarm reset | | | | | |
| 318 | 793 | | - | Compressor 1 high pressure alarm reset | | | | | |
| 319 | 794 | | - | Compressor 2 high pressure alarm reset | | | | | |
| 31A | 795 | | - | Compressor 1 high discharge temperature alarm reset | | | | | |
| 31B | 796 | | - | Compressor 2 high discharge temperature alarm reset | | | | | |
| 31C | 797 | | - | Compressor 1 EEV alarm reset | | | | | |
| 31D | 798 | | - | Compressor 2 EEV alarm reset | | | | | |
| 31E | 799 | | - | Compressor 1 inverter alarm reset | | | | | |
| 31F | 800 | | - | Comp. 1 low compression alarm reset | | | | | |
| 320 | 801 | | - | Comp. 2 low compression alarm reset | | | | | |
| 321 | 802 | | - | Fan 1 inverter alarm reset | | | | | |
| 322 | 803 | | - | Fan 2 inverter alarm reset | | | | | |
| 323 | 804 | | - | Fan 3 inverter alarm reset | | | | | |
| 324 | 805 | | - | Fan 4 inverter alarm reset | | | | | |
| 325 | 806 | | - | Fan 5 inverter alarm reset | | | | | |
| 326 | 807 | | - | Internal humidifier alarm reset | | | | | |
| 327 | 808 | | - | Dry cooler general alarm reset | | | | | |
| 328 | 809 | | - | External humidifier general alarm reset | | | | | |
| 329 | 810 | | - | General water pump alarm reset | | | | | |
| 32A | 811 | | - | Condenser 1 general alarm reset | | | | | |
| 32B | 812 | | - | Condenser 2 general alarm reset | | | | | |
| 32C | 813 | | - | Refrigerant gas leak detector alarm reset | | | | | |
| 32D | 814 | | - | General supply fans alarm reset | | | | | |
| 32E | 815 | | - | Fire/Smoke presence alarm reset | | | | | |
| 32F | 816 | | - | Non-critical generic alarm reset | | | | | |
| 330 | 817 | | - | Critical generic alarm reset | | | | | |
| 331 | 818 | | - | Condensing unit generic alarm reset | | | | | |
| 332 | 819 | | - | No power supply alarm reset | | | | | |
| 333 | 820 | | - | Compressor 1 low pressure alarm reset | | | | | |
| 334 | 821 | | - | Compressor 2 low pressure alarm reset | | | | | |

# 13 SySmart TROUBLESHOOTING

## 13.1 THE UNIT DOES NOT START

Check:

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

## 13.2 INCORRECT READING OF INPUT SIGNALS

Check:

- That the inputs have been calibrated correctly (from program).
- That the probe power supply is correct.
- That the probe connection is set up as per the wiring diagram.
- That the probe output signal is correct.
- That 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).
- That 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.

## 13.3 QUESTIONABLE ALARM SIGNALLING FROM DIGITAL INPUT

Check:

- That there is 24 Vac power supply on the alarm contact.
- That the terminal is fitted into its seat.
- That there are no breaks upstream of the terminal.

## 13.4 FAILED CLOSURE OF A DIGITAL OUTPUT

Check:

- That there is 24 Vac power supply on the digital contact.
- That the terminal is fitted into its seat.
- That there are no breaks downstream of the terminal.

## 13.5 NO ANALOGUE OUTPUTS

Check:

- That there is a 0-10Vcc analogue output signal.
- That the terminal is fitted into its seat.
- That there are no breaks downstream of the terminal.

## 13.6 THE SySmart ACTIVATES THE WATCH-DOG FUNCTION

Check:

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

## 13.7 THE SERIAL CONNECTION WITH THE SUPERVISOR/BMS IS NOT WORKING

Check:

- That the unit's serial address is set correctly.
- That the unit's baud rate (communication speed) is set correctly.
- What type of serial cables are used.
- That the serial cable connection is correct based on the wiring diagram.
- That the power cables do not run near the main board microprocessors.
- That there are no sources of electromagnetic interference near the microprocessor or the data transmission cables.

## 13.8 LOCAL NETWORK CONNECTION IS NOT WORKING

Check:

- That the unit's serial address is set correctly.
- That the unit's baud rate (communication speed) is set correctly.
- What type of serial cables are used.
- That the power cables do not run near the main board microprocessors.
- That there are no sources of electromagnetic interference near the microprocessor or the data transmission cables.

## 13.9 MODBUS MASTER CONNECTION IS NOT WORKING

Check:

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



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