STULZ

CLIMATE. CUSTOMIZED.



C2020

I/O controller

Index 58
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1. Introduction

The object of this manual is a microprocessor controller for air conditioners used in Telecommunication area.

C2020 controller manages all main functions of air conditioning units with two basic purposes:

- Temperature control with cooling and heating. The cooling mode can be obtained either by the compressor operating in a single refrigerant circuit or by introducing external air in free cooling mode. Heating requires the activation of electrical heaters.
- Humidity control can be obtained either by enabling dehumidification mode or with the humidifier operation.

C2020 controller can control 1 refrigerating circuit and can be combined with two different versions of operator interface:

- User interface with 3-digit display to allow the change of parameters, such as: cooling set point, cooling band, etc.
- Service interface with 4 × 20 display to access all parameters and functions of the controller, used for commissioning and servicing the air conditioner.

C2020 can control up to 3 DC evaporator fans, subject to parallel control. This means that fans will be controlled by the same output, while each fan sends a speed indicating feedback signal towards the board (board input). Up to five C2020 controllers can be connected in a LAN for sequencing, back-up and capacity management.

IMPORTANT NOTE: software functions and parameters described in this manual are generally valid for the software version, which is designed to control units of different product families and configurations. Therefore, unit features cannot be automatically inferred from software described in this manual. Features of a particular product family are only the ones described on its specific manual.
Information in this manual refers to software version STUTL213.

2. Hardware features

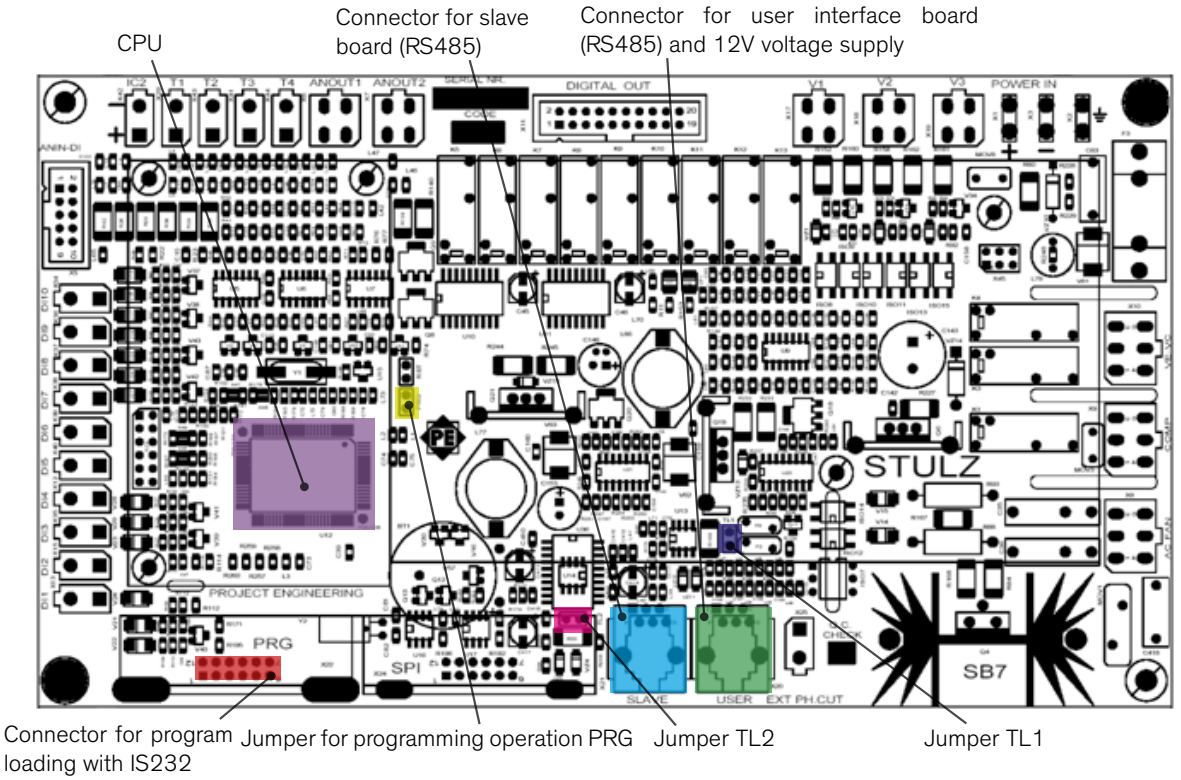


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2.1. Technical data

- Voltage supply 24 ÷ 48 V DC, tolerance -15 ÷ +25%
- Nominal supply 24 Vdc
- Current absorption: 310 mA at 24 Vdc, 210 mA at 48 Vdc
- Microprocessor with 512 Kbyte flash memory
- Mother board SB7
- Analog inputs:
  - 4 AN-IN PTC, range -35 ÷ +90 °C
  - 3 AN-IN: 4 - 20 mA
- 13 non-insulated DIG-IN for free-contact kind inputs
- Analog outputs:
  - 2 AN-OUT 0/10V non-insulated
  - 3 AN-OUT 0/10V non-insulated for DC engines control with DC tachometric feedback
  - 1 AN-OUT 230Vac, 4 A insulated for power control through phase-cut
- Digital outputs:
  - 9 DIG-OUT relays 48 V AC
  - 3 DIG-OUT relays 230 V AC - 5 A
- 1 slot connector for interface boards on SPI bus: Stulz accessory ACTHKEY (hardware key for on-site microprocessor programming and application setup).
- 3 serial interfaces with microprocessor:
  - COM0: 1 telephone connector for connection to the user interface board.
  - COM1: 1 slot for IS232 / IS485 adapter boards for connection to monitoring systems or for programming.
  - COM2: 1 telephone connector for master-slave connection.
- Clock and non volatile memory on board, on I2C bus
- Operating temperature: - 20°C ÷ 60°C
- Storage temperature: - 30°C ÷ 70°C

2.2. SB7 board layout



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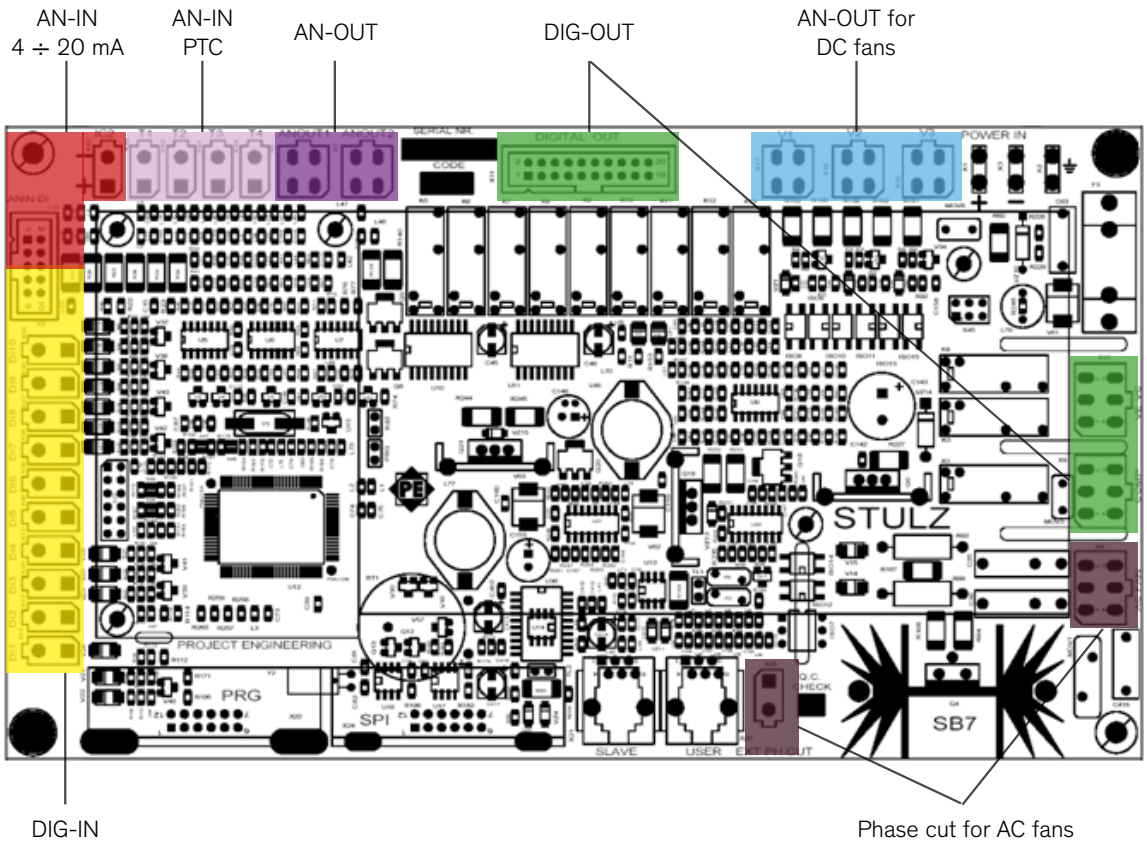
Technical Data

Dimensions:	215 × 120 × 40 mm
Power consumption:	8 W
Fuse:	1A time-lag
Download interface:	RS232 (external adapter required)
User interface board connection:	RS485

There are three jumpers on board:

Name	Description	Default configuration
TL1	Central termination of the 485 user	Not plugged in
TL2	Central termination of the 485 slave	Plugged in
PRG	Programming jumper	Not plugged in

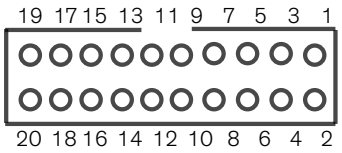
2.3. I/O assignment

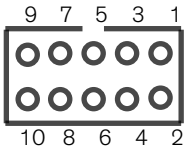


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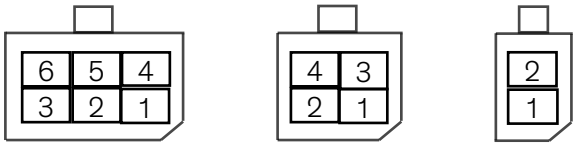
Connectors layout

Top view of flat connectors





Top view of minifit connectors



POWER SUPPLY				
Terminal	**Name**	**Type**	**Features**	**Notes**
X1	+ Vdc	Voltage	24 ÷ 48Vdc -15% / +25%	Fast-on connector
X3	0 Vdc	Supply Reference		Fast-on connector
X2	PE	Functional Earth		Fast-on connector

Analog input

ANALOG INPUT						
Name		**Logic ID**	**Signal type**	**Range**	**Terminals**	**Features - description**
T1	+	T1	PTC*	-35÷90	X29 pin 1	Evaporator Temperature (TE)
	-				X29 pin 2	
T2	+	T2	PTC*	-35÷90	X43 pin 1	Internal Temperature (TI)
	-				X43 pin 2	
T3	+	T3	PTC*	-35÷90	X41 pin 1	Condenser Temperature (TC)
	-				X41 pin 2	
T4	+	T4	PTC*	-35÷90	X44 pin 1	External Air Temperature (TAE)
	-				X44 pin 2	
ANIN-DI		IC1	mA	4÷20	X5 pin 1	Internal Relative Humidity (IRH)
					X5 pin 2	
IC2	+	IC2	mA	4÷20	X42 pin 1	Condenser Pressure (PC)
	-				X42 pin 2	
ANIN-DI		IC3	mA	4÷20	X5 pin 3	External Relative Humidity (ERH) / Evaporator pressure (PE)
					X5 pin 4	

* PTC sensor KTY-81

Digital input

The 13 digital inputs are free-contact type. All of them have a common reference. The contacts for digital inputs must be mechanical and non-solid state.

DIGITAL INPUT				
Name	**Logic ID**	**Signal type**	**Terminals**	**Features - description**
ANIN-DI	A1	Free contact	X5 pin 5	
			X5 pin 6	Fire-smoke presence
DI1	A6	Free contact	X13 pin 1	
			X13 pin 2	Magneto-thermal protection of condenser fan
ANIN-DI	A3	Free contact	X5 pin 7	
			X5 pin 8	Door open / Intrusion
ANIN-DI	A4	Free contact	X5 pin 9	
			X5 pin 10	External enable (ON-OFF)
DI2	A5	Free contact	X15 pin 1	
			X15 pin 2	Magneto-thermal protection compressor
DI3	A8	Free contact	X35 pin 1	
			X35 pin 2	Thermal protection heating element
DI4	A7	Free contact	X12 pin 1	
			X12 pin 2	Magneto-thermal protection evaporator fan
DI5	A12	Free contact	X40 pin 1	
			X40 pin 2	Air flow
DI6	A11	Free contact	X39 pin 1	
			X39 pin 2	Dirty filter alarm (or blocked condenser)
DI7	A10	Free contact	X38 pin 1	
			X38 pin 2	High pressure
DI8	A9	Free contact	X37 pin 1	
			X37 pin 2	Voltage lack
DI9	A13	Free contact	X36 pin 1	
			X36 pin 2	Low pressure input
DI10	A2	Free contact	X34 pin 1	
			X34 pin 2	Humidity switch

Analog output

ANALOG OUTPUT					
Name	**Logic ID**	**Signal type**	**Range**	**Terminals**	**Features - description**
ANOUT1	DAC0	Vdc	0÷10 V	X6 pin 1	DC 1 supply : positive
				X6 pin 2	DC 1 supply : negative
				X6 pin 3	0÷10V signal output
				X6 pin 4	Signal reference
ANOUT2	DAC1	Vdc	0÷10 V	X7 pin 1	DC 2 supply : positive
				X7 pin 2	DC 2 supply : negative
				X7 pin 3	0÷10V signal output
				X7 pin 4	Signal reference

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DC FANS					
Name	**Logic ID**	**Signal type**	**Range**	**Terminals**	**Features - description**
V1	V1	PWM	Duty cycle 0÷100 %	X17 pin 1	Fan 1 supply: positive
				X17 pin 2	Fan 1 supply: negative
				X17 pin 3	Fan 1 - PWM Signal (f = 1 kHz)
				X17 pin 4	Fan 1 - Tachometric Signal input
V2	V2	PWM	Duty cycle 0÷100 %	X18 pin 1	Fan 2 supply: positive
				X18 pin 2	Fan 2 supply: negative
				X18 pin 3	Fan 2 - PWM Signal (f = 1 kHz)
				X18 pin 4	Fan 2 - Tachometric Signal input
V3	V3	PWM	Duty cycle 0÷100 %	X19 pin 1	Fan 3 supply: positive
				X19 pin 2	Fan 3 supply: negative
				X19 pin 3	Fan 3 - PWM Signal (f = 1 kHz)
				X19 pin 4	Fan 3 - Tachometric Signal input

AC FANS OUTPUT FOR SPEED ADJUSTMENT - PHASE CUT				
Name	**Logic ID**	**Pin (X8)**	**Type**	**Function description**
AC FAN	VC	1	Line Input: Phase	Condenser fan
		2	Phase cut Output	
		3		
		4	Line Input: Neutral	230 Power supply
		5	Line Output: Neutral	
		6		

An auxiliary connector (X25) is provided on board, in order to control the phase-cut module. The signal is a 5 mA (approximately) current pulse on a 1K load; in order to produce the right phase delay between the pulse and the network voltage zero-crossing instant, the line has to be connected necessarily to the poles 1 and 4 of X8.

EXTERNAL PHASE CUT				
Name	**Logic ID**	**Pin (X25)**	**Type**	**Description**
EXT. PHASE CUT	EXT. PHASE CUT	1	Pulse signal output current	Signal for external phase cut module
		2	Current signal feedback	

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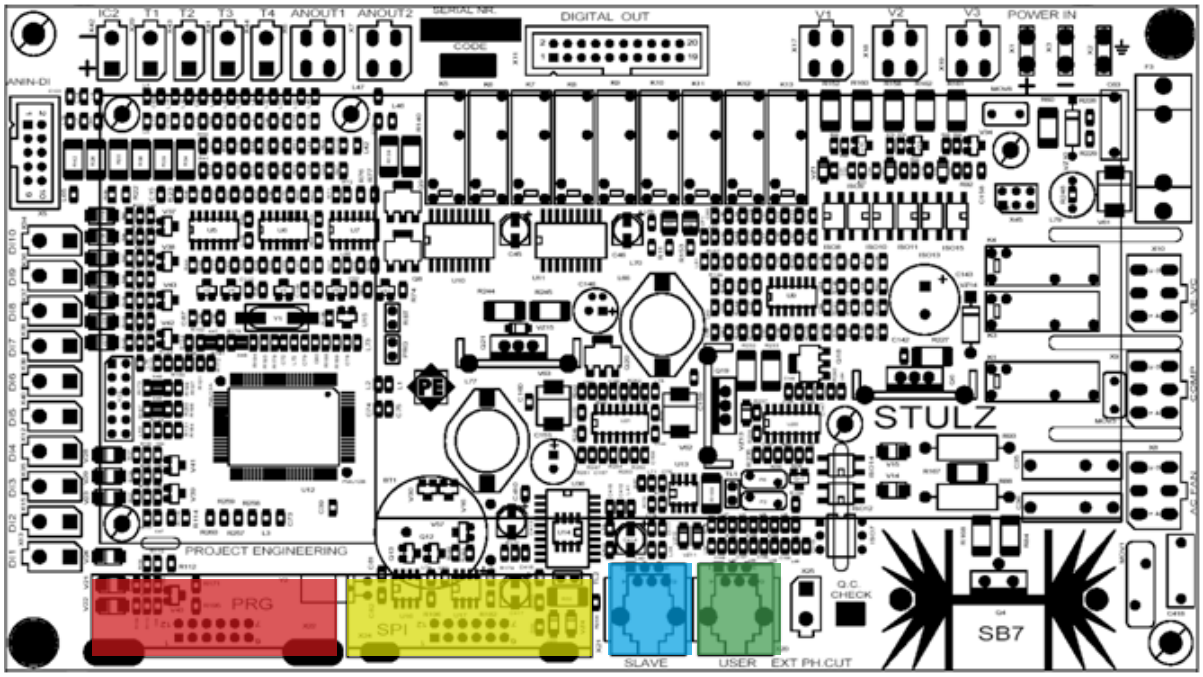
Digital output

In the following table the default settings are showed; all the other associations are selectable via software.

DIGITAL OUTPUT					
Name	**Logic ID**	**Signal type**	**Range**	**Terminals**	**Features - description**
COMP	K1	NO contact output K1	230Vac 5A resistive	X9 pin 1	Compressor contactor
		Common output K1		X9 pin 2	
		Not used		X9 pin 3	
		Reference		X9 pin 4	
		Reference		X9 pin 5	
		Not used		X9 pin 6	
VE-VC	K3	NO contact output K3	230Vac 5A resistive	X10 pin 1	Evaporator fan
		Common output K3		X10 pin 2	
	K4	NO contact output K4	230Vac 5A resistive	X10 pin 3	Condenser fan / Humidification
		Not used		X10 pin 4	
		Not used		X10 pin 5	
		Common output K4		X10 pin 6	
DIGITAL OUT	K5	NO contact output K5	48Vdc 1A resistive	X11 pin 1	Common warning
	K5	Common output K5		X11 pin 2	
	K6	NO contact output K6	48Vdc 1A resistive	X11 pin 3	Low pressure alarm
	K6	Common output K6		X11 pin 4	
	K7	NO contact output K7	48Vdc 1A resistive	X11 pin 5	High pressure alarm
	K7	Common output K7		X11 pin 6	
	K8	NO contact output K8	48Vdc 1A resistive	X11 pin 7	Air flow
	K8	Common output K8		X11 pin 8	
	K9	NO contact output K9	48Vdc 1A resistive	X11 pin 9	Dirty filter
	K9	Common output K9		X11 pin 10	
	K10	NO contact output K10	48Vdc 1A resistive	X11 pin 11	High temperature alarm
	K10	Common output K10		X11 pin 12	
	K11	NO contact output K11	48Vdc 1A resistive	X11 pin 13	Low temperature alarm
	K11	Common output K11		X11 pin 14	
	K12	NO contact output K12	48Vdc 1A resistive	X11 pin 15	High humidity alarm
	K12	Common output K12		X11 pin 16	
	K13	NO contact output K13	48Vdc 1A resistive	X11 pin 17	Common alarm
	K13	Common output K13		X11 pin 18	
		Not used		X11 pin 19	
		Not used		X11 pin 20	

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2.4. Communication



COM1: PRG SPI COM2: SLAVE COM0: USER

SPI synchronous serial interface
X24 allows the plug-in of a serial interface board, such as ACTHKEY (hardware key for software up/download).

COM1: PRG asynchronous serial interface
The connector X22 allows the plug-in of an IS232 (connector for program loading) or an IS485 (adapter to allow the connection of C2020 to RS485 serial line) interface board for communication with a Tele-control gateway and other serial devices.

COM0 – COM2: USER and SLAVE serial interfaces
There are two telephone connectors (RJ-12) on board: X20 for connection to the user interface (COM0) and X21 for connection to a remote slave controller (COM2).

A pin-to-pin telephone cable must be used for connection to USER and SLAVE ports. Over 5 m length, screened cables must be used.

Name	Logic ID	Signal type	Terminals	Features - description
USER (COM0)	-	-	X20-1	Not connected
	TX+	+ RS485	X20-2	Line + RS485
	TX-	- RS485	X20-3	Line – RS485
	GND	Ground	X20-4	Ground
	+V	V not adjusted	X20-5	12V voltage supply
	-		X20-6	Not connected
SLAVE (COM2)	-	-	X21-1	Not connected
	TX+	+ RS485	X21-2	Line + RS485
	TX-	- RS485	X21-3	Line – RS485
	GND	Ground	X21-4	Ground
	-	-	X21-5	Not connected
	-	-	X21-6	Not connected

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2.5. User interface

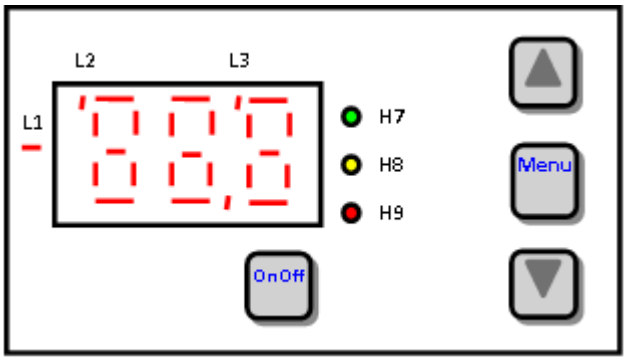
An user interface board is supplied as an option; it's connected to the mother board through a 4-poles telephone cable (including serial bi-directional RS485 line and the power supply).
There are two serial user interfaces that can be linked to the mother board through USER connector:

- EO3 (corresponding to Stulz accessory ACTUKPD) will be used for the final customer.
- CO3 (corresponding to Stulz accessory ACTKPDC1010H) will be used for manufacturer and service.

2.5.1. EO3 user interface (Stulz accessory ACTUKPD)

- Dimensions: 76.5 × 58.5 mm
- 3 digits LED 7 segments display
- Keyboard, 4 keys:
  - MENU / SET to enter into setup menu or to change setup parameters values
  - UP to change values and to scroll up
  - DOWN to change values and to scroll down
  - ON_OFF / ESC to switch on / off the machine or to exit from setup menu
- 6 on-board LEDs:
  - L1: Minus for negative number visualization on 7 segments display;
  - L2, L3: Page displayed in normal mode
  - H7: Machine status: cooling or freecooling on (green)
  - H8: Common warning presence (yellow)
  - H9: Alarm presence (red)
- Operating temperature: -0°C +70°C

The EO3 user interface layout is shown in the following drawing:

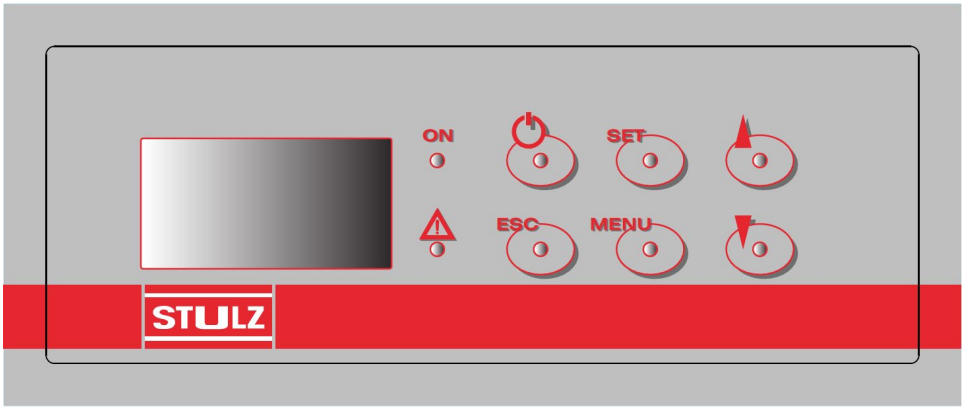


2.5.2. CO3 user interface (Stulz accessory ACTKPDC1010H)

- Dimensions: 200 × 70 mm, "no case"
- LCD display 20 × 4
- Keyboard, 6 keys:
  - SET to change set point
  - UP to change values and to scroll up
  - DOWN to change values and to scroll down
  - ESC to exit menu
  - START/STOP to start/stop the controller
  - MENU working menu access
- Operating temperature: -0°C +60°C (limited by LCD module)

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The CO3 user interface layout is shown in the following drawing:



2.5.3. WIB1000

WIB1000, or WIB1485, is a single point Ethernet interface, that is physically soldered on SPI connector. WIB1000 is the option without the serial interface 485, while WIB1485 is the option with serial interface 485.
The parameters must be set as follows:

- **M08** = 1
- **M09** = PEMS

The board has the following features:

- Power supply +5V: from the main board
- It's provided with 2 LEDs:
  - 1 LED for correct power supply
  - 1 LED for diagnostic
- It's provided with three ports:
  - USB 2.0 Full-speed Host-Port (12Mbits per second).
  - 10/100Base-TX LAN Ethernet interface.
  - Option: 1 serial 485 optocoupled connection on 3 poles, 3.81mm screw connector (only WIB1485).

3. Interfaces

Two different user interfaces can be connected to the USER connector (EO3 and CO3) and it's always possible to change the user interface also when the board is powered. The user is auto detected by the software during the connection.

3.1. Visualization on E03 User

Note that a rotation is used to display strings with size greater than 3 digit.

Initialization mode
During initialization, the firmware version and the custom (if it's different from zero) are displayed two times (STUTL2XX_YY_ZZ).

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Normal mode
If the system is off, "OFF" will be displayed.
If the system is in standby state, "STB" will be displayed (LED H8 and LED H9 off).
If the system is on, the value of internal temperature will be displayed.
When cooling or freecooling are switched on, LED H7 (green) will be switched on.

Pressing UP / DOWN key the following information will be displayed (Page 5, 6, 7, 8, 9, 10, 11, 12 and 13 with string rotation):

Page 1 - Internal temperature:"XX.X" (LED L2: OFF - LED L3: OFF)
Page 2 - External temperature: "XX.X" (LED L2: ON - LED L3: OFF)
Page 3 - Internal relative humidity: "XX.X" (LED L2: OFF - LED L3: ON)
Page 4 - External relative humidity: "XX.X" (LED L2: ON - LED L3: ON)
Page 5 - Condenser fan speed: "CF_XXX" (XXX = %)
Page 6 - Condenser pressure (**M95**=1) or condenser temperature (**M95**=0):
"PC_XXX" (XXX = bar or DIS)
"TC_XXX" (XXX = °C or DIS)
Page 7 - Compressor status: "CP_XXX" (XXX = %, ON or OFF)
Page 8 - Evaporator fans speed: "EF_XXX" (XXX = % or OFF)
Page 9 - Heater status: "HT_XXX" (XXX = ON or OFF)
Page 10 - Freecooling damper status:
"FC_XXX_A" (XXX = %, OFF or DIS; A if freecooling damper is in assisted mode)
Page 11 - Evaporator temperature: "TE_XXX" (XXX = °C or DIS)
Page 12 - Supply temperature: "TS_XXX" (XXX = °C or DIS)
Page 13 - Firmware version and custom (if different from zero):
"STUTL2XX_YY_ZZ" (XX_YY = Firmware version; ZZ = Custom)

After 30 seconds without pressing any key, it returns to Page 1.

Locked mode
If the user interface is locked, when the customer presses a key, the string "LOC" will be displayed for 5 seconds. See the chapter 4.17 Locked keypad for more information.

Alarm mode
If an alarm occurs, the alarm code will be displayed alternating with the normal mode visualization and LED H9 (red) will be switched on. If a "common warning" occurs, LED H8 (yellow) will be switched on. If a key is pressed, the alarm is not displayed for 30 seconds. For a detailed list of alarm codes see the chapter 6 Alarms.

3.2. Menu on E03 user

3.2.1. Inserting and setting the passwords

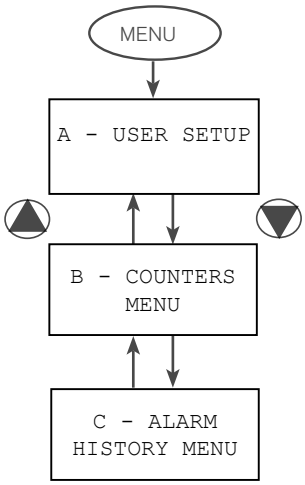
If the user password is set, it will be request. The password is a value composed by 3 digits, everyone in the range 0-9; the value must be inserted or set one digit at time. Entering in the USER SETUP menu, the mask "000" will be displayed with the first digit on the left blinking and the customer, with the UP/DOWN keys, selects a number comprehensive between 0 and 9. To confirm the choice press the SET key and the second digit will start blinking. Continue in this way until the insertion of the 3 digits and, if the inserted password is right, the USER SETUP will be accessible.
It's possible to go out from this procedure pressing the ESC key, going back the previous screen.
User password is factory set at 000, maintenance password is factory set at 111.

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3.2.2. Entering the menu

To enter into setup menu, the MENU key has to be pressed from any screen.

Below there's a flow chart that shows which menus are accessible using E03 user and how you can move between them.



Press the SET key to enter into every single setup menu to change parameters and to store a parameter changed. If you press the ESC key, you will come back to the previous menu without storing anything.
To change a parameter, press the MENU key and 'A' will appear on the screen.
For example, if the parameter "Cooling band" (**S06**) has to be changed, select the desired menu, then press the SET key and '**S01**' will appear. By pressing the UP / DOWN key it's possible to scroll the various parameter: in this case "Cooling Band" is the sixth parameter, so it's sufficient to press six times the UP key to obtain **S06**.
To change the value, press the SET key and the value will be shown (blinking), than press the UP / DOWN key to set a different value. To store the new value, press the SET key. If the ESC key is pressed, the new value isn't stored.

If A - User setup is selected:
- The display will show the code of the parameter
- Use UP / DOWN keys to scroll all the parameters

If B - Counters menu is selected:
- Use UP / DOWN keys to visualize one at a time the hours of activity of four devices (with string rotation) as below:
  - Page 1 - Hours of evaporator fans activity (x100 h): "EF_XXX"
  - Page 2 - Hours of condenser fan activity (x100 h): "CF_XXX"
  - Page 3 - Hours of compressor activity (x100 h): "CP_XXX"
  - Page 4 - Hours of freecooling damper activity (x100 h): "FC_XXX"
- Press ESC to go back to the previous menu

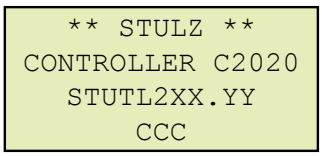
If C - Alarm history menu is selected:
- Use the UP / DOWN keys to visualize one at a time the last 50 happened alarms (with string rotation).

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3.3. Visualization on C03 user (ACTKPDC1010H)

In the first screen the following data are displayed:

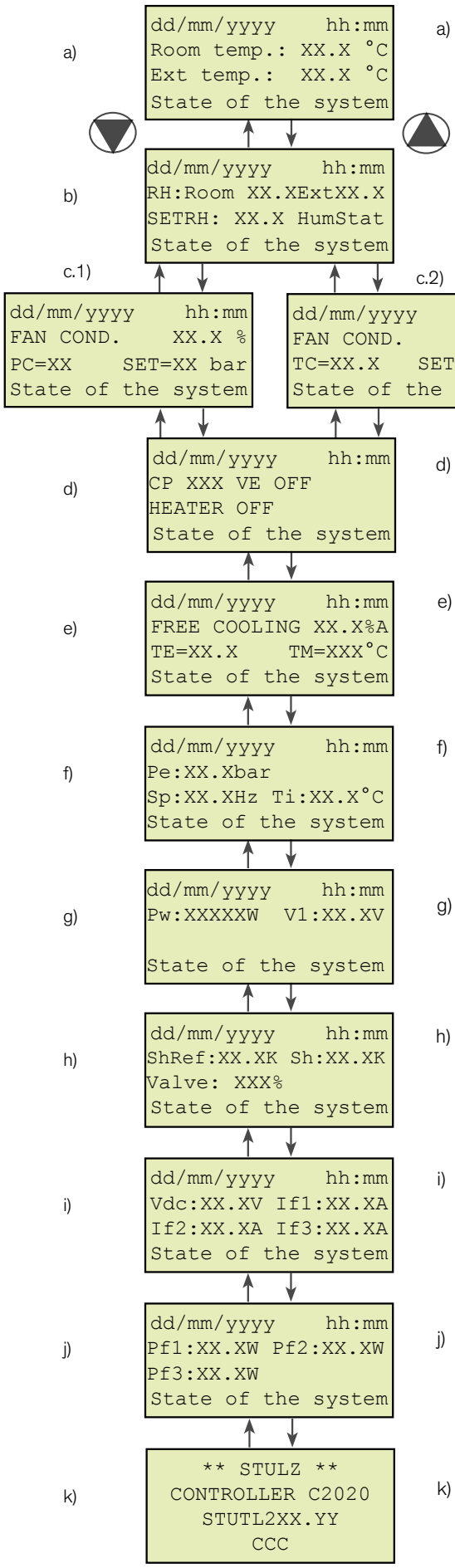
1. The manufacturer's name ("STULZ")
2. The type of controller ("CONTROLLER C2020")
3. The version of the software (standard or "client's name")
4. The client's version (standard or name of the client)



After the initialization phase a new screen appears. Use UP/DOWN ARROW keys to scroll the screens and display the measured and set parameters, for example: external and internal temperature, external and internal humidity, fans on/off, etc.

In the following figure all main screens are represented on the left and on the right side are explained the parameters indicated in every screen.
If a component is not connected, the corresponding value doesn't appear (---).

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a) - Room temp: Internal temperature (TI)
- Ext temp: External temperature (TAE)
- State of the system:
(SYSTEM OFF / SYSTEM ON / STAND-BY /EMERGENCY)

b) - Room temp: Internal temperature (TI)
- RH: Relative humidity of the room (IRH)
- Ext: External relative humidity (ERH)
- **SETRH:** Set point of humidification
- **HumStat:** State of humidification (OFF / HUMID xx% / DEHUM xx%)

c1) With pressure sensor:
- Speed of fan
- PC: Condenser pressure
- Set pressure of condenser

c2) With temperature sensor:
- Velocity of condenser fan
- TC: Condenser temperature
- Set temperature of condenser

d) - CP: State of compressor (OFF / ON / XXX%)
- VE: State of evaporator fan
- State of heater

e) - Opening of freecooling damper
(DISABLE / OFF / XX.X% / A-assisted mode)
- TE: Temperature at evaporator fan
- TM: Temperature of leaving air flow

f) (if enabled Danfoss compressor)
- Evaporator pressure - Data point Modbus 40206
- Compressor speed - Data point Modbus 40301
- Inverter temperature - Data point Modbus 40207

g) (if enabled Danfoss compressor)
- Pw: compressor power - Data point Modbus 40203
- V1: Line voltage - Data point Modbus 40222

h) (if enabled Danfoss compressor)
- Superheat reference - Data point Modbus 40007
- Superheat - Data point Modbus 40008
- Pct opening - Data point Modbus 40009

i) (if enabled Danfoss compressor)
- Vdc: Power supply voltage (V)
- IfX: Current absorbed by fan X (A). If the current absorbed is lower than 400mA, it's shown 0 A

j) (if enabled Danfoss compressor)
- PfX: Power consumption of fan X (W). If the current absorbed is lower than 400mA, it's shown 0 W

k) (if enabled Danfoss compressor)
- Information screen, equal to the screen displayed at start up

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Possible states of the system:
- SYSTEM OFF: the system has been switched off by the ON-OFF key. Components of the unit are not working, alarms are disabled, the unit is still supplied and the controller is working.
- SYSTEM ON: the system has been switched on by the ON-OFF key; unit is working according to the set logic.
- STAND-BY: the system is on, but the unit doesn't have to work for a certain time (e.g. due to sequencing function).
- EMERGENCY: see paragraph 5.5.

Locked keypad
If the keypad is locked, the key symbol "O-°" will appear in the corner on the right of the fourth line.

3.4. Menu on C03 user

All parameters are memorized in a menu structure with different level of password to access.

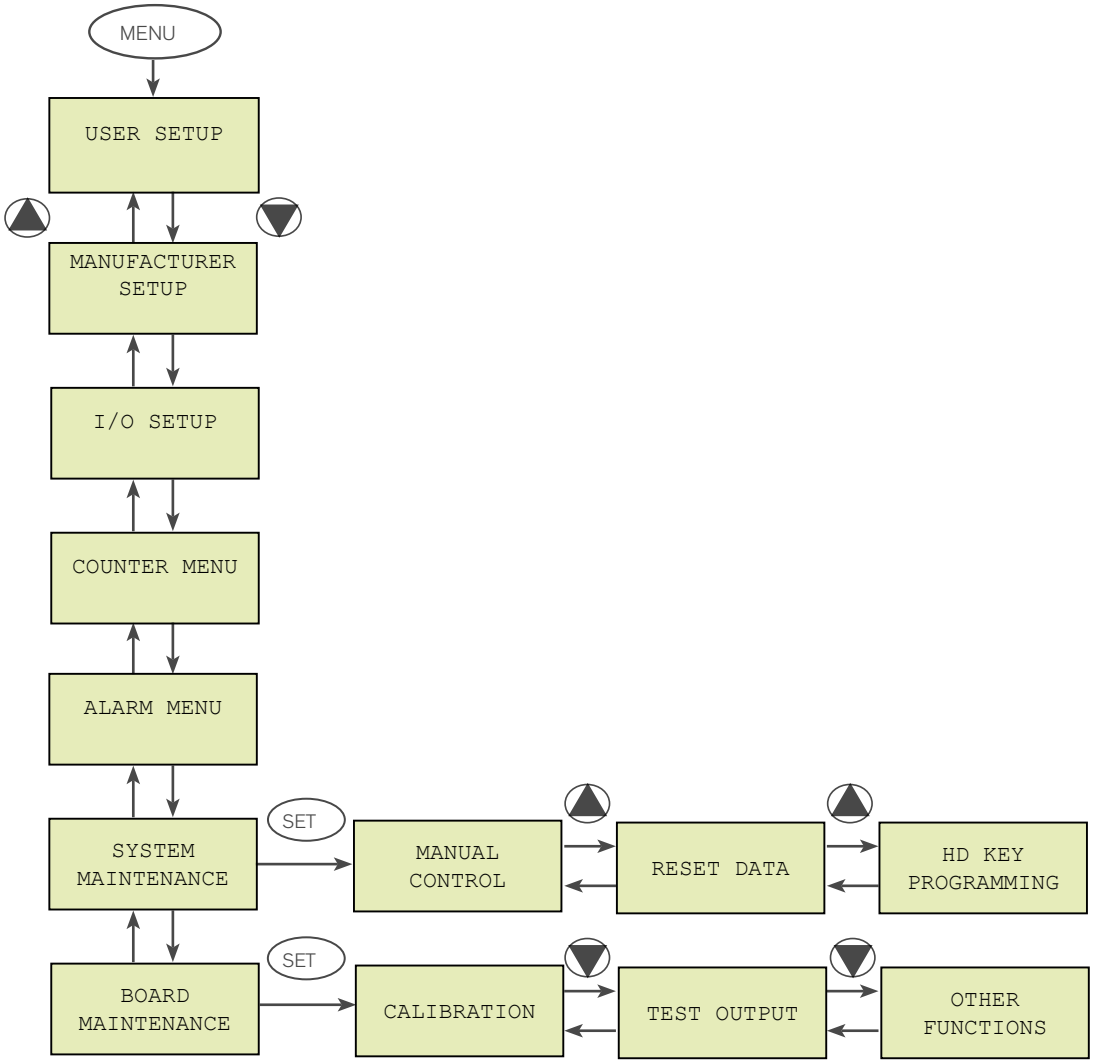
3.4.1. Inserting and setting the passwords

The password is a value composed by 3 digits, everyone in the range 0-9.
The value of the password must be inserted or set one digit at time. Entering in the USER SETUP, the display to insert the password will appear with the first digit on left blinking, with the UP/DOWN keys select a number comprehensive between 0 and 9. To confirm the choice press the SET key and the second digit will start blinking. Continue in this way until the insertion of the 3 digits of the password and, if the inserted password is right, the USER SETUP will be accessible. It's possible to go out from this procedure pressing the ESC key, going back the previous screen.
User password is factory set at 000, maintenance password is factory set at 111.

3.4.2. Entering the menu

To enter into setup menu, the MENU key has to be pressed from any screen.
In the following figure there's a flow chart which shows how you can move between the menu.

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The menu are divided in two levels and inside them you can move with UP/DOWN ARROW keys. The menu of the first level are:

- User setup
- Manufacturer setup
- I/O setup
- Counter setup
- Alarm menu
- System maintenance
- Board maintenance (menu limited to factory)

From “System maintenance” and “Board maintenance” you can access, pressing the SET key, to the menu of the second level which are:

- System maintenance:
  - Manual control
  - Reset data
  - HW key programming
- Board maintenance:
  - Calibration
  - Test output
  - Other function

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Press the SET key to enter into every single setup menu of the first or the second level to change some parameters and to store a parameter changed; but if you press the ESC key, you will come back to the previous menu without storing anything.

3.4.3. Parameter change and setting a string parameter

Procedure to change a parameter value:

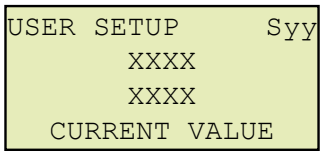
- To change a parameter it's necessary to enter into 'USER MENU', pressing the MENU key. For example, if the parameter "Cooling band" (S06) has to be changed, select the desired menu and than press the SET key. With the UP/DOWN ARROW key it's possible to scroll the various parameters.
- The value of the parameter is shown in the bottom line of the screen, press the SET key to change it and the value will start blinking.
- Press the UP/DOWN ARROW key to set a different value.
- Press SET key to store the new value. If the ESC key is pressed, the new value isn't store.
- By pressing the ESC key the "USER MENU" will appear again.

There is a dedicate procedure to set the "string" type parameter, as described below:

- Visualize the parameter, for example the IP address of WIB1000 board.
- Press SET key to enter in setting mode, a cursor will blink in the position of the first character.
- By the UP and DOWN keys select the value of the character. Here the list of the available characters: ' ', ':', '-', '/', '0', '1', '2', '3', '4', '5', '6', '7', '8', '9', 'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I', 'J', 'K','L', 'M', 'N', 'O', 'P', 'Q', 'R', 'S', 'T', 'U', 'V', 'W', 'X', 'Y', 'Z'
- Press the MENU key to move the cursor on one right character. When the MENU key is pressed, the setting is confirmed.
- Repeat this operation for every character to change.
- At the end, press the SET key to confirm or ESC key to escape from setting without confirming the setting of the last selected character.

3.4.4. User setup

As the USER SETUP is selected, the display will show the following mask.



The second and the third line of the display are on the MASK column of the following list of parameters. In the first line is indicated the type of setup menu, USER SETUP in this case, and at the corner the IdCode of the parameter. The fourth line shows the current value of the displayed parameter.

ID code	Mask	Description	Range	Unit
S01.	Cooling set point	Set point for the temperature control managed by the compressor	Variable	°C/F
S02.	Second Cooling Set point	Set point for the temperature control of zone 2 managed by the compressor (custom 15)	Variable	°C/F
S03.	Heating set point	Set point for the temperature control managed by the heating element	Variable	°C/F
S04.	Second Heater Set point	Set point of temperature associated to the control of second heater	-999/999°C	°C
S05.	Humidity Set point	Humidity % for calculation of start/stop of dehumidification process	Variable	-
S06.	Cooling Band	Selectable temperature band for cooling	0/50 °C	°C/F
S07.	Heating Band	Selectable temperature band for heating	0 / 20°C	°C/F
S08.	Humidity Band	Selectable humidity band for heating	0/100%	-

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S09.	Alarm limit low temperature	Set point for the low temperature alarm	-999/999°C	°C/F
S10.	Hysteresis of low temp alarm	Hysteresis of low temperature alarm	0/30°C	°C/F
S11.	Alarm limit high temperature	Set point for the high temperature alarm	-999/999°C	°C/F
S12.	Hysteresis of high temp alarm	Hysteresis of high temperature alarm	0/30°C	°C/F
S13.	Alarm limit max temperature	Set point for the max temperature alarm	-999/999°C	°C/F
S14.	Hysteresis of max temp alarm	Hysteresis of max temperature alarm	0/30°C	°C/F
S15.	Alarm limit low humidity	Set point for the low humidity alarm	0/100%	%
S16.	Alarm limit high humidity	Set point for the high humidity alarm	0/100%	%
S17.	Alarm delay (humid-temp)	Alarm delay time(temperature, humidity)	0/9999	Sec
S18.	Intrusion-vibration alarm delay	Delay time of intrusion-vibration alarm	0/255	Sec
S19.	Limit supply temp in freecooling mode	Limit temperature of supply air (TM) when the unit work in freecooling mode	-999/999	°C
S20.	Language selection	Selection of language	UK/DE/IT/FR ES/POR/PL	-
S21.	Setting clock Hour	Hours of clock	0/23H	H
S22.	Setting clock Minute	Minutes of clock	0/59Min	Min
S23.	Setting clock Day	Day of the month	1/31	
S24.	Setting clock Month	Month of the year	1/12	
S25.	Setting clock Year	Year	0000/9999	
S26.	Setting clock Day of the Week	Day of The week (0=Monday, 6=Sunday)	0/6	
S27.	Alarm limit low pressure	Set point for the low pressure alarm	0 / 16	Bar
S28.	Cooling band for Danfoss compressor	Selectable temperature band for cooling with Danfoss compressor. Note: this parameter is enabled only when the sequencing mode is disabled	0 / 50°C	°C
S29.	Password User	Password of menu System User. The hidden password is 674. If the set is 0 then the user password will be not request	0/999	

3.4.5. Manufacturer setup

As the MANUFACTURER SETUP is selected, the password is requested to get access to this parameter list. The column 'Psw' indicates the password to access at the parameter. Some custom do not see some parameters.
After typing the correct password, the display will show the following mask.

```
MANUFACTURER    Myy
       XXXX
       XXXX
  CURRENT VALUE
```

The second and the third line of the display are on the MASK column of the following list of parameters. In the first line is indicated the type of setup menu, MANUFACTURER in this case, and at the corner the IdCode of the parameter. The fourth line shows the current value of the displayed parameter. Use the UP/DOWN ARROW keys to scroll all the parameters.

IMPORTANT NOTE: After changed the manufacturer setup is necessary to turn off and turn on the board. If this operation is not done, the behaviour of the system can be unpredictable.

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ID code	Psw	Custom not involved	Mask	Description	Range	Unit
			PASSWORD			
M01.	M		Automatic lead lag Address	Automatic Lead Lag address: 0=stand alone; 1=master; 2-3-4-5=slaves	0/10	-
M02.	M		Function assigned to PRG port	Select the function assigned to the PRG port (SUPERVISION or SEQUENCING). NOTE: After any change the controller must be restarted	SUPERVISION /SEQUENCING	-
M03.			Number of present units	Number of units in the system	0/10	-
M04.		13 14	Max number of units on	Max number of units which can be on simultaneously	0/10	-
M05.			Rotation hours setting	Automatic Lead Lag delay (between units)	0/999	HRS
M06.			Lead lag enable	0 no lead lag allowed: 1)lead lag on running unit time, 2)lead lag on running fan time. Note: actually 1 and 2 have the same behaviour (rotation based on evaporator fan)	0/2	-
M07.			Slave unit delay start	Delay start slave unit for support the master unit	0/999	Sec
M08.			Remote assistance address	Remote assistance address Note: after any change the controller must be restarted	1/255	-
M09.			Serial Protocol	To choose the supervision protocol: 0=PEMS; 1=STULZ; 2=MODBUS STULZ; 3=SAIA-BUS; 4=MODBUS STANDARD Note: after any change the controller must be restarted	0/4	-
M10.			Select serial speed 0=9.6; 1=19.2; 2=38.4	Selection of the serial port baud rate: 0=9600 bps, 1=19200 bps, 2=38400 bps. Note: after any change the controller must be restarted	0/2	-
M11.			Select Saia-bus mode 0=Data 1=Parity	Selection of the Saia-bus mode. This parameter has effect only if the M09 is set to Saia-bus protocol. 0=Data mode; 1=Parity mode. Note: after any change the controller must be restarted	0/1	-
M12.			Address assigned to SPI connector	Address of the SPI connector. Note: After any change le controller must be restarted	1/240	-
M13.			Serial protocol SPI connector	To choose the supervision protocol: 0=PEMS; 1=STULZ; 2=MODBUS STULZ 3=MODBUS STANDARD. Note: After any change le controller must be restarted	0/3	-
M14.			PERSONALIZATION FOR CUSTOM APPLICATION	Selection of parameter's configuration: 0→standard; 1→Custom1; 2→Custom2; 3→Custom3; 4→Custom4	0/99	-
M15.			Cooling set point minimum limit	Minimum limit for cooling set point	-99.9/99.9°C	°C/F
M16.			Cooling set point maximum limit	Maximum limit for cooling set point	-99.9/99.9°C	°C/F
M17.			Heating set point minimum limit	Lower limit of temperature set point for heating	-99/99°C	°C/F
M18.			Heating set point maximum limit	Upper limit of temperature set point for heating	-99/99°C	°C/F
M19.			Humidity set point minimum limit	Lower limit of humidity set point	0 /100%	-
M20.			Humidity set point maximum limit	Upper limit of humidity set point	0 /100%	-
M21.			Temp/Humidity alarm delay on first start	Delay time of the enable temperature/humidity alarm at the first start of the machinery	3	HRS
M22.			Low pressure alarm delay	Delay time of low pressure alarm	0/9999	Sec
M23.			High pressure alarm delay	Delay time of high pressure alarm delay	0/255	Sec
M24.			Freeze alarm reset delay	Delay time of reset freeze alarm	255	Sec
M25.			Air flow alarm Delay	Delay time of alarm air flow failure	0/9999	Sec
M26.			Power failure alarm delay	Delay time of power failure alarm	0/9999	Sec
M27.			Voltage out of range alarm delay	Delay time of voltage out of range alarm	0/255	Sec
M28.			Delay voltage out of range alarm	Delay time of voltage out of range signalling	0/255	Sec

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M29.	Differ temp value bad working alarm	Difference value between TI and TE to get bad working alarm	0/100	°C
M30.	Delay time before bad working alarm	Waiting time before the bad working alarm is switched on	0/255	Min
M31.	Freecooling enable/options	Freecooling Enable + Freecooling Options (enthalpy/temperature based/temperature with PI control)	No/Temp/ Enth/Temp. PI	-
M32.	Min in-out enthalpy Different for freecooling	Min difference between internal and external enthalpy for freecooling	-200/ 500	Kj/ Kg
M33.	Freecooling Unit 1 Start value	Freecooling UNIT 1 control: Start	0/100%	-
M34.	Freecooling Unit 1 Max value	Freecooling UNIT 1 control: Max	0/100%	-
M35.	Enable freecooling for second unit	Freecooling enable for second unit	YES/NO	-
M36.	Freecooling unit 2 Offset value	Freecooling UNIT 2 control: Offset	0/100%	-
M37.	Freecooling unit 2 Night Mode Offset	Freecooling offset for Night mode (only for custom 13)	0/100%	-
M38.	Offset Value for freecooling at 100%	Only for Custom 13. Value offset for Free cooling at 100% (bypassing max value limit)	0/100%	-
M39.	Free cooling Band	Proportional band for Freecooling control temperature	0/999	°C
M40.	Freecooling Integral time	Integral time for Freecooling control temperature	0/999	Sec
M41.	Min in-out temp diff for freecooling	Min difference between ambient and external temperature for freecooling	-200/ 500°C	°C/F
M42.	Min external temp enable freecooling	Min external temperature to enable freecooling. Limit min	-90/90°C	°C/F
M43.	Max external temp enable freecooling	Max external temperature to enable freecooling. Limit max	-90/90°C	°C/F
M44.	Band for limit Supply temperature	Band for limit Supply temperature	-90/90	°C
M45.	Min freecooling damper opening	Minimum damper aperture	0/100%	-
M46.	Freecooling OFF if compressor ON	Enable of freecooling when the compressor is on	YES/NO	-
M47.	Min humidity limit for freecooling	Humidity limit for freecooling - Min limit	-999/999	-
M48.	Max humidity limit for freecooling	Humidity limit for freecooling - Max limit	-999/999	-
M49.	Freec start delay exceed humid limit	Delay start of freecooling function when an exceeded humidity limits is occurred. 0=1 minute	0/9	-
M50.	Enable freec with high temp alarm	Enable freecooling when a temperature alarm occurs	YES/NO	-
M51.	Freec regulation damper/ damp+fan	Select the freecooling regulation: 0=only by damper 1=damper+evaporator fan	Damper/ Damp+fan	
M52.	Assisted freec mode. Min temp difference	Min differential value between TI and TAE to have an assisted free-cooling control	0/50°C	°C
M53.	Assisted freec mode. Min external temp	Min external temperature to enable the compressor on together the freecooling	0/50°C	°C
M54.	Compressor Enable	It enables the compressor	Y/N	-
M55.	CP Start without freecooling	Compressor management without freecooling UNIT 1 – Start	0/100%	-
M56.	CP Stop without freecooling	Compressor management without freecooling UNIT 1 – Stop	0/100%	-
M57.	CP Start with freecooling	Compressor management with freecooling UNIT 1 – Start	0/100%	-
M58.	CP Stop with freecooling	Compressor management with freecooling UNIT 1 – Stop	0/100%	-
M59.	Compressor unit 2 offset value	Compressor management UNIT 2 Offset for Start/Stop	0/100%	-
M60.	Min switch on time compressor	Compressor management: minimum starting time	0/9999	Sec

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M61.	Min switch off time compressor	Compressor management: minimum stopping time	0/9999	Sec
M62.	Delay between two compressor starts	Compressor management: minimum time between two consecutive starts	0/9999	Sec
M63.	Cp switch on delay cond. fan start	Compressor switching on delay from condenser fan start	0/9999	Sec
M64.	Heater enable	It enables the heater	YES/NO	-
M65.	Heating elements start (% of band)	% Of Band below heating set point to switch heater on		%
M66.	Heating elements stop (% of band)	% Of Band below heating set point to switch heater off		%
M67.	Offset for unit 2 HE – Start/Stop	Heater management UNIT 2 Offset for Start/ Stop	0/100%	%
M68.	Enable second heating step	It indicates the resistance of the second heater. If YES it enables its control.	YES/NO	
M69.	Dehumidification Enable	It enables the dehumidification function	YES/NO	
M70.	Dehumidification Start	% Of the humidity band to start dehumidification. The probe has to be present	0/100%	
M71.	Dehumidification Stop	% Of the humidity band to stop dehumidification. The probe has to be present	0/100%	
M72.	% Of Dehumid band for min fan speed	% Of the humidity band to start dehumidification. The probe has to be present	0/100%	
M73.	% Of Dehumid band for max fan speed	% Of the humidity band to stop dehumidification. The probe has to be present	0/100%	
M74.	Temperature set point dehumid compressor	Set point of temperature for compressor logic during the dehumidification. Note: it should be set to a value less than **S01**	-20/100°C	°C/F
M75.	Start delay slave units for dehumid.	Interval time to switch on auxiliary compressor after occurred humidity digital alarm. It's enabled only during sequencing function	0/9999 sec	Sec
M76.	Heaters enable with dehumid	Enable of the heaters for dehumidification	YES/NO	-
M77.	Humidification Enable	It enables the humidification function	YES/NO	-
M78.	Humidification mode	It selects if humidifying by digital humidifier (0), by analog humidifier (1), or by freecooling damper (2)	0/2	-
M79.	Humidification Start	% Of the humidity band to start humidification. The probe has to be present	0/100%	
M80.	Humidification Stop	% Of the humidity band to stop humidification. The probe has to be present	0/100%	
M81.	Diff ext-in enth for humidif freec	Difference between external enthalpy and internal enthalpy to enable humidification with freecooling	0/100 KJ/Kg	K J / Kg
M82.	Temp interval for humidif with freec	Temperature interval, relative to internal temperature, to enable/disable the humidification with freecooling	0/100°C	°C
M83.	External ambient pressure	Pressure of the external ambient. It depends on altitude (meters from sea level) of installation.	0/2000 mbar	mbar
M84.	Evaporator fan configuration	Configuration of evaporator fans: which fans are present	0/7	-
M85.	Min Speed for tachometric signal	Speed for begin to control tachometric signal	0/100	%
M86.	Delay time for start evap fan	Delay time of start evaporator fan	0/999	Sec
M87.	Delay time for stop evap fan	Delay time of stop evaporator fan	0/999	Sec
M88.	Min switching on for evap fan	The evaporator fan has to be on for this time	0/999	Sec
M89.	Min switching off for evap fan	The evaporator fan has to be off for this time	0/999	Sec
M90.	Min evaporator fan speed	Min speed of the evaporator fan	0/100%	-
M91.	Min evaporator fan speed with heaters	Min speed of the evaporator fan for dehumidification when heating heaters are on	0/100%	-
M92.	Max evaporator fan speed Cool	Max speed of the evaporator fan in cooling mode	0/100	%

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M93.	Max evaporator fan speed free cool	Max speed of the evaporator fan in free cooling mode	0/100	%
M94.	Evap fan speed in dead zone	Evaporator fan speed in dead zone	0/100%	%
M95.	Evap temp for min evap fan speed	Evaporator temperature to have the min fan speed for anti freezing	0/99°C	°C/F
M96.	Evap temp for max evap fan speed	Evaporator temperature to have the max fan speed for anti freezing	0/99°C	°C/F
M97.	Conden control mode 0=temper; 1=press.	Selection of discharge control type: Temperature(=0) or pressure (=1). With pressure probe the temperature param are unable and conversely.	0/1	-
M98.	Conden temp set point	TC set	-20/99°C	°C/F
M99.	Conden temperature proportional band	Proportional term of PID algorithm for TC control.	-20/99°C	°C/F
M100.	Conden temp integral time	Integral term of PID algorithm for TC control. Note: integral time = 0 => integral term is 0	0/999sec.	Sec
M101.	Conden pressure set point	PC set	0/99bar	Bar
M102.	Conden pressure proportional band	Proportional term of PID algorithm for PC control.	0/99bar	Bar
M103.	Conden pressure integral time	Integral term of PID algorithm for PC control. Note: integral time = 0 => integral term is 0	0/999sec.	Sec
M104.	Power Supply Frequency	Indicate if we are working with a 50Hz or 60Hz net	50Hz/ 60Hz	-
M105.	Condenser fan triac pulse length	Time of the ON state for the AC condenser fan to control its speed. If zero then a PWM with 5ms period is done.	0/3 msec	msec
M106.	Lower limit TRIAC control	Lower limit to control the TRIAC dedicated to AC fan. The min AC fan speed corresponds to this value	0/100%	%
M107.	Upper limit TRIAC control	Upper limit to control the TRIAC dedicated to AC fan. The max AC fan speed corresponds to this value	0/100%	%
M108.	Min ext temp for cond fan speed band	Lower limit of external temperature when the condenser fan is switched on	-50/100°C	°C
M109.	Max ext temp for cond fan speed band	Upper limit of external temperature when the condenser fan is switched on	-50/100°C	°C
M110.	Delay time to start PI control cond fan	Interval time before the condenser fan will be under PI control from its start	0/255sec	Sec
M111.	Max condenser fan speed	Max condenser fan speed to reduce the noise	0/100%	%
M112.	Tc Value For Start Ve Limitation	Value of tc for start adaptive control (Ve speed starts to decrease)	0/100°C	°C/F
M113.	Tc Value For Max Ve Limitation	Value of tc where the adaptive control is at the maximum limitation (Ve speed at minimum)	0/100°C	°C/F
M114.	TC Value to bypass VC Speed limitation	Born for custom 9 but can be used in every Custom	0/200	°C/F
M115.	Pc Value For Start Ve Limitation	Value of Pc for start adaptive control (Ve speed starts to decrease)		Bar
M116.	Pc Value For Max Ve Limitation	Value of Pc where the adaptive control is at the maximum limitation (Ve speed at minimum)		Bar
M117.	PC Value to bypass VC Speed limitation	Born for custom 9 but can be used in every Custom	0/99	Bar
M118.	Value for high int temp mode enable	Set point of internal temperature to have the evaporator fan speed under high temperature control	0/255°C	°C
M119.	Value for high ext temp mode enable	Set point of temperature to have the evaporator fan speed under high temperature control	0/255°C	°C
M120.	Value for high ext temp mode disable	Differential value to stop the control of evaporator fan speed under high temperature	0/255°C	°C
M121.	Soft control mode Temp set point	Set point of temperature to have a soft control of evaporator fan	0/255°C	°C

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M122.	Soft control mode Waiting time	Waiting time to complete the soft control	0/255min	Min
M123.	Night mode start time	Time of the start for fan condenser timing control	0/23	-
M124.	Night mode stop time	Time of the stop for fan condenser control timing	0/23	-
M125.	Max evap fan speed during night mode	Upper limit of evaporator fan speed at night to reduce unit noise	0/100%	-
M126.	Max cond fan speed during night mode	Max speed of condenser fan under timing control	0/100%	%
M127.	Enable debug display	Enable for visualization of debug screen	YES/NO	-
M128.	Real Time Clock Enable	Enable for real time clock	YES/NO	-
M129.	Key lock enable	Sequence to lock the keys	YES/NO	-
M130.	Alarm limit Low supply temp.	Min Value of Tm to have Tm out of range alarm	-20/60°	°C/F
M131.	Alarm limit high supply temp.	Max Value of Tm to have Tm out of range alarm	-20/60°	°C/F
M132.	Inactivity Time to force FCB	See custom 13,0=10 minutes used for debug	0/200	HRS
M133.	FCB Forcing Time after inactivity	See custom 13, 0=DISABLED	0/200	Min
M134.	FCB Speed during Forcing time	See custom 13	0/100	%
M135.	TAE min limit to activate Comfort Unit	See custom 14	-50/100	°C/F
M136.	TAE max limit to activate Comfort Unit	See custom 14	0/200	°C/F
M137.	Ti value to force Comfort Unit	See custom 14	0/200	°C/F
M138.	Upper limit of the dead zone	Differential value refers to the cooling set point (**S01**)	-100/100°C	°C
M139.	Free air fan control Mode	See chapter 8.23 Custom 23	0/1	-
M140.	Free air fan minimum speed	See chapter 8.23 Custom 23	0/100	%
M141.	Free air fan maximum speed	See chapter 8.23 Custom 23	0/100	%
M142.	Free air fan start value	See chapter 8.23 Custom 23	0/100	%
M143.	Free air fan maximum value	See chapter 8.23 Custom 23	0/100	%
M144.	Free air fan proportional band	See chapter 8.23 Custom 23	0/200	°C
M145.	Free air fan integral time	See chapter 8.23 Custom 23	0/999	Sec
M146.	Enable air change	See chapter 8.23 Custom 23	YES/NO	-
M147.	Free air fan speed in air change mode	See chapter 8.23 Custom 23	0/100	%
M148.	Enable freecooling in night mode	Enable the freecooling in night mode (Custom 24)	YES/NO	-
M149.	Delay dis fans from heater switch off	Delay for disable fans from heater switch off (Custom 24)	0/255	Min
M150.	Enable dead zone control	Enable the dead zone control	YES/NO	-
M151.	Hysteresis for enter in dead zone	Hysteresis for enter in dead zone	-99/99	°C
M152.	Delay open damper from compressor off	Delay for open the damper from when the compressor switch off (Custom 24)	0/999	Sec
M153.	Emergency temperature	Emergency temperature (Custom 24)	-99/99	°C
M154.	Differential temp in emergency mode	Differential temperature in emergency mode (Custom 24)	-99/99	°C
M155.	Enable damper in emergency mode	Enable the damper in emergency mode (Custom 24)	YES/NO	-
M156.	Maximum fans speed in heater mode	Maximum fans speed in heater mode (Custom 24)	0/100	%
M157.	Maximum value for fans in freecooling	Maximum value for fans in freecooling (Custom 24)	0/100	%
M158.	Enable Danfoss compressor	Enable Danfoss compressor	NO/YES	
M159.	Therm setup crank case heating on temp	Therm setup crank case heating on temp. Note: after any change the controller must be restarted	10/25	°C
M160.	Manual Od PCT	Manual Od PCT	0/100	%

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M161.	Manual control	Manual control	0/1	-
M162.	Maximum superheat	Maximum superheat	2.0/20.0	K
M163.	Minimum superheat	Minimum superheat	1.0/20.0	K
M164.	MOP	MOP	0.0/60.0	Bar
M165.	Compressor integral time	Compressor integral time	0/999	Sec
M166.	Evaporator fans set point	Evaporator fans set point	0/999	°C
M167.	Evaporator fans band	Evaporator fans band	0/999	°C
M168.	Evaporator fans integral time	Evaporator fans integral time	0/999	Sec
M169.	Max compressor speed during night mode	Max compressor speed during night mode	0/100	%
M170.	Min voltage value	Minimum voltage value	0/999	V
M171.	Max voltage value	Maximum voltage value	0/999	V
M172.	Min int temp for Hot Start function	Minimum internal temperature for Hot Start function	-99/99	°C
M173.	Min ext temp for Hot Start function	Minimum external temperature for Hot Start function	-99/99	°C
M174.	Enable Max EER function	Enable Max EER function	NO/YES	-
M175.	Gas type	Gas type	0=R407C 1=R22 2=R134A 3 = R 4 0 4 A 4=R1270 5=R717 6 = R 2 9 0 7 = R 4 1 0 A 8=R507A	-
M176.	Set point for Max EER function	Set point for Max EER function	-99/99	°C
M177.	Min cond temp for Max EER function	Minimum condenser temperature for Max EER function	-99/99	°C
M178.	Max cond temp for Max EER function	Maximum condenser temperature for Max EER function	-99/99	°C
M179.	Compr control by supply temperature	Compressor control by supply temperature	NO/YES	-
M180.	Other compr start in sequencing mode	Other compressor start in sequencing mode	0/99	%
M181.	Delay for PLC comm error alarm	Delay for PLC communication error alarm	0/999	Sec
M182.	Hours of operating of fans	Hours of operating of evaporator fans (for alarm). If 0, the alarm is bypassed	0/999	Hx 100
M183.	Maximum condenser pressure	Maximum condenser pressure for Condenser pressure alarm	0/100	Bar
M184.	Therm setup unit type	Therm setup unit type. Note: after any change the controller must be restarted	0/2	-
M185.	Therm setup system configuration	Therm setup system configuration. Note: after any change the controller must be restarted	1/255	
M186.	Therm setup compr max speed	Therm setup compressor max speed Note: after any change the controller must be restarted	15/70	Hz
M187.	Therm setup oil loss trig time	Therm setup oil loss trig time. Note: after any change the controller must be restarted	0/18000	Sec
M188.	Therm setup start up hold time	Therm setup start up hold time Note: after any change the controller must be restarted	10/240	Sec
M189.	Fan error alarms delay	Delay time of fan error alarms	0/9999	Sec
M190.	Sequencing mode	Enables the control of the master-slave system if **M03**=2 or enables the control of the sequencing system if **M03**≥3	0=Stand alone 1=Sequencing 2=Sequencing with stand-by management	-

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M191.	Bypass Alarms	Indicates the system status where alarms are disabled	0=DISABLED 1=SYSTEM OFF 2=STAND -BY 3=SYSTEM OFF & STAND-BY	-
M192.	USER PASSWORD	Password of User Menu The hidden password is 674. If this password is zero no password is required.	0/999	-
M193.	PASSWORD MAINTENANCE	Password of menu System Maintenance The hidden password is 674	0/999	-
M194.	PASSWORD I/O SETTING	Password of menu I/O Setup. The hidden password is 674	0/999	-
M195.	PASSWORD MANUFACTURER	Password of menu Manufacturer Setup. The hidden password is 674	0/999	-

3.4.6. I/O Setup

As the I/O SETUP is selected, the password is requested to get access to this parameter list. After typing the correct password, the display will show the following mask.

```
I/O SETUP       Iyy
       XXXX
       XXXX
  CURRENT VALUE
```

The second and the third line of the display are on the MASK column of the following list of parameters. In the first line is indicated the type of setup menu, I/O SETUP in this case, and at the corner the IdCode of the parameter. The fourth line shows the current value of the displayed parameter. Use the UP/DOWN ARROW keys to scroll all the parameters.

IMPORTANT NOTE: After changed the I/O SETUP is necessary to turn off and turn on the board. If this operation is not done, the behaviour of the system can be unpredictable.

I D code	Mask	Description	Range	Unit
	PASSWORD	Necessary to enter the following parameters		
I01.	Unit configuration Right=0 Left=1	Parameter for change the analog input and the logical for the damper motor	0/1	
I02.	Channel offset T1	Offset of the channel T1. Default: TE	-99.9/99.9°C	°C/F
I03.	Channel offset T2	Offset of the channel T2. Default: TI	-99.9/99.9°C	°C/F
I04.	Channel offset T3	Offset of the channel T3. Default: TC	-99.9/99.9°C	°C/F
I05.	Channel offset T4	Offset of the channel T4. Default: TAE	-99.9/99.9°C	°C/F
I06.	Channel offset IC1	Offset of the channel IC1. Default: IRH	-99.9/99.9	%
I07.	Channel offset IC2	Offset of the channel IC2. Default: PC	-99.9/99.9	Bar
I08.	Channel offset IC3	Offset of the channel IC3. Default: ERH	-99.9/99.9	-
I09.	4mA value for An-In IC1	4mA value for the channel IC1. Default: IRH *value at 4 mA	-99.9/99.9	%
I10.	20mA value for An-In IC1	20mA value for channel IC1. Default: IRH *value at 20 mA	-99.9/99.9	%
I11.	4mA value for An-In IC2	4mA value for channel IC2. Default: PC *value at 4 mA	-99.9/99.9	Bar
I12.	20mA value for An-In IC2	20mA value for channel IC2. Default: PC *value at 20 mA	-99.9/99.9	Bar
I13.	4mA value for An-In IC3	4mA value for channel IC3. Default: ERH *value at 4 mA	-99.9/ 99.9	-
I14.	20mA value for An-In IC3	20mA value for channel IC3. ERH *value at 20 mA	-99.9/ 99.9	-
I15.	0V value for An-Out1	0V value for channel AnOut1.	0 /100	%

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I16.	10V value for An-Out1	10V value for channel AnOut1.	0 /100	%
I17.	0V value for AnOut2	0V value for channel AnOut2.	0 /100	%
I18.	10V value for AnOut2	10V value for channel AnOut2.	0 /100	%
I19.	Analog channel Linked to IC1	Name of the Analog channel linked to the physical analog input1	See table below	-
I20.	Analog channel Linked to IC2	Name of the Analog channel linked to the physical analog input2	See table below	-
I21.	Analog channel Linked to IC3	Name of the Analog channel linked to the physical analog input3	See table below	-
I22.	Analog channel Linked to T1	Name of the Analog channel linked to the physical analog input4	See table below	-
I23.	Analog channel Linked to T2	Name of the Analog channel linked to the physical analog input5	See table below	-
I24.	Analog channel Linked to T3	Name of the Analog channel linked to the physical analog input6	See table below	-
I25.	Analog channel Linked to T4	Name of the Analog channel linked to the physical analog input7	See table below	-
I26.	Select Relay Evaporator Fan	Select the relay linked to evaporator fan	R3-R13/No conn	-
I27.	Select Relay Condenser Fan	Select the relay linked to condenser fan	R3-R13/No conn	-
I28.	Select Relay Humidifier	Select the relay linked to humidifier	R3-R13/No conn	-
I29.	Select Relay Cooling	Select the relay linked to cooling	R3-R13/No conn	-
I30.	Select Relay freecooling	Select the relay linked to freecooling	R3-R13/No conn	-
I31.	Select Relay Low Temp. Alarm	Select the relay activated by low temperature alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I32.	Select Relay High Temp. Alarm	Select the relay activated by high temperature alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I33.	Select Relay Max Temp. Alarm	Select the relay activated by max temperature alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I34.	Select Relay Antifreeze Alarm	Select the relay activated by antifreeze alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I35.	Select Relay Low Humid. Alarm	Select the relay activated by low humidity alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I36.	Select Relay High Humid. Alarm	Select the relay activated by high humidity alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I37.	Select Relay Humidity Switch Al.	Select the relay activated by humidity switch alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I38.	Select Relay Low Press. Alarm	Select the relay activated by low pressure alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I39.	Select Relay High Press. Alarm	Select the relay activated by high pressure alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I40.	Select Relay Air Flow Alarm	Select the relay activated by air flow alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I41.	Select Relay Fire – Smoke Alarm	Select the relay activated by fire – smoke alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I42.	Select Relay Intr.-Vibr. Alarm	Select the relay activated by intrusion – vibration alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I43.	Select Relay Power Failure Alarm	Select the relay activated by power failure alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I44.	Select Relay Volt out range Al.	Select the relay activated by voltage out of range alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I45.	Select Relay Dirty Filter Alarm	Select the relay activated by dirty filter alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I46.	Select Relay Compress. Therm. Al.	Select the relay activated by compressor thermic alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I47.	Select Relay Resist. Therm. Alarm	Select the relay activated by heater thermic alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I48.	Select Relay Evap Fan Th. Alarm	Select the relay activated by evaporator fan thermic alarm	(R3-R13)+(CW) or(CA)/No conn.	-

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I49.	Select Relay Cond Fan Th. Alarm	Select the relay activated by condenser fan thermic alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I50.	Select Relay Lan Failure Alarm	Select the relay activated by Lan failure alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I51.	Select Relay Evap Fan1 Bl. Alarm	Select the relay activated by evaporator fan1 blocked alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I52.	Select Relay Evap Fan2 Bl. Alarm	Select the relay activated by evaporator fan2 blocked alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I53.	Select Relay Evap Fan3 Bl. Alarm	Select the relay activated by evaporator fan3 blocked alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I54.	Select Relay External En. Alarm	Select the relay activated by external enable alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I55.	Select Relay Bad working alarm	Select the relay activated by bad working alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I56.	Select Relay Broken Probe Al.IC1	Select the relay activated by broken probe alarm IC1	(R3-R13)+(CW) or(CA)/No conn.	-
I57.	Select Relay Broken Probe Al.IC2	Select the relay activated by broken probe alarm IC2	(R3-R13)+(CW) or(CA)/No conn.	-
I58.	Select Relay Broken Probe Al.IC3	Select the relay activated by broken probe alarm IC3	(R3-R13)+(CW) or(CA)/No conn.	-
I59.	Select Relay Broken Probe Al.T1	Select the relay activated by broken probe alarm T1	(R3-R13)+(CW) or(CA)/No conn.	-
I60.	Select Relay Broken Probe Al.T2	Select the relay activated by broken probe alarm T2	(R3-R13)+(CW) or(CA)/No conn.	-
I61.	Select Relay Broken Probe Al.T3	Select the relay activated by broken probe alarm T3	(R3-R13)+(CW) or(CA)/No conn.	-
I62.	Select Relay Broken Probe Al.T4	Select the relay activated by broken probe alarm T4	(R3-R13)+(CW) or(CA)/No conn.	-
I63.	Select Relay Common Warning	Select the relay activated by common warning	R3-R13/No conn.	-
I64.	Select Relay Common Alarm	Select the relay activated by common alarm	R3-R13/No conn	-
I65.	Select Relay First heater	Select the relay linked to the first heater	(R3-R13)+(CW) or(CA)/No conn.	-
I66.	Select Relay Second Heater	Select the relay linked to the second heater	R3-R13/No conn	-
I67.	Select Relay HGB	Select the linked to HGB	(R3-R13)+(CW) or(CA)/No conn.	-
I68.	Select Relay Tm Range Alarm	Select the relay activated by Tm out of range alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I69.	Select Relay Freecooling Alarm	Select the relay activated by freecooling alarm (Custom 1)	(R3-R13)+(CW) or(CA)/No conn.	-
I70.	Select Relay Level Alarm	Select the relay activated by level alarm (Custom 3 and 4)	(R3-R13)+(CW) or(CA)/No conn.	-
I71.	Select Relay Comfort Unit 1	Select the relay to activate Comfort Unit 1 (Custom 13 and Custom 14)	(R3-R13)+(CW) or(CA)/No conn.	-
I72.	Select Relay Comfort Unit 2	Select the relay to activate Comfort Unit 2 (Custom 13)	(R3-R13)+(CW) or(CA)/No conn.	-
I73.	Select Relay Comfort Alarm	Select the relay to activate by Comfort Unit alarm (Custom 14)	(R3-R13)+(CW) or(CA)/No conn.	-
I74.	Select Relay Bad Working Comfort1	Select the relay to activate by Bad Working alarm of Comfort 1 Unit (Custom 13)	(R3-R13)+(CW) or(CA)/No conn.	-
I75.	Select Relay Bad Working Comfort2	Select the relay to activate by Bad Working alarm of Comfort 1 Unit (Custom 13)	(R3-R13)+(CW) or(CA)/No conn.	-
I76.	Select Relay Wrong Phase	Select the relay to activate by Wrong Phase alarm (Custom 24)	(R3-R13)+(CW) or(CA)/No conn.	-
I77.	Select Relay Exp board com err	Select the relay to activate by Expansion board communication error alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I78.	Select Relay Voltage out of range	Select the relay to activate by Voltage out of range alarm	(R3-R13)+(CW) or(CA)/No conn.	-

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I79.	Select Relay Trip lock	Select the relay to activate by Trip lock alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I80.	Select Relay Drive temp high st.	Select the relay to activate by Drive temperature high status alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I81.	Select Relay Dis temp high st.	Select the relay to activate by Discharge temperature high status alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I82.	Select Relay Suct press low st.	Select the relay to activate by Suction pressure low status alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I83.	Select Relay Cond press low st.	Select the relay to activate by Condenser pressure low status alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I84.	Select Relay Cond press high st.	Select the relay to activate by Condenser pressure high status alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I85.	Select Relay Output pow limit st.	Select the relay to activate by Output power limit status alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I86.	Select Relay EEV IN failure	Select the relay to activate by EEV IN failure alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I87.	Select Relay Ambient temp inv.	Select the relay to activate by Ambient temperature invalid alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I88.	Select Relay Suction press inv.	Select the relay to activate by Suction pressure invalid alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I89.	Select Relay Cond press invalid	Select the relay to activate by Condenser pressure invalid alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I90.	Select Relay Peripherals error	Select the relay to activate by Peripherals error alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I91.	Select Relay Out of envelope	Select the relay to activate by Out of envelope alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I92.	Select Relay Over current	Select the relay to activate by Over current alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I93.	Select Relay Over voltage	Select the relay to activate by Over voltage alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I94.	Select Relay Drive temp high	Select the relay to activate by Drive temperature high alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I95.	Select Relay Supply voltage low	Select the relay to activate by Supply voltage low alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I96.	Select Relay Discharge temp high	Select the relay to activate by Discharge temperature high alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I97.	Select Relay Discharge temp inv.	Select the relay to activate by Discharge temperature invalid alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I98.	Select Relay Internal error	Select the relay to activate by Internal error alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I99.	Select Relay PLC comm error al.	Select the relay to activate by PLC communication error alarm (Custom 25)	(R3-R13)+(CW) or(CA)/No conn.	-
I100.	Select Relay Hours operating fans	Select the relay to activate by Hours operating fans alarm (Custom 25)	(R3-R13)+(CW) or(CA)/No conn.	-
I101.	Select Relay Therm high temp al.	Select the relay to activate by Thermostat high temperature alarm (Custom 25)	(R3-R13)+(CW) or(CA)/No conn.	-
I102.	Select Relay Cond pressure alarm	Select the relay to activate by Condenser pressure alarm (Custom 25)	(R3-R13)+(CW) or(CA)/No conn.	-
I103.	Select Relay Alarm active	Select the relay to activate by alarm Alarm active	(R3-R13)+(CW) or(CA)/No conn.	-
I104.	Select Relay Fan 1 error	Select the relay to activate by Fan 1 error alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I105.	Select Relay Fan 2 error	Select the relay to activate by Fan 2 error alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I106.	Select Relay Fan 3 error	Select the relay to activate by Fan 3 error alarm	(R3-R13)+(CW) or(CA)/No conn.	-
I107.	Select Relay FC stop by wind	Select the relay to activate by FC stop by wind alarm (Custom 27)	(R3-R13)+(CW) or(CA)/No conn.	-
I108.	Select Relay FC stop by fire	Select the relay to activate by FC stop by fire alarm (Custom 27)	(R3-R13)+(CW) or(CA)/No conn.	-

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I109.	Select Relay Evap fan 1 broken	Select the relay to activate by Evaporator fan 1 broken alarm (custom 29)	(R3-R13)+(CW) or(CA)/No conn.	-
I110.	Select Relay Evap fan 2 broken	Select the relay to activate by Evaporator fan 2 broken alarm (custom 29)	(R3-R13)+(CW) or(CA)/No conn.	-
I111.	Select Relay Inverter Alarm	Select the relay to activate by Inverter Alarm (custom 31)	(R3-R13)+(CW) or(CA)/No conn.	-
I112.	Select Relay Eev Driver Alarm	Select the relay to activate by Eev Driver Alarm (custom 31)	(R3-R13)+(CW) or(CA)/No conn.	-
I113.	Select Relay Water Floor Alarm	Select the relay to activate by Water Floor Alarm (custom 31)	R3-R13/No conn	-
I114.	Select Relay Unit Off	Select the relay to activate by Unit Off status	R3-R13/No conn	-
I115.	Select Relay Unit Stand By	Select the relay to activate by Unit Stand By status	R3-R13/No conn	-
I116.	Select Relay Unit On	Select the relay to activate by Unit On status	R3-R13/No conn	-
I117.	Select Relay Unit Emergency	Select the relay to activate by Unit Emergency status	R3-R13/No conn	-
I118.	Select Relay Unit normal	Select the relay to activate by Unit when in normal status (no alarm)	R3-R13/No conn	-
I119.	Select Relay Free air on	Select the relay to activate when free air on	R3-R13/No conn	-
I120.	Polarity digit input A1	Select the polarity of digital input A1: 0 = normally opened 1= normally closed	0/1	-
I121.	Polarity digit input A2	Select the polarity of digital input A2: 0 = normally opened 1= normally closed	0/1	-
I122.	Polarity digit input A3	Select the polarity of digital input A3: 0 = normally opened 1= normally closed	0/1	-
I123.	Polarity digit input A4	Select the polarity of digital input A4: 0 = normally opened 1= normally closed	0/1	-
I124.	Polarity digit input A5	Select the polarity of digital input A5: 0 = normally opened 1= normally closed	0/1	-
I125.	Polarity digit input A6	Select the polarity of digital input A6: 0 = normally opened 1= normally closed	0/1	-
I126.	Polarity digit input A7	Select the polarity of digital input A7: 0 = normally opened 1= normally closed	0/1	-
I127.	Polarity digit input A8	Select the polarity of digital input A8: 0 = normally opened 1= normally closed	0/1	-
I128.	Polarity digit input A9	Select the polarity of digital input A9: 0 = normally opened 1= normally closed	0/1	-
I129.	Polarity digit input A10	Select the polarity of digital input A10: 0=normally opened 1= normally closed	0/1	-
I130.	Polarity digit input A11	Select the polarity of digital input A11: 0= normally opened 1= normally closed	0/1	-
I131.	Polarity digit input A12	Select the polarity of digital input A12: 0=normally opened 1= normally closed	0/1	-
I132.	Polarity digit input A13	Select the polarity of digital input A13:0 = normally opened 1= normally closed	0/1	-
I133.	Polarity digit out R1	Select the polarity of digital output R1: 0= normally opened 1=normally closed	0/1	-
I134.	Polarity digit out R2	Select the polarity of digital output R2: 0=normally opened 1=normally closed	0/1	-
I135.	Polarity digit out R3	Select the polarity of digital output R3: 0=normally opened 1=normally closed	0/1	-
I136.	Polarity digit out R4	Select the polarity of digital output R4: 0=normally opened 1=normally closed	0/1	-
I137.	Polarity digit out R5	Select the polarity of digital output R5: 0=normally opened 1=normally closed	0/1	-
I138.	Polarity digit out R6	Select the polarity of digital output R6: 0=normally opened 1=normally closed	0/1	-
I139.	Polarity digit out R7	Select the polarity of digital output R7: 0=normally opened 1=normally closed	0/1	-
I140.	Polarity digit out R8	Select the polarity of digital output R8: 0=normally opened 1=normally closed	0/1	-
I141.	Polarity digit out R9	Select the polarity of digital output R9: 0=normally opened 1=normally closed	0/1	-
I142.	Polarity digit out R10	Select the polarity of digital output R10:0=normally opened 1=normally closed	0/1	-
I143.	Polarity digit out R11	Select the polarity of digital output R11:0=normally opened 1=normally closed	0/1	-
I144.	Polarity digit out R12	Select the polarity of digital output R12:0=normally opened 1=normally closed	0/1	-
I145.	Polarity digit out R13	Select the polarity of digital output R13:0=normally opened 1=normally closed	0/1	-
I146.	Filter coefficient Analog ch. IC1	Value of the filter coefficient for the analogic channel IC1. This coefficient is used to calculate the average of measurement of this channel.	0/200	-
I147.	Filter coefficient Analog ch. IC2	Value of the filter coefficient for the analogic channel IC2. This coefficient is used to calculate the average of measurement of this channel.	0/200	-
I148.	Filter coefficient Analog ch. IC3	Value of the filter coefficient for the analogic channel IC3. This coefficient is used to calculate the average of measurement of this channel.	0/200	-
I149.	Filter coefficient Analog ch. T1	Value of the filter coefficient for the analogic channel T1. This coefficient is used to calculate the average of measurement of this channel.	0/200	-
I150.	Filter coefficient Analog ch. T2	Value of the filter coefficient for the analogic channel T2. This coefficient is used to calculate the average of measurement of this channel.	0/200	-

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I151.	Filter coefficient Analog ch. T3	Value of the filter coefficient for the analogic channel T3. This coefficient is used to calculate the average of measurement of this channel.	0/200	-
I152.	Filter coefficient Analog ch. T4	Value of the filter coefficient for the analogic channel T4. This coefficient is used to calculate the average of measurement of this channel.	0/200	-
I153.	PASSWORD			-

In the next table there are the analog channels which can be connected.

IRH	Internal relative humidity
PC	Condenser pressure
ERH	External relative humidity
TE	Evaporator temperature
TC	Condenser temperature
TI	Internal temperature
TAE	External air temperature
TM	Delivery air Temperature
TM1	Delivery air Temperature for Comfort 1 in Custom 13
TM2	Delivery air Temperature for Comfort 2 in Custom 13
TI1	Internal temperature 1 in Custom 9
TI2	Internal temperature 2 in Custom 9
NO Conn.	No connection

3.4.7. Counters menu

By pressing the SET key from COUNTERS MENU you can screen the hours of activity of four parameters as below.

```
VE ON:       xxxxx H
VC ON:       xxxxx H
CP ON:       xxxxx H
FC ON:       xxxxx H
```

The parameters visualized are:
- VE ON: hours of evaporator fan activity
- VC ON: hours of condenser fan activity
- CP ON: hours of compressor activity
- FC ON: hours of freecooling activity

Press the ESC key to go back the previous menu.

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3.4.8. Alarm history menu

By pressing the SET key from ALARM MENU you can enter into ALARM HISTORY MENU, where there are all the information about the last 50 happened alarms. The last 50 happened alarms are stored and displayed in this menu accessible by the user. For each alarm we have 2 pages.
First page:

```
HISTORY ALARM  xx/yy
dd/mm/yyyy hh:mm 1/2
DESCRIPTION OF ALARM
DESCRIPTION OF ALARM
```

Second page:

```
HISTORY ALARM  xx/yy
dd/mm/yyyy hh:mm 2/2
TAE=XX.X     TI=XX.X
TC=XX.X      TE=XX.X
```

In the screen the following information are indicated :
- xx/yy: "xx" is a progress number while "yy" is the total number of alarms happened
- dd/mm/yyyy: date when the alarm is happened
- hh:mm: time when the alarm is happened
- DESCRIPTION OF ALARM: which type of alarm is happened as described in the Alarm chapter.
- TAE, TI, TC/PC, TE image of temperatures when alarm occurred.

By pressing the UP/DOWN ARROW keys you can screen one at a time the happened alarms and their description. To come back the previous menu, press the ESC key.

3.4.9. System maintenance

In this menu there are other five menus:
1. Manual control (see par. 4.6)
2. Reset data
3. HKEY programming (please refer to doc.'C2020 installation, programming and software update')
4. Serial number
5. Day programming (only Custom 14, see par. 7.14)

To enter into the 'reset data' menu, press the SET key from the relative screen and a new screen will appear, where it's possible to reset the counters and the history of alarms. Use the UP/DOWN ARROW keys to move between the screens and press the SET key to reset a counter. Pressing the ESC key, you'll come back the previous menu without resetting anything.

In the 'serial number' menu is possible to read the serial number of the board, that is a twenty characters string.

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3.4.10. Menu of WIB1000 board

The menu of WIB1000 board is accessible only if WIB1000 is linked with System Maintenance password (**M193**). In the menu are present a subset of the parameters of WIB1000, and some commands and information of WIB1000 board.

Every time is changed a parameter of the list, it's always necessary to reset WIB1000. The reset is possible by switching off the machine or by the parameter **E06** (see table below).

ID code	Mask	Description	Range	Unit
	PASSWORD	SYSTEM MAINTENANCE password (**M190**)		
E01	Software version of ETH board	Software version of WIB1000, it's only read parameter		
E02	IP address of ETH board	IP address of WIB1000, it's a string parameter		
E03	Network mask of ETH board	Network mask of WIB1000, it's a string parameter		
E04	IP address of SNMP trap messages	IP address of SNMP trap messages, it's a string parameter		
E05	Mode working of ETH board	Mode working of WIB1000 board: • NORMAL MODE: working mode with SNMP, web server activated • USB MODE: working mode for USB programming	NORMAL MODE, USB MODE	
E06	Reset ETH board	Reset the WIB1000	NO/YES	
E07	Insert default values and reset	Insert the default values of all WIB1000 parameters and reset the WIB1000	NO/YES	

4. Control functions

4.1. Temperature control

The parameters involved are:

- **S28** COOLING BAND FOR DANFOSS COMPRESSOR: pre-set = 5°C
- **M158** ENABLE DANFOSS COMPRESSOR: pre-set = NO
- **M159** THERM SETUP CRANK CASE HEATING ON TEMP: pre-set = 10 °C
- **M160** MANUAL OD PCT: pre-set = 0 %
- **M161** MANUAL CONTROL: pre-set = 0
- **M162** MAXIMUM SUPERHEAT: pre-set = 160 K
- **M163** MINIMUM SUPERHEAT: pre-set = 40 K
- **M164** MOP: pre-set = 137 Bar
- **M165** COMPRESSOR INTEGRAL TIME: pre-set = 0 Sec
- **M169** MAX COMPRESSOR SPEED DURING NIGHT MODE: pre-set = 70 %
- **M179** COMPRESSOR CONTROL BY SUPPLY TEMPERATURE: pre-set = NO
- **M184** THERM SETUP UNIT TYPE: pre-set = 0
- **M185** THERM SETUP SYSTEM CONFIGURATION: pre-set = 6
- **M186** THERM SETUP COMPRESSOR MAX SPEED: pre-set = 70 Hz
- **M187** THERM SETUP OIL LOSS TRIG TIME: pre-set = 18000 Sec
- **M188** THERM SETUP START UP HOLD TIME: pre-set = Sec

When parameter **M158** is set to YES, the C2020 controller communicates with a Danfoss compressor through the RS485 serial port. The communication protocol is automatically set to ModBus, the baud rate is automatically set to 19200 bps.

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The Danfoss compressor can be connected only to the SLAVE connector.
The control of Danfoss compressor starts after 20 seconds from the switching on of the C2020 controller.
When Danfoss compressor is enabled, PC and TAE are read by Danfoss compressor (data points Modbus 40204 and 40216).

The temperature control is delayed of 30 seconds from the switching on of the C2020 controller. The access to the data points Modbus is performed every 200 ms.

In the following table are shown all data points ModBus for the communication with the Danfoss compressor.

Application Control Microprocessor (AOC DRIVE) Registers - Address = 162

Address	Size	Description	Type	Def	Min	Max	Unit	Dir.
40101	10	AOC software version	STRING					R
40111	10	AOC registers version	STRING					R
40121	2	Drive status	UNSIGNED 32					R
40123	2	De rating status	UNSIGNED 32					R
40125	2	Safe mode status	UNSIGNED 32					R
40127	2	Alarm	UNSIGNED 32					R
40201	1	Therm in mode	UNSIGNED 8	0	0	2		W
40202	1	Therm in compressor mode	UNSIGNED 8	0	0	2		W
40204	2	Therm in PC	FLOAT 32	1	0.1	60	Bar	R
40206	2	Therm in P0	FLOAT 32	1	0.1	60	Bar	R
40212	1	Therm in compressor external speed PCT	UNSIGNED 8	0	0	100	%	W
40214	2	Therm in discharge temperature	FLOAT 32	0	-60	200	°C	R
40216	2	Therm in ambient temperature	FLOAT 32	0	-60	100	°C	R
40222	2	Therm in line volt	FLOAT 32	0	0	1000	V	R
40301	2	Therm out compressor speed Hz	FLOAT 32	0	0	75	Hz	R
40401	1	Therm setup unit type (**M182**)	UNSIGNED 8	0	0	2		R/W
40402	1	Therm setup system configuration (**M183**)	UNSIGNED 8	6	1	255		R/W
40404	1	Therm setup compressor max speed (**M184**)	UNSIGNED 8	70	15	70	Hz	R/W
40409	1	Therm setup oil loss trig time (**M185**)	UNSIGNED 16	18000	0	18000	s	R/W
40413	1	Therm setup start up hold time (**M186**)	UNSIGNED 8	10	10	240	s	R/W
40479	2	Therm setup crank case heating on temp (**M157**)	FLOAT 32	10	10	25	°C	R/W

Motor Control Microprocessor (MOC DRIVE) Registers - Address = 163

Address	Size	Description	Type	Def	Min	Max	Unit	Dir.
40101	10	MOC software version	STRING					R
40111	10	MOC registers version	STRING					R
40203	2	Compressor power	UNSIGNED 32				W	R
40207	2	Inverter temperature	FLOAT 32	40	-25	200	°C	R

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Indoor EEV Controller (EEV IN) Registers - Address = 165

Address	Size	Description	Scaling	Type	Def	Min	Max	Unit	Dir.
40002	1	S2 temperature	10	SIGNED 16		-2000	2000	°C	R
40007	1	Superheat reference	10	SIGNED 16		0	1000	K	R
40008	1	Superheat	10	SIGNED 16		0	1000	K	R
40009	1	Opening PCT	1	SIGNED 16		0	100	%	R
40018	1	Manual OD PCT (parameter **M158**)	1	SIGNED 16	0	0	100	%	R/W
40019	1	Max SH (parameter **M160**)	10	SIGNED 16	160	20	200	K	R/W
40020	1	Min SH (parameter **M161**)	10	SIGNED 16	40	10	200	K	R/W
40023	1	MOP (parameter **M162**)	10	SIGNED 16	137	0	600	Bar	R/W
40036	1	Manual CTRL (parameter **M159**)	1	SIGNED 16	0	0	1		R/W

In night mode the Danfoss compressor speed is limited by parameter **M169**.

When the Danfoss compressor is enabled, the temperature control is integral-proportional (PI) type, by parameter **M165** is possible to set the integral time for the control. Otherwise the temperature control is proportional (P) type.

Temperature control uses as regulation parameter the difference between the value of desired temperature (SET POINT) and the value of measured temperature (real temperature).

When the Danfoss compressor is enabled, by parameter **M179** is possible to select if the temperature control is done by internal or supply temperature.

When the Danfoss compressor is enabled and the sequencing mode is not enabled, the cooling band of the compressor is set by parameter **S28**.

The drive of the Danfoss compressor is switched on by digital output R1 when the C2020 controller is switched on.

The Danfoss compressor status is set by sending a new value to data point ModBus 40212.

Value 1 is sent to the data point ModBus 40201 when the machine is ON or in EMERGENCY, it's made at least one refresh cycle of all data points and the following alarms are not active: fire – smoke, peripherals error, condenser pressure invalid, ambient temperature invalid, eev in failure, discharge temperature invalid and suction pressure invalid. Value 0 is sent in all other cases.

Value 2 is always sent to the data point ModBus 40202.

General temperature control parameters:
- **S01** COOLING SET POINT (cool set point - CS): pre-set = 25°C
- **S03** HEAT SET POINT (HS): pre-set = 15°C
- **S06** COOLING BAND: (B): pre-set = 5°C

Compressor management includes the following parameters for time delays:
- **M60** MIN SWITCH ON TIME COMPRESSOR: pre-set = 10 seconds
- **M61** MIN SWITCH OFF TIME COMPRESSOR: pre-set = 180 seconds
- **M62** DELAY BETWEEN TWO COMPRESSOR STARTS: pre-set = 0 seconds

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Compressor and heating elements are normally actuated automatically, as described in the following section, or may be manually actuated, as described in the manual control chapter.

Warning: control logic changes according to freecooling status. If freecooling option is on, refer to section: Cooling with freecooling.

Compressor switch on and off time delay, according to the above parameters, must be guarantee except in alarm condition.

4.1.1. Cooling

Unit 1 - Without freecooling:

Parameters	Compressor starts (DIG-OUT R1) when temp:	Compressor stops (DIG-OUT R1) when temp:
M55 **M56**	T-ON=CS+[50% B] T-ON=**S01**+[**M55*S06**]	T-OFF=CS+[0% B] T-OFF=**S01**+[**M56*S06**]

Unit 1 - With freecooling TI-TAE>2°C:

Parameters	Compressor starts (DIG-OUT R1) when temp:	Compressor stops (DIG-OUT R1) when temp:
M57 **M58** **M36**	T-ON=CS+ [100% B]+[OFFSET FC*B]= 25+[100%*5]+[40%*5]=32°C T-ON=**S01**+[**M57*S06**]+[**M36*S06**]	T-OFF=CS+[50% B]+[OFFSET FC*B]= 25+[50%*5]+[40%*5] = 29.5°C T-OFF=**S01**+[**M58*S06**]+[**M36*S06**]

Unit 2 - Without freecooling:

Parameters	Compressor starts (DIG-OUT R1) when temp:	Compressor stops (DIG-OUT R1) when temp:
M55 - M56 **M59 - M07**	T-ON=CS+[50% B]+ [OFFSET*B] T-ON=**S01**+[**M55*S06**]+[**M59*S06**]	T-OFF=CS+[0% B]+[OFFSET*B] T-OFF=**S01**+[**M56*S06**]+[**M59*S06**]

Unit 2 - With freecooling:

Parameters	Compressor starts (DIG-OUT R1) when temp:	Compressor stops (DIG-OUT R1) when temp:
M36 - M57 **M58 - M59** **M07**	T-ON=CS+[100% B]+[OFFSET*B]+ [OFFSET FC* B] = 25 + 5 + 2 + 2 = 34°C T-ON=**S01**+[**M57*S06**]+[**M59*S06**]+[**M36 *S06**]	T-OFF=CS+[50% B]+[OFFSET*B]+ [OFFSET FC*B]= 25+2.5+2+2=31.5°C T-OFF=**S01**+[**M58*S06**]+[**M59*S06**]+[**M36 *S06**]

Unit 2 is used in case one unit is not enough to satisfy the need of cooling (or dehumidification): the second unit will support the work of the first one. In order to avoid useless working of the second unit, it's possible to decide the time in which the support unit must start (delay start).

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4.1.2. Heating

The parameters involved are:

- **S03** HEATING SET POINT: pre-set = 15°C
- **S04** SECOND HEATER SET POINT: pre-set = 15°C
- **S07** HEATING BAND: (B): pre-set = 5°C
- **I66** SELECT RELAY SECOND HEATER: pre-set = No connection
- **M64** HEATER ENABLE YES/NO: pre-set = NO
- **M65** HEATING ELEMENTS START (% OF BAND): pre-set = 50%
- **M66** HEATING ELEMENTS STOP (% OF BAND): pre-set = 0%
- **M68** ENABLE SECOND HEATING STEP: pre-set = NO

Special parameter involved for unit 2:

- **M67** OFFSET for UNIT #2 HE – Start/Stop: pre-set = 50%

	Heaters start (DIG-OUT R3) when temp:	Heaters stop (DIG-OUT R3) when temp:
Unit 1 - With or without freecooling	T-ON = HS - [50% B] T-ON = **S03** - [**M65 * S07**]	T-OFF = HS - [0% B] T-OFF = **S03** - [**M66** * **S07**]
Unit 2 - With or without freecooling	T-ON = HS - [50% B] - [50% B] T-ON = **S03** - [**M65 * S07**] - [**M67* S07**]	T-OFF = HS - [0% B] - [50% B] T-OFF = **S03** - [**M66** * **S07**] - [**M67 * S07**]

If one unit is not enough to satisfy the need of heating, the second unit will support the work of the first one.

Second heater control

Unit1:

Parameters	The second heater starts, when the temp:	The second heater stops, when the temp:
S04: pre-set = 15°C **I66**: pre-set = No connection **M68**: pre-set = NO	T-ON = HS2 - [50% B] T-ON = **S04** - [**M65 * S07**]	T-OFF = HS2 - [0% B] T-OFF = **S04** - [**M66** * **S07**]

Unit 2:

Parameters	The second heater starts, when the temp:	The second heater stops, when the temp:
S04: pre-set = 15°C **S07**: pre-set = 5°C **I66**: pre-set = No connec **M65**: pre-set = 50% **M66**: pre-set = 0% **M67**: pre-set = 50% **M68**: pre-set = NO	T-ON = HS2 - [50% B] - [OFFSET * B] T-ON = **S04** - [**M65 * S07**] - [**M67** * **S07**]	T-OFF = HS2 - [0% B] - [OFFSET * B] T-OFF = **S04**- [**M66** * **S07]** - [**M67** * **S07**]

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4.2. Dehumidification

The parameters involved are:
- **S05** HUMIDITY SET POINT (DS): pre-set = 40%
- **S06** COOLING BAND: (B): pre-set = 5°C
- **S08** BAND HU (BHU): pre-set = 50%
- **M69** DEHUMIDIFICATION ENABLE: YES/NO (Default = YES)
- **M70** DEHUMIDIFICATION START: pre-set = 20%
- **M71** DEHUMIDIFICATION STOP: pre-set = 2%
- **M74** TEMP. SET POINT DEHUMID. COMPRESS: pre-set = 20°C **

** Note: **M74** should be set the to a value less than **S01** for the correct working of this function.

The dehumidification is enabled if **M69** = YES.
If the internal humidity probe is connected (see I/O Setup par. 3.4.6), the compressor logic will be as it's shown in the next paragraph. Evaporator fan will module its speed according to IRH and to the TE. If the heater is enabled, it'll be switched on and off according to internal temperature.

If internal humidity probe isn't connected, the compressor logic is under the control of humidity switch. The compressor will be on (dehumidification ON) if the humidity switch is ON, otherwise the compressor is off (dehumidification OFF). Evaporator fan will be controlled as 100% of dehumidification, if required.

4.2.1. Compressor logic

Dehumidification ON (i.e. compressor ON):	Dehumidification OFF (i.e. compressor OFF):
RH-ON = DS + 20% BHU	RH-OFF = DS + 2% BHU
RH-ON = **S05** + **M70** * **S08**	RH-OFF = **S05** + **M70** * **S08**

The compressor logic depends also from temperature:

Compressor ON:	Compressor OFF:
T-ON = TCP + 50% B	T-OFF = TCP + 0% B
T-ON = **M74** + **M55** * **S06**	T-OFF = **M76** + **M56** * **S06**

4.2.2. Evaporator fan logic

Fan speed is modulated according to IRH (to have dehumidification action) and according to TE to avoid internal coil freezing. Fan will be driven to the maximum value between the two control logic.

Fan control for dehumidification
Special parameters involved:
- **M72** % of Dehumidification Band for Min fan speed: pre-set = 20%
- **M73** % of Dehumidification Band for Max fan speed: pre-set = 2%
- **M90** MIN EVAPORATOR FAN SPEED: pre-set = 30%
- **M91** MIN EVAPORATOR FAN SPEED with Heater on; pre-set = 70%
- **M92** MAX EVAPORATOR FAN SPEED: pre-set = 100%

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Standard parameters involved:
- **S05** HUMIDITY SET POINT (DS): pre-set = 40%
- **S08** BAND HU (BHU): pre-set = 50%

If internal humidity probe isn't connected, the behaviour of fan is under the humidity switch control. The fan will be at 100% of its speed if the humidity switch is "ON", otherwise it will be at min of its speed (**M90**).
If the internal humidity probe is connected, the behaviour of fan will be as it is described below. The minimum speed of the evaporator fan corresponds to the highest humidity level, while the maximum value corresponds to the lowest humidity value.
The fan speed is proportionally changed between the two values.

Fan going to **M90** MIN SPEED (or, if heater is on, to **M91**):	Fan going to **M92** MAX SPEED:
If RH > DS + 20% (BHU)	If RH < DS + 2% (BHU)
If RH > **S05** + **M72** * **S08**	If RH < **S05** + **M73** * **S08**

Fan control for antifreeze
Special parameters involved:
- **M90** MIN EVAPORATOR FAN SPEED: pre-set = 30%
- **M91** MIN EVAPORATOR FAN SPEED with Heater on; pre-set = 70%
- **M92** MAX EVAPORATOR FAN SPEED: pre-set = 100%

Temperature limit for setting fan min speed and fan max speed are fixed.
- **M95** EVAP. TEMP. FOR MIN EVAP. FAN SPEED: pre-set= 10°C
- **M96** EVAP. TEMP. FOR MAX EVAP. FAN SPEED: pre-set= 5°C

The fan speed depends on evaporator temperature: if TE is too low (default 10 degrees), speed starts to increase till to reach 100% at 5°C.
The fan speed is proportionally changed between the two values.

Fan going to **M90** MIN SPEED (or, if heater is on, to **M91**):	Fan going to **M92** MAX SPEED:
If TE > 10°C (TE > **M95**)	If TE < 5°C (TE > **M96**)

If TE is not present, the anti-freezing control goes on the TM. If also the TM is not present, the anti-freezing control is bypassed.

4.2.3. Heater logic

The parameters involved are:
- **S01** COOLING SET POINT: pre-set= 25°C
- **S07** HEATING BAND: pre-set= 5°C
- **M65** HEATING ELEMENTS START (% of band): pre-set= 50%
- **M66** HEATING ELEMENTS STOP (% of band): pre-set= 0%
- **M76** HEATERS ENABLE WITH DEHUMIDIFICATION: pre-set= YES

The heaters start during the dehumidification if enabled by **M74** set-up parameter. Their effect is to maintain TI temperature to **S01** set point, during the compressor dehumidification action.

Heaters start (digital output R3) when the temperature:	Heaters stop (digital output R3) when the temperature:
T-ON = CS - [50% B]	T-OFF = CS - [0% B]
T-ON = **S01** - [**M65** * **S07**]	T-OFF = **S01** - [**M66** * **S07**]

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Note that the status of heater (on or off) will affect the minimum speed used by the system for the evaporator fan (system uses different parameters, **M90** or **M91**, for minimum evaporator fan speed according to heating element status).

4.3. Humidification

The parameters involved are:
- **S05** HUMIDITY SET POINT (DS): pre-set = 40%
- **S08** BAND HU (BHU): pre-set = 50%
- **M77** HUMIDIFICATION ENABLE: pre-set= NO
- **M78** HUMIDIFICATION MODE: pre-set = 0 (Digital Humidifier)
- **M79** HUMIDIFICATION START: pre-set = 20%
- **M80** HUMIDIFICATION STOP: pre-set = 2%

The humidification is enabled if **M77** = NO.
All parameters will be accessible if internal humidity probe is connected (see I/O Setup par. 3.4.6) and humidification is enabled (**M77**= NO).

To humidify it's possible to use a humidifier (digital exit) or use the external humidity with the freecooling damper. The selection of device is done by the parameter **M78**, where:
- HUM. MODE = 0 : the digital humidifier is selected
- HUM. MODE = 1 : the analog humidifier is selected
- HUM. MODE = 2 : the free cooling damper is selected

Humidifying with humidifier
With DIG-OUT:

The humidifier start to humidify when humidity is:	The humidifier stop to humidify when humidity is:
H-ON = DS – 20% * BHU H-ON = **S05 - M78 * S08**	H-OFF = DS – 2% * BHU H-OFF = **S05 - M80 * S08**

Humidifying with freecooling
The parameters involved are:
- **M81**: pre-set = 2KJ/Kg
- **M82**: pre-set = 2°C

Comparing the external and internal humidity, the damper can be opened or not in order to let the humidity comes in. This function is conditioned to a control on the internal temperature, internal and external humidity, comparing it on the Psychometric diagram.

In the following table are shown the conditions to enable and disable humidification with freecooling.

Enable humidification with freecooling (if all of this conditions are satisfied)	Disable humidification with freecooling (if one on this conditions is satisfied)
– Damper not be under the conditions to be opened (par 5.4) – External Enthalpy – Internal Enthalpy > **M81** – (**S01**-**M82**) < TI < (**S01**+**M82**)	– The conditions to enable freecooling are satisfied. – External Enthalpy – Internal Enthalpy < **M81** – TI < [**S01**–(**M82**+1)] or TI > [**S01**+(**M82**+1)]

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When the humidification with freecooling is enabled, the damper aperture will be proportional to the measured humidity.

At the following humid value the aperture damper is min:	At the following humid value the aperture damper is max:
DAMP. MIN = DS – 2% * BHU DAMP. MIN = **S05 - M80 * S08**	DAMP. MAX = DS – 20% * BHU DAMP. MAX = **S05** - **M79** * **S08**

4.4. Freecooling

The parameters involved are:

- **S01** COOLING SET POINT (CS) : pre-set = 25°C
- **S06** COOLING BAND : pre-set = 5°C
- **M31** FREECOOLING ENABLE/OPTIONS: pre-set = Temperature
- **M32** MIN IN-OUT ENTHALPY DIFF. FOR FREECOOLING: pre-set = 15KJ/Kg
- **M33** START FREECOOLING UNIT 1 : pre-set = 0%
- **M34** FREECOOLING UNIT 1 MAX VALUE: pre-set = 75%
- **M36** FREECOOLING UNIT 2 OFFSET VALUE: pre-set = 40%
- **M41** MIN IN-OUT TEMP. DIFF. FOR FREECOOLING: pre-set = 10°C
- **M42** MIN EXTERNAL TEMP. ENABLE FREECOOLING (LTAEM) : pre-set = -25°C
- **M43** MAX EXTERNAL TEMP. ENABLE FREECOOLING (HTAEM) : pre-set = 60°C
- **M47** MIN HUMIDITY LIMIT FOR FREECOOLING (LHUM) : pre-set = 20%
- **M48** MAX HUMIDITY LIMIT FOR FREECOOLING (HHUM) : pre-set = 80%
- **M49** FREEC. START DELAY EXCEED. HUMID. LIMIT: pre-set = 2h
- **M51** FREECOOLING REGULATION: pre-set = Damper
- **M83** EXTERNAL AMBIENT PRESSURE: pre-set = 1013mbar
- **M90** MIN EVAPORATOR FAN SPEED: pre-set = 30%
- **M92** MAX EVAPORATOR FAN SPEED: pre-set = 100%

Important Note: TAE controlled for free cooling is the last TAE sampled with the condenser fan on.

Enable conditions

Special parameters involved:

- **M31** FREECOOLING ENABLE/OPTIONS: pre-set = Temperature
- **M35** ENABLE FREECOOLING FOR 2 UNIT: pre-set= YES

Freecooling is selectable. If it's enabled, two options will be available: enthalpic control or control based on temperature, on one or two units, selected by **M31** and **M35** setup parameters.

Temperature

When temperature based freecooling is chosen (**M31** = Temp) the conditions to enable freecooling are the following:

Conditions to enable freecooling:	TI- TAE > OFFSET (by default is 10°C), TI - TAE > **M41** LTAEM (**M42**) < TAE < HTAEM (**M43**) If the ERH probe is present then: LHUM (**M47**) < ERH < HHUM (**M48**) If the IRH probe is present then: LHUM (**M47**) < IRH < HHUM (**M48**)
Condition to disable freecooling:	TI - TAE ≤ OFFSET (by default is 10°C), TI - TAE ≤ **M41**

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Enthalpic control with freecooling

Conditions to enable freecooling:	Internal Enthalpy - External Enthalpy > OFFSET (15) Internal Enthalpy - External Enthalpy > **M32**. LTAEM (**M42**) < TAE < HTAEM (**M43**) LHUM (**M44**) < ERH < HHUM (**M48**)
Condition to disable freecooling:	Internal Enthalpy - External Enthalpy ≤ OFFSET (15) Internal Enthalpy - External Enthalpy ≤ **M32**.

The pressure of the external ambient can be set, by parameter **M83**, to adapt the enthalpy calculation to the altitude.
The pressure of the external ambient depends on the altitude (meters above the sea level) of installation, so the pressure will decrease if the altitude increases.

4.4.1. Function description

The parameter involved is:
- **I30** SELECT RELAY FREECOOLING: pre-set = NO CONN.

There are two control methods to do “freecooling” function: with damper or with damper and evaporator fan partialization.

It’s possible to choose the control algorithm by the parameter **M51** if 0 = only by damper;
if 1 = damper + evaporator fan.

It’s possible to associate the freecooling status to a relay by parameter **I30**.

If (FC status > 0): Relay associated to FC status On, else: Relay associated to FC status Off

Damper regulation
The damper regulation is done in the following way with 2 units at the same time, if enabled by **M35** setup parameter. The conditions to start/stop the freecooling on unit 1 and 2 are:

	Start Freecooling	Max Freecooling
Unit 1	U1 = CS + 0% B U1 = **S01** + **M33** * **S06**	U1 = CS + 75% B U1 = **S01** + **M34** * **S06**
Unit 2	U2 = CS + 40% B = START FRC. U1 + OFFSET U2 = **S01** + (**M33** + **M36**)* **S06**	U2 = CS + (75% + 40%) B = MAX FRC. U1 + OFFSET U2 = **S01** +(**M34** + **M36**)* **S06**

If IRH or ERH is below “LIMIT MIN” (**M47**) or exceeds “LIMIT MAX” (**M48**) or if IRH probe is absent and humidity switch is active, freecooling will be disabled for a settable time **M49**. The freecooling will restart if, after this time, the humidity value is re-entered into the limits. If **M49**=0, the disabled time is one minute.
If the dehumidification is active and the external humidity probe ERH is absent, the freecooling will be disable.
The evaporator fan speed is at its maximum value (**M93**).

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Fan speed and damper regulation
It's possible to control both damper and evaporator fan speed to obtain a noiseless regulation.
In damper regulation, the evaporator fan speed doesn't change and temperature is controlled by the damper aperture.
In this case (fan speed and damper regulation), to obtain a lower noise when the damper is opened, the evaporator fan speed is decreased and the damper reaches its max aperture before than under "damper regulation".
In particular, when the damper reaches its max aperture, the evaporator fan speed will increase from its minimum to its maximum speed up to the situation of max cooling.
When the damper is closed and the dehumidification is disabled, the evaporator fan speed will be at its minimum value.

When P control is enabled (parameter **M31** set to 1), the conditions are:

	Start Freecooling	Max damper aperture	Max Freecooling
U1	U1 = **S01** + (**M33** / 100) * **S06**	U1 = The evaporator fan is till at **M90**	U1 = **S01** + (**M34** / 100) * **S06**
U2	U2 = **S01** + ((**M33** + **M36**) / 100) * **S06**	U2 = The evaporator fan is till at **M90**	U2 = **S01** + ((**M34** + **M36**) / 100) * **S06**

The damper reaches its max aperture at the temperature:

T max_ap_u1 = **S01** + ((**M33** + **M36**) / 100) * **S06** + (**M90** / 100) * (**S06** * (**M34** - **M33**) / 100)
T max_ap_u2 = **S01** + ((**M33** + **M36**) / 100) * **S06** + (**M90** / 100) * (**S06** * (**M34** - **M33**) / 100)

When PI control is enabled (parameter **M31** set to 3), the conditions are:

	Start Freecooling	Max damper aperture	Max Freecooling
U1	U1=**S01**+(**M33**/100)*S06	U1=The evaporator fan is till at **M90**	U1=**S01**+(**M33**/100)*S06+M39
U2	U2=**S01**+((**M33**+**M36**)/100)*S06	U2=The evaporator fan is till at **M90**	U2=**S01**+((**M33**+**M36**)/100)*S06+M39

The damper reaches its max aperture at the temperature:

T max_ap_u1 = **S01** + (**M33** / 100) * **S06** + (**M90** / 100) * **M39**
T max_ap_u2 = **S01** + ((**M33** + **M36**) / 100) * **S06** + (**M90** / 100) * **M39**

When IRH or ERH is below "LIMIT MIN" (**M47**) or exceeds "LIMIT MAX" (**M48**) or if IRH probe is absent and humidity switch is active, freecooling will be disabled for a settable time **M49**. The freecooling will restart if, after this time, the humidity value is re-entered into the limits. If **M49**=0, the disabled time is one minute.
If the dehumidification is active and the external humidity probe ERH is absent, the freecooling will be disable.

4.4.2. Assisted freecooling

The parameters involved are:
- **M31** FREECOOLING ENABLE/OPTIONS: pre-set = Temperature
- **M46** FREECOOLING OFF IF COMPRESSOR ON: pre-set = YES
- **M47** MIN HUMIDITY LIMIT FOR FREECOOLING (LHUM) : pre-set = 20%
- **M48** MAX HUMIDITY LIMIT FOR FREECOOLING (HHUM) : pre-set = 80%
- **M49** FREEC. START DELAY EXCEED. HUMID. LIMIT: pre-set = 2h
- **M52** ASSISTED FREEC. MODE MIN TEMP. DIFFERENCE: pre-set = 2°C
- **M53** ASSISTED FREEC. MODE MIN EXTERNAL TEMPERATURE: pre-set = 20°C

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"Assisted freecooling " is the use of freecooling together with the compressor when there aren't the conditions to enable the traditional freecooling.

Compressor and free cooling logic is the same as in the traditional free cooling control.
To enable the "assisted freecooling", **M46** has to be set as NO.
The conditions to obtain an "assisted freecooling" are the followings:
– (TI – TAE > **M52)** and (TAE > **M53)**
– HHUM (**M48**) < IRH < LHUM (**M47**).
– HHUM (**M48**) < ERH < LHUM (**M47**).
If the dehumidification is active, the external humidity probe has to be present.

When IRH or ERH humidity is below "LIMIT MIN" (**M47)** or exceeds "LIMIT MAX" (**M48**), freecooling will be disabled for a settable time (**M49**). If **M49**=0, the disabled time is one minute. The freecooling will restart if after this time the humidity value is re-entered into the limits.

Note that the assisted freecooling is automatically disabled when the freecooling is not enabled (parameter **M31** set to No enable).

4.4.3. HGB (Hot Gas Bypass) control

The parameters involved are:
- **S19** LIMIT SUPPLY TEMPERATURE IN FREECOOLING MODE: pre-set = 15 °C
- **M44** BAND FOR LIMIT SUPPLY TEMPERATURE: pre-set = 5 °C
- **M45** MINIMUM FREECOOLING DAMPER OPENING: pre-set = 0 %
- **I67** SELECT RELAY HGB: pre-set = No connected

The HGB control is enabled only if the supply temperature probe is present.

If the HGB control is enabled and there are the conditions to enable the traditional freecooling, the freecooling damper status is determined by the minimum value between the value calculated by standard freecooling control and that calculated as described below:
– IF (TM < **S19**), DAMPER STATUS = **M45**
– IF (TM > (**S19** + **M44**)), DAMPER STATUS = 100 %
– IF ((TM > **S19**) AND (TM < (**S19** + **M44**)), DAMPER STATUS = MAX (**M45**, (100 / **M44**) * (TM - **S19**))

The HGB control can be associated to a relay by parameter **I67.**

If the machine is ON, the relay associated to the HGB control switches on if the supply temperature is lower than **S19** and it switches off if the supply temperature is greater than **S19** + **M44**.
If the machine is OFF, the relay associated to the HGB control is always off.

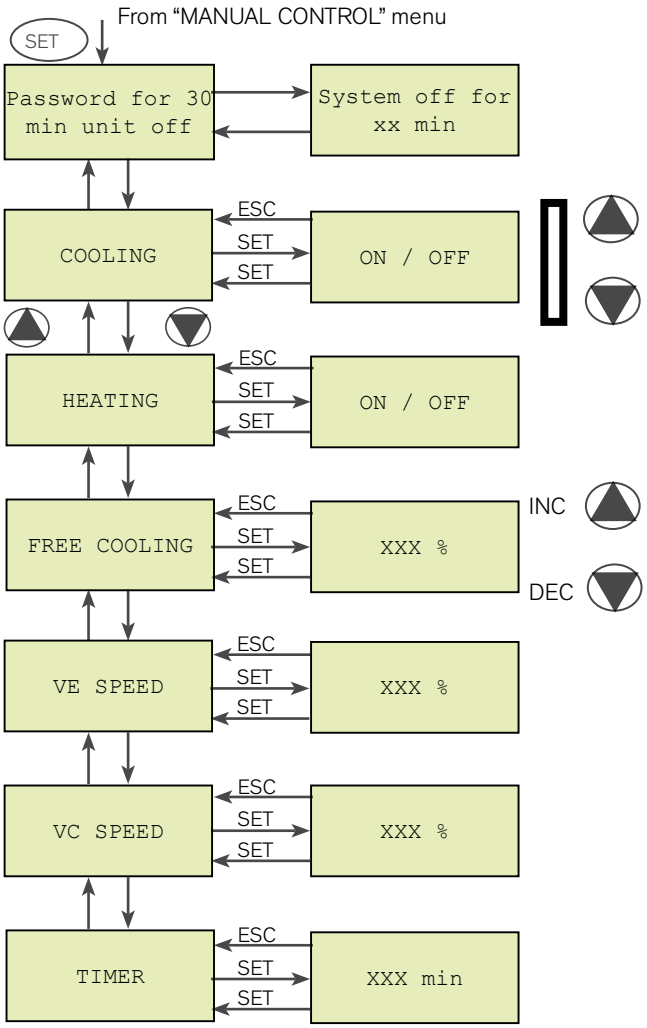
4.5. Emergency ventilation management

When there is a serious alarm, the emergency ventilation starts:
– Compressor is switched off
– Dirty filter alarm disabled
– Temperature management by freecooling damper and evaporator fan

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4.6. Manual control

This part of the program allows to control manually the devices of the unit, excluding the automatic control but keeping interlock with protections, to guarantee safety and integrity of all components.
The setting masks are under password.
It's possible to get a manual control even if the unit is OFF.
To carry out the manual control you have to enter into "Manual control" menu from "System maintenance" menu, how it's described in par. 3.4.2**.**
In the following figure is shown the sub menu existing.



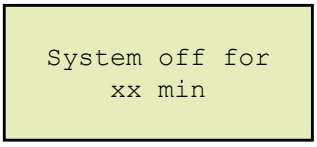
Use UP/DOWN ARROW keys to move between the menu and press the SET key to enter into every menu. After that the state of the control can be modified by UP/DOWN ARROW keys. To come back there are two ways:

1. Press the SET key to store the new state
2. Press the ESC key to not storing the new state

Following a description of every function:

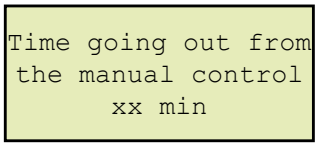
- **ON/OFF MANAGEMENT**: in this menu it's possible to switch off the machinery for a fixed time equal to 30 minutes. After 30 minutes the machinery will switch on. Once inside this menu, to switch off the machinery it's necessary typing the right password and pressing the SET key. The following screen will appear:

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Where “xx” is a down counter and displays the time for switching on the machinery automatically. It’s possible to switch on the unit before the time is over pressing the ON key.

- **COOLING**: in this menu it’s possible to control the state of cooling mode, the temperature control rules are bypassed and compressor is forced on.
  ON: CP on, VE = 100% ; VC = 100% (UP key) / OFF: the cooling has an automatic control (DOWN key)
- **HEATING**: in this menu it’s possible to control the state of heating, the temperature control rules are bypassed and resistor is forced on.
  ON: Heating element on, VE = 100% ; VC = 0% (UP key) / OFF: the heating has an automatic control (DOWN key)
- **FREECOOLING** : in this menu it’s possible to control the opening of freecooling damper
  INC: to increase the value use the UP key / DEC: to decrease the value use the DOWN key
- **VE SPEED**: this is the speed of evaporator fan which can be controlled by this menu
  INC: to increase the value use the UP key / DEC: to decrease the value use the DOWN key
- **VC SPEED**: this is the speed of condenser fan which can be controlled by this menu
  INC: to increase the value use the UP key / DEC: to decrease the value use the DOWN key
- **TIMER** : this is a parameter which indicates how long it’s possible to stay under manual control. The following screen is displayed:



When the time is over, all the manual controls will be switch off. The displayed time is in minutes from 0 to 255.

4.7. Automatic lead lag management (master-slave)

The parameter involved is:
- **M190** ENABLE CONTROL OF SEQUENCING SYSTEM: pre-set = YES

The configuration Master-Slave is a system where there are only two units: one of them is the master and the other one the slave. The master board will control all the logic functions of the system and it can ask support to the slave to cool or to heat.
To enable the control of the Master-Slave system set **M190** to YES. If **M190** is set to NO, the two boards will work as in stand alone mode.

The Lead Lag Management is an algorithm which allows two independent units, installed in parallel in the same ambient, to work alternatively on a time base. The stand by unit is ready to work in case of alarm of the first one or peak of load.
A control is made on temperature and humidity of the ambient. If only one unit isn’t able to satisfy the demand of heating, cooling or dehumidification, after a time settable the other unit will start. The support function can be enabled from the mask. In the same mask is visualised the number of hours which the unit has been working as support.

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The setup parameters involved are:

- **S01** COOLING SET POINT (CS) : pre-set = 25°C
- **S06** COOLING BAND : pre-set = 5°C
- **M01** AUTOMATIC LEAD LAG ADDRESS : pre-set : 0
- **M03** NUMBER OF PRESENT UNITS : in this case its value will be : 2
- **M04** MAX NUMBER OF UNITS ON : pre-set = 1
- **M05** ROTATION HOURS SETTING: pre-set= 24 h

It allows to set rotation hours between master and slave in normal working.

- **M06** LEAD LAG ENABLE : pre-set = 2

To enable Automatic lead lag (0 - no lead lag allowed; 1 - lead lag on running unit time; 2 - lead lag on running evaporator fan time)

- **M07** SLAVE UNIT DELAY START : pre-set = 5 sec
- **M55** CP START WITHOUT FREECOOLING : pre-set = 50%
- **M56** CP STOP WITHOUT FREECOOLING : pre-set = 0%
- **M57** CP START WITH FREECOOLING : pre-set = 100%
- **M58** CP STOP WITH FREECOOLING : pre-set = 50%
- **M59** COMPRESSOR UNIT 2 OFFSET VALUE : pre-set = 40%

Also the cooling control parameters are involved.

These are the rules that manage the Automatic Lead Lag Algorithm:

1. Units are distinguished by address **M01**: master has address 1, slave has address 2.
2. “Master” is master on the serial line communication and “slave” is slave.
3. The automatic lead lag algorithm is completely managed by master.
4. Algorithm is based on the concept that there is a leader unit and an auxiliary unit, the leader takes care of control asking help to the auxiliary unit if the load is in excess to his capacity.
5. Leader role is cycled by master on time base (lead lag).
6. The leader is always on, the auxiliary board may be in stand-by or enabled
7. When the auxiliary board is enabled, it will control its component with its set point and probes
8. If unit is auxiliary, it’s enabled by master in the following way:

The auxiliary unit is enabled when the temperature of the leader is:	The auxiliary unit is disabled when the temperature of the leader is:
T-ON = CS + [100% B] + [OFFSET * B]	T-OFF = CS+ [50% B] + [OFFSET * B]
T-ON = **S01** + [**M55 * S06**] + [**M59 * S06**]	T-OFF = **S01** + [**M56 * S06**] + [**M59 * S06**]

9. In a similar way, the auxiliary unit can be enabled for support cooling with freecooling, heating, dehumidification or humidification
10. Once auxiliary is enabled all its components are enabled independently from the leader probes (i.e. if auxiliary board is enabled by master for cooling support but it call heating its heater could be switched on; of course this usually doesn’t happen if probes and parameters are well set)
11. If the master is leader, to enable auxiliary master sends an ‘enable’ command, then slave will work as leader board, controlling on his probe with his parameters.
12. To disable slave, master sends a ‘disable’ command.
13. When the slave is enabled, it’ll answer with his status between OK, ALARM.
14. ALARM status is set for:
    - High/low pressure for the compressor
    - High/low humidity
    - Overload (Circuit breaker)
    - Air flow

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15. If none of the conditions at 11 point are true, the status of slave will be OK;
16. If master, in stand by condition, receives an ALARM status from slave then, after **M07**, it begins controlling normally;
17. When **M05** is elapsed, the master will send commands to make leader the slave unit and it will become the auxiliary one;
18. If serial communication is lost, master and slave unit will control, normally according to the 'cooling' rules;
19. Causes that can make standby unit start: Normal rotation / Alarm / Leader unit support.

Installing system

For the configuration Master-Slave (only two units in the system) the following parameters have to be set as below:

- **M01** AUTOMATIC LEAD LAG ADDRESS = 1 for Master board; 2 for Slave board
- **M03** NUMBER OF PRESENT UNITS = 2
- **M04** MAX NUMBER OF UNITS ON = 2
- **M06** LEAD LAG ENABLE = 1

The connection between the boards is a RS485 serial one, which connects the RS485 serial ports, called SLAVE, of the two boards.
In the system the user will be connected to the master board by the RS485 serial port called USER. It's possible an user for the slave board which will be connected to the its USER serial port.

In the next figure the connection is shown.



4.8. Sequencing

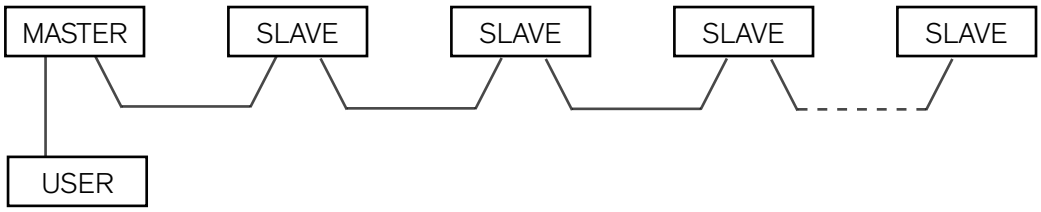
The parameters involved are:

- **S01** COOLING SET POINT: pre-set= 25°C
- **S03** HEATING SET POINT: pre-set= 15°C
- **S06** COOLING BAND: pre-set= 5°C
- **S07** HEATING BAND: pre-set= 5°C
- **M01** AUTOMATIC LEAD LAG ADDRESS: pre-set = 0
- **M03** NUMBER OF PRESENT UNITS: pre-set = 1
- **M04** MAX NUMBER OF UNITS ON: pre-set = 1
- **M05** ROTATION HOUR SETTING: pre-set = 24h
- **M06** LEAD LAG ENABLE: pre-set = 2
- **M158** ENABLE DANFOSS COMPRESSOR: pre-set = NO
- **M180** OTHER COMPRESSOR START IN SEQUENCING MODE: pre-set = 50%

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4.8.1. General description

The sequencing function must be enabled when it's necessary to use a system with more than two units.
The configuration system is similar to bus one, the number of units which can be present is limited by parameter **M03** and the number of units that can be on simultaneously is limited by parameter **M04**.
In the following figure is shown the configuration system.



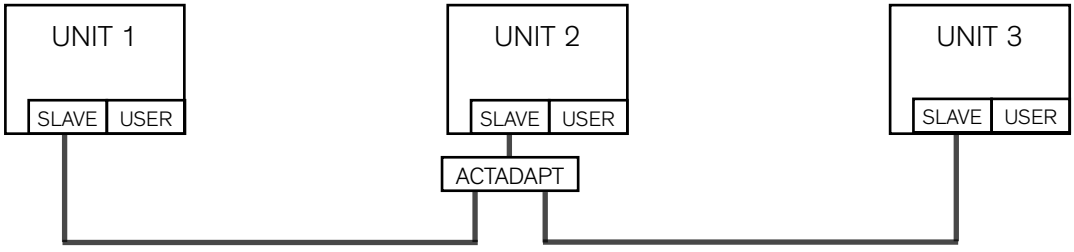
In the system there is only one master board, there may be only one user board and the other units are all slaves; a slave board may be the user board too. The user board has to be connected to the RS485 serial port called USER of the board.
To the master board can be connected either a CO3 user or a EO3 user.

- If the users connected to the slave boards are different from the user connected to the master board, the users connected to the slave boards can't be used when the remote user mode is enabled.
- If the users connected to the slave boards are equal to the user connected to the master board, the keypad of the users connected to the slave boards can't be locked when the remote user mode is enabled.

The units don't have the same values for their parameters.
The master is always the board with the lowest lead lag address (parameter **M01**), therefore the board with serial address 1 is always the master. If the master doesn't work, automatically another unit will replace it, in this case the board with serial address 2. When the board with serial address 1 works well, it becomes the master.
User CO3 can also be connected to SLAVE link of sequencing; in this case EO3 cannot be used.
User connection on SLAVE link is checked every one minute. User on the SLAVE link needs an external power supply.

4.8.2. System installing instruction

The system has different configurations according to the number of its boards.
All the boards are connected by a bus to their RS485 serial port called SLAVE and it's necessary an external adapter to split the SLAVE connector (Stulz accessory ACTADAPT). In this way two boards can be connect to the same serial port.
The TL2 jumper of the external boards of the system has to be closed, opened in the other boards.
In this paragraph it's shown how the boards of the system are connected.



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It's possible to have a system from three to ten units. In the following table are shown the parameters involved for the master board and the slave boards.

Parameters configuration for the master board:

M01 = 1
M03 = 3 / 4 / 5 (it depends on the units involved)
M04 = 1 / 2 / 3 / 4 / 5 (it depends on the units involved)
- 5, if 5 boards can be on simultaneously (if 5 units are present)
- 4, if 4 boards can be on simultaneously (if 4 units are present)
- 3, if 3 boards can be on simultaneously
- 2, if only 2 boards can be on simultaneously
- 1, if only 1 board can be on: in this case only the leader board is on (see par. 4.8.3)

M05 = it depends by the installer
M06 = 1

Parameters configuration for the slave board:

M01 = 2 / 3 / 4 / 5 (it depends on the units involved)
M03 = 3 / 4 / 5 (it depends on the units involved)
M04 = 1 / 2 / 3 / 4 / 5 (it depends on the units involved)
- 5, if 5 boards can be on simultaneously (if 5 units are present)
- 4, if 4 boards can be on simultaneously (if 4 units are present)
- 3, if 3 boards can be on simultaneously
- 2, if only two boards can be on simultaneously
- 1, if only one board can be on: in this case only the leader board is on (see par.4.8.3)

M05 = it depends by the installer
M06 = 1

The parameter involved is:
- **M190** ENABLE CONTROL OF SEQUENCING SYSTEM: pre-set = YES

Set the parameter **M190** to YES to enable the control of the sequencing system. If parameter **M190** is set to NO, all the boards will work as in stand alone mode.

In the next paragraphs is described the control of the sequencing system.

4.8.3. Sequencing with stand-by management mode

The parameters involved are:
- **M188** ENABLE CONTROL OF SEQUENCING SYSTEM: pre-set = YES
- **M04** MAX NUMBER OF UNITS ON: pre-set = 1
- **M05** ROTATION HOUR SETTING: pre-set = 24h

All the units on works like in stand alone mode. If an alarm occurs in a unit on, that unit is switched off and another is switched on. At every interval time, settable by parameter **M05**, the unit with more running hours will be switched off and the one with less running hours will be switched on.

4.8.4. Lead lag management

In the system there is always a unit that is the "leader" one: it's on and the system controls on its probe reading. If necessary, the leader can ask the support from the other units.
At every interval time, settable by parameter **M05**, the role of leader is exchanged with that one which has the lower running hours of evaporator fan. The new leader will be switched on and the old one will be switched off.
Each slave will communicate the running hours of their evaporator fan to the master, which will decide who will switch on.

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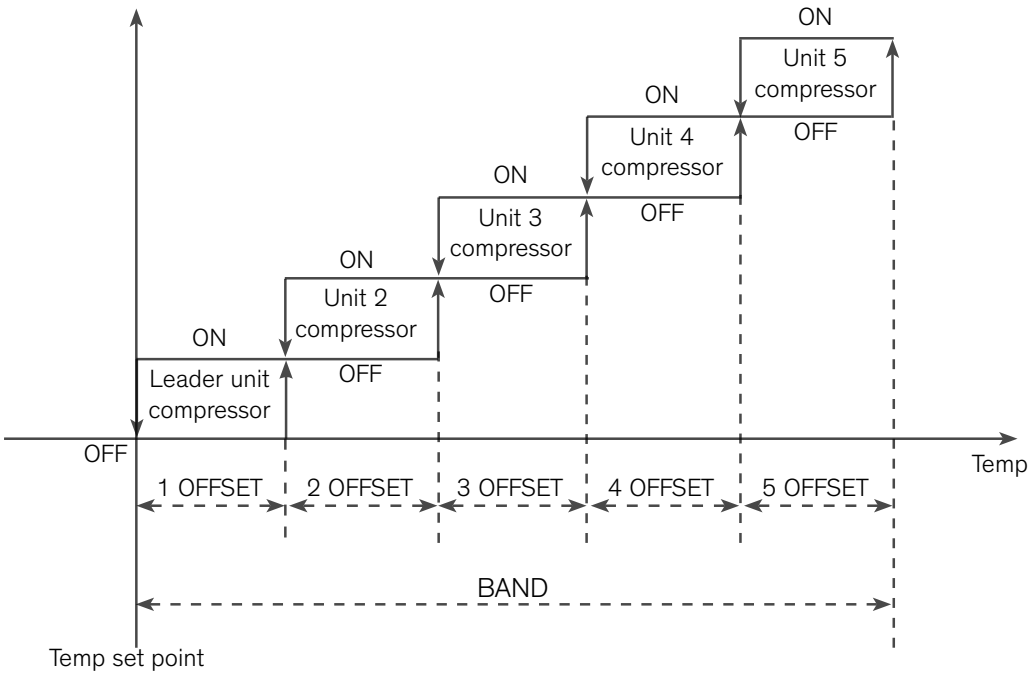
4.8.5. Cooling without freecooling conditions

The parameters involved are:
- **M158** ENABLE DANFOSS COMPRESSOR: pre-set = NO
- **M180** OTHER COMPRESSOR START IN SEQUENCING MODE: pre-set = 50 %

If an unit is on and it isn't sufficient to cool, it will ask support to another unit and the one with lower number of compressor running hours will be switched on by master. The logic function is under control of the master. If two units aren't sufficient to cool, a third one will be switched on following the logic of lower number of compressor running hours.
For example, in a system of five units the offset is equal to: offset = **S06** / (number of unit) = **S06** / **M04**

	The compressor is switched on at the temp:	The compressor is switched off at the temp:
Unit 1 (Leader board)	T-ON = CS + [B / 5] T-ON = **S01** + [**S06** / **M04**]	T-OFF = CS + [0 * B / 5] T-OFF = **S01** + [0 * **S06** / **M04**]
Unit 2	T-ON2 = CS + [2 * B / 5] T-ON2 = **S01** + [2 * **S06** / **M04**]	T-OFF2 = CS + [1 * B / 5] T-OFF2 = **S01** + [1 * **S06** / **M04**]
Unit 3	T-ON3 = CS + [3 * B / 5] T-ON3 = **S01** + [3 * **S06** / **M04**]	T-OFF3 = CS + [2 * B / 5] T-OFF3 = **S01** + [2 * **S06** / **M04**]

In the next figure there's an example:



When the Danfoss compressor is enabled (**M158** set to YES), it's possible to set a first step by parameter **M180**.
In sequencing mode is not possible to select the temperature control mode by parameter **M179**. The temperature control is always done by internal temperature.

If there are only three units in the system, the compressor of leader unit will be switched on at temperature:
T-ON = CS + [B / 3] and T-ON = **S01** + [**S06** / **M04**]

Where the offset is equal to: Offset = **S06** / (number of units) = **S06** / **M04**

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4.8.6. Cooling with freecooling conditions

If freecooling is enabled and it's necessary to cool, before switching on the compressor of the leader unit, the damper of all units will be opened in according to the freecooling logic explained below. There are two types of freecooling control methods, which can be chosen by the parameter **M51**:

- If 0 = only damper regulation;
- If 1 = damper + evaporator fan regulation.

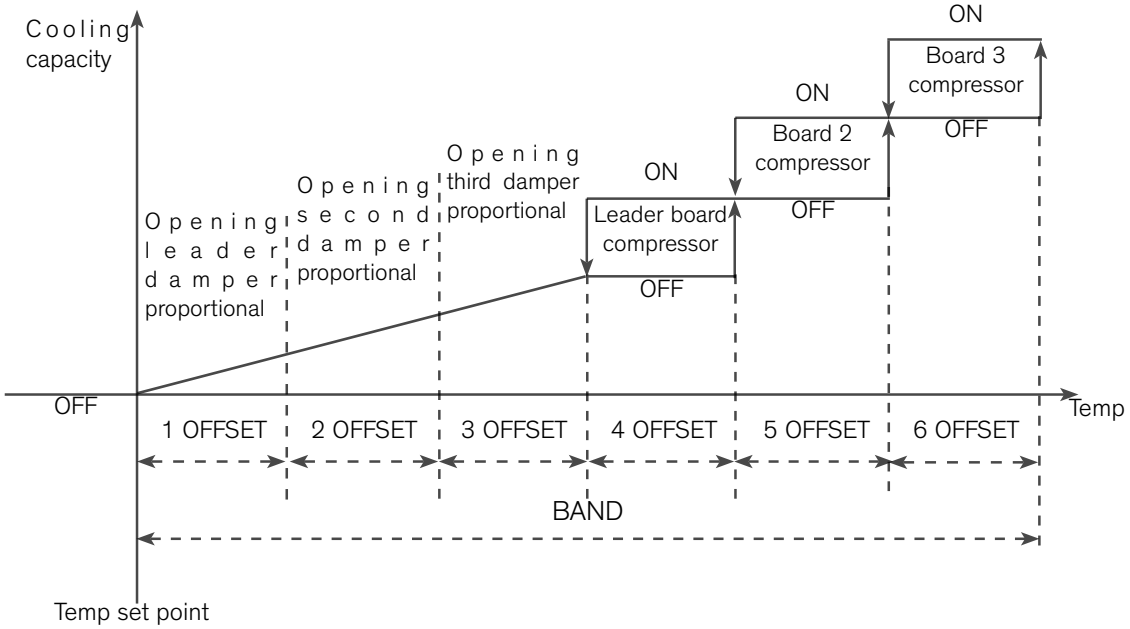
Damper regulation

In a system where max number of units on is three (**M04** = 3), the offset is equal to:
Offset = B / (2 * max number of units on) = **S06** / (2 * **M04**) = **S06** / (6)

The damper of the leader board (unit 1) starts to open and then it gets its maximum aperture at the temperatures described in the table below. If the temperature increases, the second and then the third units will open the damper at the conditions described below. If the temperature continues to increase, the third unit stays at its maximum aperture and the compressor of the first unit will switch on; it will continues it this way with the compressors of the unit 2 and 3 if the temperature continues to increase.

	Unit 1	Unit 2	Unit 3
Damper starts to open at T:	T-START=CS+[0*B/6] T-START=**S01**+[0*__S06__/(2*__M04__)]	T-START=CS+[1*B/6] T-START=**S01**+[1*__S06__/(2*__M04__)]	T-START=CS+[2*B/6] T-START=**S01**+[2*__S06__/(2*__M04__)]
Damper max aperture at T:	T-MAX=CS+[1*B/6] T-MAX=**S01**+[1*__S06__/(2*__M04__)]	T-MAX=CS+[2*B/6] T-MAX=**S01**+[2*__S06__/(2*__M04__)]	T-MAX=CS+[3*B/6] T-MAX=**S01**+[3*__S06__/(2*__M04__)]
Compressor on:	T-ON=CS+[4*B/6] T-ON=**S01**+[4*__S06__/(2*__M04__)]	T-ON=CS+[5*B/6] T-ON=**S01**+[5*__S06__/(2*__M04__)]	T-ON=CS+[6*B/6] T-ON=**S01**+[6*__S06__/(2*__M04__)]
Compressor off:	T-OFF=CS+[3*B/6] T-OFF=**S01**+[3*__S06__/(2*__M04__)]	T-OFF=CS+[4*B/6] T-OFF=**S01**+[4*__S06__/(2*__M04__)]	T-OFF=CS+[5*B/6] T-OFF=**S01**+[5*__S06__/(2*__M04__)]

In the next figure there's an example:



If in a system the max number of units on is five (**M04**= 5), the offset will be equal to:
Offset = B / (2 * max number of units on) = **S06** / (2 * **M04**) = **S06** / (10)

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Damper and evaporator fan regulation

With this type of regulation, if in the system the max number of unit on is three (**M04** = 3), the offset will be equal to: Offset = B / (3 * max number of units on) = **S06** / (3 * **M04**) = **S06** / (9)

	Unit 1 (Leader board)	Unit 2	Unit 3
Damper starts to open at T:	T-START=CS+[0*B/9] T-START=**S01**+[0*S06/(3*M04)]	T-START=CS+[1*B/9] T-START=**S01**+[1*S06/(3*M04)]	T-START=CS+[2*B/9] T-START=**S01**+[2*S06/(2*M04)]
Damper max aperture at T:	T-MAX=CS+[1*B/9] T-MAX=**S01**+[1*S06/(3*M04)]	T-MAX=CS+[2*B/9] T-MAX= **S01**+[2*S06/(3* M04)]	T-MAX=CS+[3*B/6] T-MAX=**S01**+[3*S06/(2*M04)]
Evaporator fan speed starts to increase at T:	T-MIN=CS+[3*B/9] T-MIN=**S01**+[3*S06/(3*M04)]	T-MIN=CS+[4*B/9] T-MIN=**S01**+[4*S06/(3*M04)]	T-MIN=CS+[5*B/9] T-MIN=**S01**+[5*S06/(3*M04)]
Evaporator fan speed max value at T:	T-MAX=CS+[4*B/9] T-MAX=**S01**+[4*S06/(3*M04)]	T-MAX=CS+[5*B/9] T-MAX=**S01**+[5*S06/(3*M04)]	T-MAX=CS+[6*B/9] T-MAX=**S01**+[6*S06/(3*M04)]
Compressor on:	T-ON=CS+[7*B/9] T-ON=**S01**+[7*v/(3*M04)]	T-ON=CS+[8*B/9] T-ON=**S01**+[8*S06/(3*M04)]	T-ON=CS+[9*B/9] T-ON=**S01**+[9*S06/(3*M04)]
Compressor off:	T-OFF=CS+[6*B/9] T-OFF= **S01**+[6*S06/(3*M04)]	T-OFF=CS+[7*B/9] T-OFF= **S01**+[7*S06/(3*M04)]	T-OFF=CS+[8*B/96] T-OFF=**S01**+[8*S06/(3*M04)]

If in a system the max number of units on is five (**M04**= 5), the offset will be equal to:
Offset = B / (2 * max number of units on) = **S06** / (3 * **M04**) = **S06** / (15)

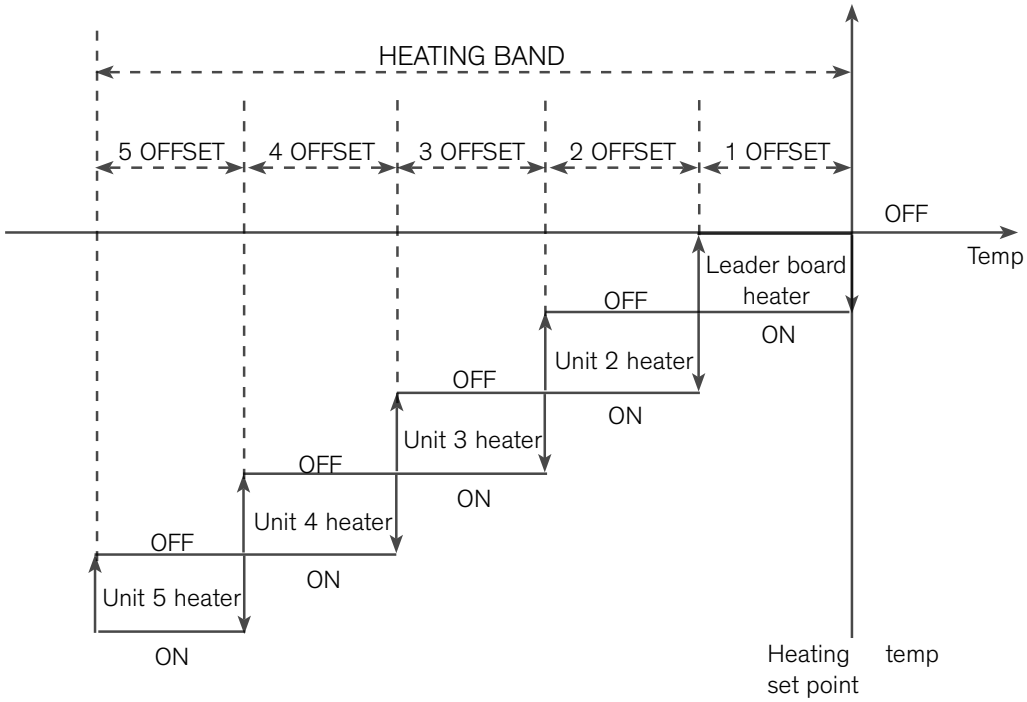
4.8.7. Heating

If the leader unit isn't sufficient to heat, it will ask the support to another unit and that one with lower number of evaporator fan running hours will switch on its heaters. The logic function is under control of the master. If two units aren't sufficient to heat, a third one will be switched on following the logic of lower number of evaporator fan running hours. The offset is equal to: Offset = **S03** / (number of unit) = **S03** / **M04**

	Unit 1 (Leader board)	Unit 2	Unit 3
Heaters on:	T-ON = CS - [HB / 5] T-ON = **S03** - [**S07** / **M04**]	T-ON = CS - [2 * HB / 5] T-ON = **S03** - [2 * **S07** / **M04**]	T-ON = CS - [3 * HB / 5] T-ON = **S03** - [3 * **S07** / **M04**]
Heaters off:	T-ON = CS - [0 * HB / 5] T-ON = **S03** - [0 * **S07** / **M04**]	T-ON = CS - [1 * HB / 5] T-ON = **S03** - [1 * **S07** / **M04**]	T-ON = CS - [2 * HB / 5] T-ON = **S03** - [2 * **S07** / **M04**]

In the next figure there's an example.

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If in the system there are only three units, the offset will be: Offset = **S03** / 3 = **S03** / **M04**

4.8.8. Dehumidification with humidity switch

If there isn't the humidity probe and the humidity switch is present, the dehumidification function is under the control of the humidity switch.
The parameters involved are:

- **M04** MAX NUMBER OF UNITS ON: pre-set = 1
- **M75** START DELAY SLAVE UNITS FOR DEHUMID: pre-set = 300sec

If the humidity switch is off, the system doesn't do any action of dehumidification.
When the humidity switch of the leader is on, the evaporator fans will be immediately driven at their min speed and, after a period of time equal to **M75,** the compressor of the unit off will be switched on. If after another interval time (**M75**), the humidity switch is still on, another compressor will be switched on. The number of compressors on will be limited by the parameter **M04**. When the Humidity switch turns off, all compressors will be switched off.

4.8.9. Dehumidification with humidity probe

If the humidity probe is present, the dehumidification function will be under the control of it.
The parameters involved are:

- **M04** MAX NUMBER OF UNIT ON: pre-set = 1
- **M75** START DELAY SLAVE UNITS FOR DEHUMID: pre-set = 300sec

To dehumidify, the leader board has to met the conditions shown in par. 4.2.
If the leader board is dehumidifying and the period of time **M75** is elapsed, an unit of support will start to dehumidify. If after another interval time (**M75**) the dehumidification required conditions are still there, another support unit will start to dehumidify. The number of unit on is limited by the parameter **M04**. When the dehumidification condition is over (according to par. 5.2) all compressors will be switched off.

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4.8.10. Humidification

The parameters involved are:

- **S05** HUMIDITY SET POINT: pre-set = 40%
- **S08** HUMIDITY BAND: pre-set = 50%
- **M03** NUMBER OF PRESENT UNITS: pre-set = 1
- **M77** HUMIDIFICATION ENABLE: pre-set = NO
- **M78** HUMIDIFICATION MODE: pre-set = 0 (Digital humidifier)
- **M79** HUMIDIFICATION START: pre-set = 20%
- **M80** HUMIDIFICATION STOP: pre-set = 2%

Set the parameter **M77** to YES to enable the humidification in sequencing mode.
If the leader unit is not sufficient to humidify, it will ask support to the units with the lower number of evaporator fan running hours. The logic function is under control of the master unit.

For example, in a system of five units the behaviour of digital humidifier (**M78** set to 0) is as follows:

	Humidifier starts to humidify when:	Humidifier stops to humidify when:
Unit 1 (Leader board)	IRH_{ON}=**S05**-(**M80***S08)/100–**UNIT_OFFSET**	IRH_{OFF}=**S05**-(**M80***S08)/100
Unit 2	IRH_{ON}=**S05**-(**M80***S08)/100–(2***UNIT_OFFSET**)	IRH_{OFF}=**S05**-(**M80***S08)/100–**UNIT_OFFSET**
Unit 3	IRH_{ON}=**S05**-(**M80***S08)/100–(3***UNIT_OFFSET**)	IRH_{OFF}=**S05**-(**M80***S08)/100–(2***UNIT_OFFSET**)
Unit 4	IRH_{ON}=**S055**-(**M80***S08)/100–(4***UNIT_OFFSET**)	IRH_{OFF}=**S05**-(**M80***S08)/100–(3***UNIT_OFFSET**)
Unit 5	IRH_{ON}=**S05**-(**M80***S08)/100–(5***UNIT_OFFSET**)	IRH_{OFF}=**S05**-(**M80***S08)/100–(4***UNIT_OFFSET**)

Where: **UNIT_OFFSET** = ((**M79** – **M80**) * **S08**) / (**M03** * 100)

4.8.11. Visualization

The parameter involved is:

- **M190** ENABLE CONTROL OF SEQUENCING SYSTEM: pre-set = YES

The system may has only one user board for all the messages.
Each of them must give information about the source unit, so in the first line of the screen there is the origin displayed.
The standard screen is as the following one:

```
dd/mm/yy Uxx hh:mm
 -----device-----
---information---
  ++++++++++++
```

In the first line the “Uxx” indicates the number of the unit.

When the parameter **M190** is set to YES, you can view the status of the system with the following two screens:

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1)

```
U STS CP H VE FC HM
1 ON   1 0 50 50 50
2 OFF  0 0  0  0  0
3 SBY  0 0  0  0  0
```

2)

```
U STS CP H VE FC HM
4 ---  0 0  0  0  0
5 ---  0 0  0  0  0
L=x T=yy.y hh:mm:ss
```

These two screens gives the following information:

- **U = unit:** it indicates the number of the unit (1...5);
- **STS = state:** it indicates the state of the unit:
  - **ON:** the unit is on
  - **OFF:** the unit is off
  - **SBY:** the unit is in stand-by. That's means the unit is on but disabled.
  - **AL:** the unit is in alarm state
  - **ERR:** there's a serial communication error with the unit
  - - - - **:** there isn't any unit connected;
- **H = heater:** it indicates the state of the compressor (1 → ON; 0 → OFF);
- **CP = compressor:** it indicates the state of the compressor (1 → ON; 0 → OFF);
- **VE = evaporator fan :** it indicates the state of the evaporator fan (ON → 100%; XX → XX%);
- **FC = freecooling:** it indicates the state of the freecooling (ON → 100%; XX → XX%);
- **HM = humidifier:** it indicates the state of the digital humidifier (1 → ON; 0 → OFF) or the analog humidifier (ON → 100%; XX → XX%);

At the fourth line of the second screen it's shown which unit is the leader, the internal temperature read by the leader unit and the time remaining to the next rotation.

If **M190** is set to sequencing with stand by management the next screen wil appear, where the running hour of each unit is showed.

```
U STS Running hours
1 ON   10h
2 OFF  25h
3 SBY  30h
```

Remote user mode

When the system is on, it's possible to choose the board at which ask information. If a CO3 user interface is connected to the master board and the SET key is pressed, the next screen will appear:

```
Select the board

      Uxx
```

If an EO3 user interface is connected to the master board and the UP + SET keys are pressed, 'Ux' will appear. By the UP / DOWN keys it's possible to select the desired board and by the SET key it's possible to confirm the choice. In this way it's possible to visualize the information about state, parameters, alarms, etc., refer to the selected unit.
If no key (out of the menus) is pressed for three minutes, the remote user mode will be disabled.

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4.9. Condenser fan speed management

The parameters involved are the following:

With temperature probe:
- **M98** CONDENSER TEMPERATURE SET POINT
- **M99** CONDENSER TEMPERATURE PROPORTIONAL BAND
- **M100** CONDENSER TEMPERATURE INTEGRAL TIME

With pressure probe:
- **M101** CONDENSER PRESSURE SET POINT
- **M102** CONDENSER PRESSURE PROPORTIONAL BAND
- **M103** CONDENSER PRESSURE INTEGRAL TIME

Other parameters involved:
- **M63** CP SWITCH ON DELAY COND. FAN START: pre-set = 90sec
- **M110** DELAY TIME TO START PI CONTROL COND. FAN: pre-set = 180sec
- **M111** MAX CONDENSER FAN SPEED : pre-set = 100%
- **M158** ENABLE DANFOSS COMPRESSOR: pre-set = NO

The condenser fan speed control is available and it's a proportional-integral (PI) one.
The condenser fan is under the PI control after a time equal to parameter **M110** from its start.

When the compressor has to be switched on, the condenser fan will switch on before it. After a period of time equal to the settable parameter **M63**, the compressor will switch on.
When the compressor has to be switched off, both compressor and condenser fan will switch off simultaneously. The condenser fan starts at a fixed speed depending on external temperature, which has the following limits:
- **M108** MIN EXTERNAL TEMP. FOR COND. FAN SPEED: pre-set = -15°C
- **M109** MAX EXTERNAL TEMP. FOR COND. FAN SPEED: pre-set = 30°C

The behaviour of condenser fan at its start is described below:
- TAE < **M108** -→ VC = 20%
- TAE > **M109** -→ VC = **M111**
- **M108** < TAE < **M109** -→ VC is proportional

After 20 sec from the start of the machine, the fan speed will be under PI control.
The max fan speed under PI control is limited by parameter **M111**.
When parameter **M158** is set to YES, the condenser fan is switched off only when the Danfoss compressor is effectively off.

4.9.1. Night mode

During night time it's possible to reduce the total noise level by limiting the fan speed.
The parameters involved are:
- **M123** NIGHT MODE START TIME: pre-set = 0
- **M124** NIGHT MODE STOP TIME: pre-set = 0
- **M125** MAX EVAP. FAN SPEED DURING NIGHT MODE: pre-set = 75%
- **M126** MAX COND. FAN SPEED DURING NIGHT MODE: pre-set = 60%

The max condenser fan speed is limited to reduce the fan noise.

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When (**M123** ≠ **M124**), the max condenser fan speed will be under timing control.
If (**M123** < clock time < **M124**), the max condenser fan speed will be limited by the parameter **M124**.
If the clock time isn't included between **M123** and **M124**, the max condenser fan speed will be limited by **M111**.
When (**M123** = **M124**), the max condenser fan speed won't be under timing control and it'll always be limited by **M111**.
In this mode, also evaporator fan speed is limited to **M125** setup parameter.

4.9.2. Bypass of Condenser Fan Speed limitation

	Bypass condenser fan speed limitation if:	Returns to normal condition when:
If PC probe is present:	PC > **M117**	PC < (**M117** – 1.5)
If TC probe is present:	TC > **M114**	PC < (**M114** – 5)

4.9.3. Triac Control

The parameters involved are:
- **M105** CONDENSER FAN TRIAC PULSE LENGTH: pre-set = 1msec
- **M106** LOWER LIMIT TRIAC CONTROL: pre-set = 20%
- **M107** UPPER LIMIT TRIAC CONTROL: pre-set = 75%

The condenser fan speed is under the control of an algorithm, called phase cut, of the microcontroller which sets the TRIAC analog output. The parameters **M106** and **M107** correspond to the min/max threshold of analog output signal to have the min/max fan condenser speed.
For example, if the desired min condenser fan speed is 20% and the real one is 30%, the parameter **M106** will have to decrease. If the desired max condenser fan speed is 100% (the **M111** has to be 100% in this case) and the real one is 90%, the parameter **M107** will have to increase.
The parameter **M105** is used for the algorithm and it must be set only from expert users.

4.9.4. Maximum EER function

The parameters involved are:
- **M158** ENABLE DANFOSS COMPRESSOR: pre-set = NO
- **M174** ENABLE MAX EER FUNCTION: pre-set = NO
- **M175** GAS TYPE: pre-set = R407C
- **M176** SET POINT FOR MAX EER FUNCTION: pre-set = 8 °C
- **M177** MINIMUM CONDENSER TEMPERATURE FOR MAX EER FUNCTION: pre-set = 30 °C
- **M178** MAXIMUM CONDENSER TEMPERATURE FOR MAX EER FUNCTION: pre-set = 60 °C

When **M158** and **M174** are set to YES, than the condenser fans status control uses as regulation parameter the difference between the parameter **M176** and (TC - TAE).
The TC values are computed by a polynomial based on PC and gas type. The PC is read by the Danfoss compressor. The gas type is set by parameter **M175**. The polynomial works correctly in the following pressure range:
– PC = 2 ÷ 45 bar when R410a gas is used (**M175** set to R410A)
– PC = 0 ÷ 30 bar when others gas are used (**M175** set to a value different from R410A)

The condenser temperature is limited by parameters **M177** and **M178**.
The band is set by parameter **M99,** while the integral time is set by parameter **M100**.

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4.10. Evaporator fan speed management

The parameters involved are:

- **M51** FREECOOLING REGULATION: pre-set= DAMPER
- **M86** DELAY TIME FOR START EVAPORATOR FAN: pre-set= 30 sec
- **M87** DELAY TIME FOR STOP EVAPORATOR FAN: pre-set= 90 sec
- **M88** MIN SWITCHING ON FOR EVAPORATOR FAN: pre-set= 10 sec
- **M89** MIN SWITCHING OFF FOR EVAPORATOR FAN: pre-set= 10 sec
- **M91** MIN EVAPORATOR FAN SPEED WITH HEATERS ON; pre-set = 70%
- **M92** MAX EVAPORATOR FAN SPEED: pre-set= 100%
- **M93** MAX EVAPORATOR FAN SPEED IN FREE COOLING: pre-set= 100%
- **M94** MIN EVAP. FAN SPEED IN DEAD ZONE: pre-set= 0%
- **M125** MAX EVAP. FAN SPEED DURING NIGHT MODE: pre-set= 75%
- **M138** UPPER LIMIT OF THE DEAD ZONE: pre-set = 0 °C
- **M150** ENABLE DEAD ZONE CONTROL: pre-set = NO
- **M151** HYSTERESIS FOR ENTER IN DEAD ZONE: pre-set = 2 °C
- **M158** ENABLE DANFOSS COMPRESSOR: pre-set = NO
- **M166** EVAPORATOR FANS SET POINT: pre-set = 10 °C
- **M167** EVAPORATOR FANS BAND: pre-set = 10 °C
- **M168** EVAPORATOR FANS INTEGRAL TIME: pre-set = 0 Sec

If the unit is off or in stand by, the evaporator fan is off. When the unit is switched on, the evaporator will be switched on after a time equal to the parameter **M86**.
When the unit is switched off, the evaporator will be switched off after a time equal to the parameter **M87**. The evaporator fan is on for minimum time, which is the parameter **M88**, and, when it is switched off, it will be off for a minimum time, which is the parameter **M89**.

Free cooling Disabled:
If TM is present, **M166**>0, **M167**>0 the fans status control is a proportional-integral (PI) type. This control uses as regulation parameter: (**M166** - (TI-TM)). The band is set by parameter **M167** while the integral time is set by parameter **M168**. Min speed is **M90** and max speed is **M92**.
If TM is not present or **M166**=0, **M167**=0: speed is **M92**.

Free cooling enabled and **M51** = “damper”
Cooling: Fan speed = **M92**.
Free cooling and Assisted Free cooling: Fan speed = **M93**.
No condition (dead zone): Fan speed = **M92**.

Free cooling enabled and **M51** = “damper + fan”
Cooling: Fan speed = as free cooling disabled
Assisted Free cooling: Fan speed = maximum between cooling and free cooling fan speed
No condition (dead zone): Fan speed = **M92**.

If dehumidification is active, evaporator fan speed is partialized according to par. 4.2.2.
If freecooling is enabled with evaporator fan speed partialization, then refer to par. 4.4.1, fan speed and damper regulation.
If the parameter **M51** is set on “damp+fan” option, the management of evaporator fan is as described in par. 4.4.1, fan speed and damper regulation.
In night mode the evaporator fan speed is also limited to **M125** setup parameter.

When **M150** is set to YES, the heating and the cooling are off and TI < **S01** + **M138** - **M151** (upper limit of the dead zone), the unit enters in the dead zone and the evaporator fans speed becomes equal to the parameter **M94**. The unit exits from the dead zone when the heating or the cooling is on or IT > **S01** + **M138**. The dead zone control can be disabled by setting parameter **M150** to NO.

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In all other conditions, the evaporator fan runs at full speed limited by the value:

M92 + (**M93** - **M92**) * (Free cooling position) / 100

When the parameter **M158** is set to YES, the parameter **M51** is set to 0 (only by damper) and TI > (**S01** + 1°C), then the evaporator fans status control is a proportional integral (PI) type. When TI < **S01** the evaporator fans speed is set to **M90**. To enable this function, the parameter **M166** must be set to a value greater than zero.
This control uses as regulation parameter (**M166** - (TI -TM)). The band is set by parameter **M167** while the integral time is set by parameter **M168**.
The evaporator fans speed is in any case limited by the value:

M92 + ((**M93** - **M92**)*x) / 100

When parameter **M158** is set to YES, the evaporator fans are switched off only when the Danfoss compressor is effectively OFF (data point Modbus 40301 equal to 0).
When parameter **M158** is set to YES and the heater is on, the evaporator fans speed is set to **M91**.

4.11. Control under high external/internal temperature

The parameters involved are:
- **M116** VALUE FOR HIGH INT. TEMPER. MODE ENABLE: pre-set = 35°C
- **M117** VALUE FOR HIGH EXT. TEMPER. MODE ENABLE: pre-set = 50°C
- **M118** VALUE FOR HIGH EXT. TEMPER. MODE DISABLE: pre-set = 10°C

When the compressor is on and:
- TAE > **M117** or TI > **M116 °**C -→ evaporator fan speed under anti-freezing control
- TAE < (**M117** - **M118**) -→ evaporator fan speed control (as described in par. 4.10) and TI < (**M116**-1) °C

4.12. Hot start function

The parameters involved are:
- **S11** ALARM LIMIT HIGH TEMPERATURE: pre-set = 40°C
- **S12** HYSTERESIS OF HIGH TEMPERATURE ALARM: pre-set = 5°C
- **M158** ENABLE DANFOSS COMPRESSOR: pre-set = NO
- **M172** MINIMUM INTERNAL TEMPERATURE FOR HOT START FUNCTION: pre-set = 50 °C
- **M173** MINIMUM EXTERNAL TEMPERATURE FOR HOT START FUNCTION: pre-set = 45 °C

The “hot start” function is enabled when parameter **M158** is set to YES.

When TI > **M172** and TAE > **M173** then the Danfoss compressor speed is forced to 20%, until TI < (**S11** - **S12)** and the electrostatic valve is forced to 25% for a time equal to 90 seconds.

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4.13. Control under high tc (or pc) (adaptive control)

The parameters involved are:
- **M90** MinSpeed (Min Ve Speed)
- **M112** TcMaxVe (Tc Value for Max Ve Speed)
- **M113** TcMinVe (Tc Value for Min Ve Speed)
- **M158** ENABLE DANFOSS COMPRESSOR :pre-set = NO

When the compressor is on and the Tc is over the **M112** value, then the Ve speed is limited with the following formula:

New Speed = Speed - (Tc - TcMaxVe)*(Speed - MinSpeed) / (TcMaxVe - TcMinVe);

If anti-freezing control gives a value higher then the adaptive control, the anti-freezing value will be used. The adaptive control can be done also using the Pc probe instead of Tc. Parameters to use for Pc are: **M115** and **M116.** If TE is not present, adaptive control is bypassed.
This function is disabled when parameter **M158** is set to YES.

4.14. Soft control

The parameters involved are:
- **M121** SOFT CONTROL MODE TEMPERATURE SET POINT: pre-set = 45°C
- **M122** SOFT CONTROL MODE WAITING TIME: pre-set = 3min

When the compressor is switched on, if TAE > **M121**, the evaporator fan speed will be under the anti-freezing control for an interval of time equal to **M122**. During this interval, even if TAE < **M121**, the evaporator fan speed will stay under anti-freezing control until the time is over.

4.15. Split air unit

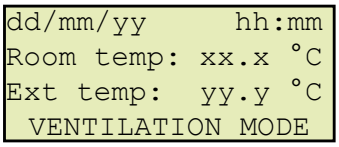
The parameter involved are:
- **M41** MIN IN-OUT TEMP. DIFF. FOR FREECOOLING: pre-set = 10°C
- **M54** COMPRESSOR ENABLE: pre-set = YES

The parameter **M54** selects the configuration of the board:

- **NO**: the unit is configured as “split air” unit which hasn’t the compressor, so the cooling function and all the alarms tied to the compressor are disabled. The enabled functions of a split air unit are freecooling and heater. In this case there is only one condition to enable the freecooling and it’s TI-TE > **M41**. The conditions about humidity are ignored. So, the humidity switch and the humidity probe are used only for their relative alarms but not for the other functions tied to compressor. The evaporator fan speed is always at its max value. The disabled alarms are:
  – Low, high pressure alarm
  – Power failure alarm
  – Compressor thermic alarm
  – Condenser fan thermic alarm
  – Bad working alarm

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If the unit is a split air one, the following screen will be displayed.



- **YES**: the unit is configured as standard C2020 controller with all its functions.

4.16. Offset correction

The parameters involved are:

- **I02** CHANNEL OFFSET T1: pre-set = 0°C
- **I03** CHANNEL OFFSET T2: pre-set = 0°C
- **I04** CHANNEL OFFSET T3: pre-set = 0°C
- **I05** CHANNEL OFFSET T4: pre-set = 0°C
- **I06** CHANNEL OFFSET IC1: pre-set = 0%
- **I07** CHANNEL OFFSET IC2: pre-set = 0bar
- **I08** CHANNEL OFFSET IC3: pre-set = 0%
- **I09** 4mA VALUE FOR An-In IC1: pre-set = 0%
- **I10** 20mA VALUE FOR An-In IC1: pre-set = 30%
- **I11** 4mA VALUE FOR An-In IC2: pre-set = 0bar
- **I12** 20mA VALUE FOR An-In IC2: pre-set = 100bar
- **I13** 4mA VALUE FOR An-In IC3: pre-set = 0%
- **I14** 20mA VALUE FOR An-In IC3: pre-set = 30%

The parameters from **I02** to **I08** add an offset to the correspondent probe reading.
The procedure to set the correct offset is the following:

1. Read on the display the value of analog channel that you want to calibrate;
2. Measure with a reference instrument the effective value;
3. Calculate the offset as 'effective value' - C2020 reading';
4. Set the correspondent offset parameter with the value calculated above.

The parameters from **I09** to **I14** set for each analog input the extreme points of their range:

1. The 4mA value is the lowest one of the range (at 4mA);
2. The 20mA value is the greatest one of the range (at 20mA).

For example, if the probe connected at IC1 analog channel has a range as: -5bar at 4mA and 10bar at 20mA, the parameters of this channel will be set so:

- **I09** 4mA VALUE FOR An-In IC1 = -5bar;
- **I10** 20mA VALUE FOR An-In IC1 = 10bar.

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4.17. Locked keypad

The parameters involved are:
- **M129** KEY LOCK ENABLE: pre-set= NO;
- **M191** PASSWORD USER SETUP: pre-set= 0

When **M129** is set to YES and no key is pressed for three minutes out of the menus or it's pressed the SET-ESC-SET keys in this order by 2 seconds from the starting of sequence, the keypad will be lock. To unlock the keypad it's necessary to press the SET-ESC-SET keys in this order by 2 seconds from the starting of sequence. After this sequence, if **M191** is different from zero it's necessary enter the USER password to unlock the keypad. After the key sequence, if **M191** is equal to zero, the keypad will immediately unlock. When the keypad is locked, any action on the keys has no effect. If the parameter **M129** is set to NO, it will be impossible to lock the keypad.

5. Alarms

Every alarm has an error message on the display. The alarm message is displayed on LCD alternatively (few seconds) with the standard display.
Press the ESC button for more than 5 seconds to reset the alarm with manual reset.

In the following table the alarm list is shown.

	Alarm	Reset	Unit switching off	Unit behaviour	Stand-by	Notes
A01.	High temperature	Automatic	No	No changes	Yes	DelayON fan
A02.	Low temperature	Automatic	No	No changes	Yes	DelayON fan
A03.	Max temperature	Automatic	No	No changes	Yes	DelayON fan
A04.	Antifreeze	Automatic	No	Stop compress	Yes	Immediate
A05.	Digital humidity	Automatic	No	No changes	Yes	Immediate
A06.	High humidity	Automatic	No	No changes	Yes	DelayON fan
A07.	Low humidity	Automatic	No	No changes	Yes	DelayON fan
A08.	High pressure	Manual by attempts	No	Start Unit 2* Stop compress	Yes	DelayON compressor
A09.	Low pressure	Manual	No	Start Unit 2* Stop compress	Yes	DelayON compressor
A10.	Dirty filter	Manual	No	No changes	No	Only signal
A11.	Air flow	Manual	No	Start Unit 2* Stop compress	Yes	DelayON fan
A12.	Overload Heaters	Manual	No	Off heaters	Yes	Immediate
A13.	Overload Compressor	Manual	No	Start Unit 2* Stop compress	Yes	Immediate
A14.	Overload evaporator fan	Manual	No	Start Unit 2* Stop compress	Yes	Immediate
A15.	Overload condenser fan	Manual	No	Start Unit 2* Stop evap fan	Yes	Immediate
A16.	Sensor broken	Automatic	No	See below	No	Immediate
A17.	Fire smoke	Manual	Yes	Unit Off	No	Immediate
A18.	Power failure	Automatic	No	Off comp / resist	No	Immediate
A19.	Lan Failure	Automatic	No	No changes	Yes	Immediate
A20.	Intrusion	Manual	Yes	Unit Off	No	Delay by user
A21.	Voltage out of range	Automatic	No	Stop compress. Off heaters	No	Delay by user
A22.	Evaporator fan blocked	Manual	No	Stop compress. Stop evap fan	Yes	Immediate
A23.	External enable	Automatic	No	Stop compress	Yes	Immediate
A24.	Bad working	Manual	No	Stop compress	Yes	DelayON compressor

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A25.	Freecooling (Custom 1 and 23)	Automatic	No	No changes	No	Immediate
A26.	Level (Custom 3 and Custom 4)	Automatic	No	Stop compress	Yes	Immediate
A27.	Tm out of range	Automatic	No	No changes	No	DelayON compressor

Unit management in case of sensor failure:

Alarm	Action
Internal humidity probe broken	Stop dehumidification
External humidity probe broken	Stop freecooling (if enthalpic control on)
Internal temperature probe broken	Both units switched off
External temperature probe broken	Stop freecooling
Discharge air temperature broken	No changes (anti-freezing alarm disabled)
Condenser temp or pressure probe unit	If T ext>15°C, condenser fan speed at 100%, If T ext<15°C, unit switched off

Alarm codes shown on EO3 user:

Alarm	Code
MAX TEMPERATURE	NT
HIGH TEMPERATURE	HT
LOW TEMPERATURE	LT
ANTIFREEZE	AF
LOW HUMIDITY	LH
HIGH HUMIDITY	HH
LOW PRESSURE	LP
HIGH PRESSURE	HP
AIR FLOW	FL
FIRE - SMOKE	SF
INTR. - VIBRATION	INT
POWER FAILURE	PF
VOLTAGE OUT OF RANGE	PS
DIRTY FILTER	DF
COMPRESSOR THERMIC	CTH
HEATER THERMIC	HTH
EVAPORATOR. FAN THERMIC	ETH
CONDENSER FAN THERMIC	FTH
LAN FAILURE	LF
EVAP. FAN1 BLOCKED	EF1
EVAP. FAN2 BLOCKED	EF2
EVAP. FAN3 BLOCKED	EF3
EXT. ENABLE ABSENT	EEA
BAD WORKING	EA
FREE COOLING	FC
HUMIDITY SWITCH	HS
LEVEL	LE
BROKEN PROBE CH.IC1	IC1

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BROKEN PROBE CH.IC2	IC2
BROKEN PROBE CH.IC3	IC3
BROKEN PROBE CH. T1	T1
BROKEN PROBE CH. T2	T2
BROKEN PROBE CH. T3	T3
BROKEN PROBE CH. T4	T4
DIRTY FILTER 2	DF2
TM OUT OF RANGE	ST
BROKEN AIR CONDITION 1	AC1
BROKEN AIR CONDITION 2	AC2
BROKEN AIR CONDITION	AC
WRONG PHASE	PH
DANFOSS COMPRESSOR COMMUNICATION ERROR	EBC
VOLTAGE OUT OF RANGE	POR
TRIP LOCK	TL
DRIVE TEMPERATURE HIGH STATUS	DTS
DISCHARGE TEMPERATURE HIGH STATUS	DHS
SUCTION PRESSURE LOW STATUS	SPL
CONDENSER PRESSURE LOW STATUS	CPL
CONDENSER PRESSURE HIGH STATUS	CPH
OUTPUT POWER LIMIT STATUS	OPL
EEV IN FAILURE	EIF
AMBIENT TEMPERATURE INVALID	ATI
SUCTION PRESSURE INVALID	SPI
CONDENSER PRESSURE INVALID	CPI
PERIPHERALS ERROR	PE
OUT OF ENVELOPE	OE
OVER CURRENT	OC
OVER VOLTAGE	OS
DRIVE TEMPERATURE HIGH	DTA
SUPPLY VOLTAGE LOW	SL
DISCHARGE TEMPERATURE HIGH	DHA
DISCHARGE TEMPERATURE INVALID	DTI
INTERNAL ERROR	IE
PLC COMMUNICATION ERROR	PLC
HOURS OF OPERATING OF FANS	HOF
RUNTIME ERROR	RE
THERMOSTAT HIGH TEMPERATURE	THT
CONDENSER PRESSURE	CP
ALARM ACTIVE	AA
FAN 1 ERROR	F1E
FAN 2 ERROR	F2E
FAN 3 ERROR	F3E
FC STOP BY WIND	FSI
FC STOP BY FIRE	FSF

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In the next table the alarms are listed with the conditions to enable and disable them.

Displayed alarm	Select relay	Enable	Disable	Delay	Notes
High temperature	**I32**	TI > **S11**	TI < **S11** – **S12**	**S17, M21**(delay on 1st start)	
Low temperature	**I31**	TI < **S09**	TI > **S09** + **S10**	**S17, M21**(delay on 1st start)	
Max temperature	**I33**	TI > **S13**	TI < **S13** – **S14**	**S17, M21**(delay on 1st start)	**M 4 8** = Yes Emergency mode
Antifreeze	**I34**	TE < 3°C	TE > 3°C for 180s		
Digital humidity	**I37**				
High humidity	**I36**	IRH > **S16**	IRH < **S16** – 5%	**S17**,**M21**(delay on 1st start)	
Low humidity	**I35**	IRH < **S15**	IRH > **S15** + 5%	**S17**,**M21**(delay on 1st start)	
High pressure	**I39**	A10 DIG-IN enabled	A10 DIG-IN disabled	**M23** from compressor start	**M158** enables compressor
Low pressure	**I38**	A13 DIG-IN enabled	A13 DIG-IN disabled	**M22** from compressor start	**M158** enables compressor
Dirty filter	**I45**	A11 DIG-IN enabled	A11 DIG-IN disabled		
Air flow	**I40**	Units with AC evap fans A12 DIG-IN enabled	A12 DIG-IN disabled	**M25** from evaporator fan start	
Heater thermic	**I47**	A8 DIG-IN enabled	A8 DIG-IN disabled		
Compressor thermic	**I46**	A5 DIG-IN enabled	A5 DIG-IN disabled		
Evaporator fan thermic	**I48**	A7 DIG-IN enabled	A7 DIG-IN disabled		
Condenser fan thermic	**I49**	A6 DIG-IN enabled	A6 DIG-IN disabled		
Broken probe ch. xxx	**I56** (IC1) **I57** (IC2) **I58** (IC3) **I59** (T1) **I60** (T2) **I61** (T3) **I62** (T4)	Analogue signal outside the admitted range	Analogue signal within the admitted range		
Fire smoke	**I41**	A1 DIG-IN enabled	A1 DIG-IN disabled		
Power failure	**I43**	AC power absent	AC power present	**M26**	
LAN Failure	**I50**	Lack of communication between master and all its slaves	Communication between two or more units is present		
Intrusion	**I42**	A3 DIG-IN enabled	A3 DIG-IN disabled	**S18**	
Voltage out of range	**I44**	A9 DIG-IN enabled	A9 DIG-IN disabled for **M28** sec	**M27**	
Evaporator fan x blocked	**I51**(Fan 1) **I52**(Fan 2) **I53**(Fan 3)	Speed fan x > **M85** and actual speed = 0 for more than one minute	Speed signal to fan x < **M85** or actual speed > 0	60 s	
External enable	**I54**	A4 DIG-IN disabled	A4 DIG-IN enabled		
Bad working	**I55**	TI-TE < **M29**	**M29** = 0		
Freecooling (Custom 1 and 23)	**I69**	(TI>12) and (TM–TI>2)		5 s	
Level (Custom 3 and Custom 4)	**I70**	Level of condensed water is too high.			
Tm out of range	**I68**	TM<**M130** or TM>**M131**		150 s from compressor start	

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6. Supervision by

The parameters involved are:
- **M08** REMOTE ASSISTANCE ADDRESS: pre-set = 1;
- **M09** SERIAL PROTOCOL: pre-set = 0;
- **M12** Address assigned to SPI connector 0=PEMS, 1=STULZ, 2=MODBUS STULZ, 4=MODBUS STANDARD: pre-set= 1
- **M13** Serial protocol SPI connector: pre-set= PEMS

The C2020 controller can communicate, through the PRG serial port or/and through WIB1000 connected to the SPI connector, with the software installed on host computer which displays the setup parameters, the controller states and alarms. The parameter **M09** (**M13**) selects which protocol manages the communication: 0=PEMS, 1=STULZ, 2=MODBUS STULZ, 3=SAIA-BUS, 4=MODBUS STANDARD. Note that after any change the controller must be restarted

To allow the connection of a C2020 controller to the RS485 serial line, the serial 485 adapter (IS485, Stulz accessory ACTSERC1010) is required.

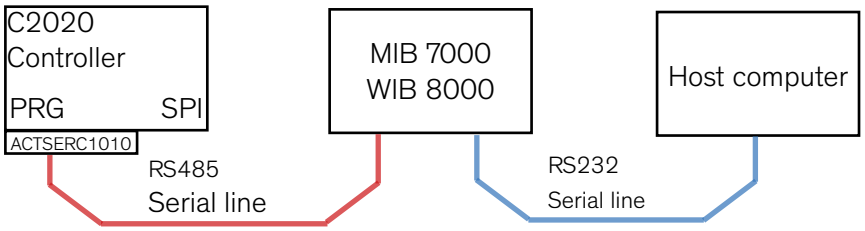
6.1. PEMS Protocol (PE)

In case of PEMS PROTOCOL, the parameter **M09** must be = 0.

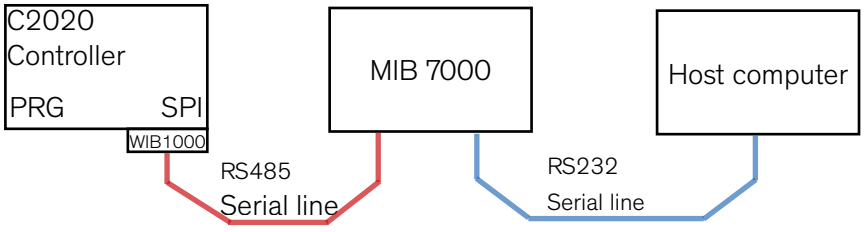
6.2. Stulz Protocol

In case of STULZ PROTOCOL, the parameter **M09** must be = 1.
There are two Stulz gateways: MIB, which manages the local communication according to the STULZ protocol specifications, and WIB, which manages internet communication
The following example shows how the gateways MIB7000 and WIB 8000 are connected via the serial PRG port or the WIB1000 via the SPI port.

Communication with PRG connector:



Communication with SPI connector:



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6.3. Modbus Stulz protocol

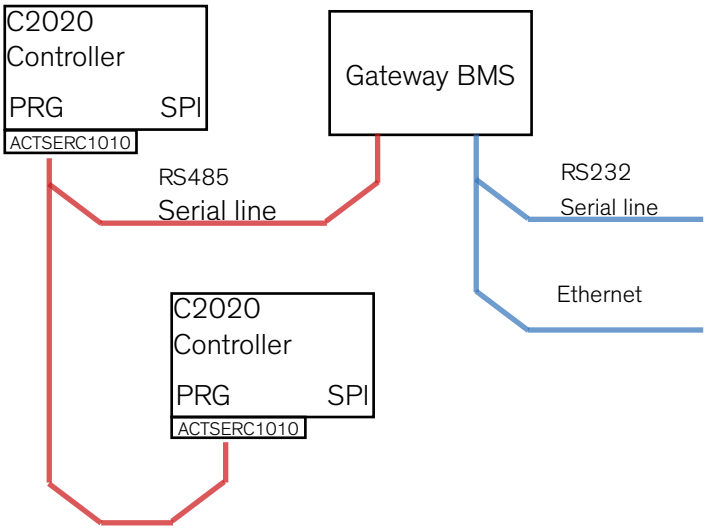
In case of MODBUS STULZ PROTOCOL, the parameter **M09** must be = 2.
In the system there is no gateway managing the communication.

There will be 2 kinds of connection in this system:

1. The connection between the RS485 serial port (named PRG) of two C2020 controllers;
2. The connection between the PRG port of a C2020 control board and the RS485 serial port of the host computer.

6.4. Modbus standard protocol

In case of MODBUS STANDARD, the parameter **M09** must be = 4.
In the example below in shown a gateway BMS which manages the communication according to the ModBus protocol specifications.



In the following table are shown the serial parameters for the ModBus communication.

Protocol:	MODBUS-RTU
Baud Rate:	9600
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow control	None

The controller doesn't support broadcast message.

In the following tables it's showed the relation between ModBus functions and the parameters of the application software. The measurement units are °C for temperature and bar for pressure.

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Read coil status (0×01)

With this function it's possible to read the state of the machine.
The state is shown by a bit: 0=OFF; 1=ON.
The ModBus address corresponds to number of the bit.

ModBus function 0×01: read coil status	ModBus address
MACHINE OFF	1
MACHINE ON	2
MANUAL TESTING	3
EMERGENCY	4
STANDBY	5
AUTOMATIC TESTING	6

Read input status (0×02)

With this function it's possible to read the alarms, input/output digital state.
The state is shown by a bit: 0=OFF; 1=ON.
The ModBus address corresponds to number of the bit.

ModBus function 0×02: read coil status	ModBus address
Digital input status	
DIG IN - A1	1
DIG IN - A2	2
DIG IN - A3	3
DIG IN - A4	4
DIG IN - A5	5
DIG IN - A6	6
DIG IN - A7	7
DIG IN - A8	8
DIG IN - A9	9
DIG IN - A10	10
DIG IN - A11	11
DIG IN - A12	12
DIG IN - A13	13
Alarms - First part	
MAX TEMPERATURE	14
HIGH TEMPERATURE	15
LOW TEMPERATURE	16
ANTIFREEZE	17
LOW HUMIDITY	18
HIGH HUMIDITY	19
LOW PRESSURE	20
HIGH PRESSURE	21
AIR FLOW	22
FIRE - SMOKE	23
INTRUSION - VIBRATION	24
POWER FAILURE	25
VOLTAGE OUT OF RANGE	26
DIRTY FILTER	27

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COMPRESSOR THERMIC	28
HEATER THERMIC	29
EVAPORATOR FAN THERMIC	30
CONDENSER FAN THERMIC	31
LAN FAILURE	32
EVAPORATOR FAN1 BLOCKED	33
EVAPORATOR FAN2 BLOCKED	34
EVAPORATOR FAN3 BLOCKED	35
EXTERNAL ENABLE ABSENT	36
BAD WORKING	37
FREE COOLING	38
HUMIDITY SWITCH	39
LEVEL	40
BROKEN PROBE CH. IC1	41
BROKEN PROBE CH. IC2	42
BROKEN PROBE CH. IC3	43
BROKEN PROBE CH. T1	44
BROKEN PROBE CH. T2	45
BROKEN PROBE CH. T3	46
BROKEN PROBE CH. T4	47
DIRTY FILTER 2	48
TM OUT OF RANGE	49
BROKEN AIR CONDITION 1	50
BROKEN AIR CONDITION 2	51
BROKEN AIR CONDITION	52
WRONG PHASE	53
Digital output state	
DIG OUT - R1	54
DIG OUT - R2	55
DIG OUT - R3	56
DIG OUT - R4	57
DIG OUT - R5	58
DIG OUT - R6	59
DIG OUT - R7	60
DIG OUT - R8	61
DIG OUT - R9	62
DIG OUT - R10	63
DIG OUT - R11	64
DIG OUT - R12	65
DIG OUT - R13	66
Alarm - Second part	
DANFOSS COMPRESSOR COMMUNICATION ERROR	67
VOLTAGE OUT OF RANGE	68
TRIP LOCK	69
DRIVE TEMPERATURE HIGH STATUS	70
DISCHARGE TEMPERATURE HIGH STATUS	71

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SUCTION PRESSURE LOW STATUS	72
CONDENSER PRESSURE LOW STATUS	73
CONDENSER PRESSURE HIGH STATUS	74
OUTPUT POWER LIMIT STATUS	75
EEV IN FAILURE	76
AMBIENT TEMPERATURE INVALID	77
SUCTION PRESSURE INVALID	78
CONDENSER PRESSURE INVALID	79
PERIPHERALS ERROR	80
OUT OF ENVELOPE	81
OVER CURRENT	82
OVER VOLTAGE	83
DRIVE TEMPERATURE HIGH	84
SUPPLY VOLTAGE LOW	85
DISCHARGE TEMPERATURE HIGH	86
DISCHARGE TEMPERATURE INVALID	87
INTERNAL ERROR	88
PLC COMMUNICATION ERROR	90
HOURS OF OPERATING OF FANS	91
RUNTIME ERROR	92
THERMOSTAT HIGH TEMP	93
CONDENSER PRESSURE	94
ALARM ACTIVE	95
FAN 1 ERROR	96
FAN 2 ERROR	97
FAN 3 ERROR	98
FC STOP BY WIND	99
FC STOP BY FIRE	100
EVAPORATOR FAN 1 BROKEN	101
EVAPORATOR FAN 2 BROKEN	102
INVERTER	103
EEV DRIVER	104
WATER FLOW	105
Internal use	106
Internal use	107
Internal use	108

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Read holding registers (0×03) and Write single register (0×06)

With the command Read Holding Registers (command code 0×03) it's possible to read the parameters listed below, while with the command Write Holding Registers (command code 0×06) it's possible to set these parameters. The ModBus addresses of the parameters are the same for the two commands. The value is sent by two bytes, the first one is the MSB.

ModBus function 0×03: read holding registers ModBus function 0×06: write single registers	ModBus address
(S001) Cooling set point	1
(S002) Second cooling set point	2
(S003) Heating set point	3
(S004) Second heater set point	4
(S005) Humidity set point	5
(S006) Cooling band	6
(S007) Heating band	7
(S008) Humidity band	8
(S009) Alarm limit low temperature	9
(S010) Hysteresis of low temperature alarm	10
(S011) Alarm limit high temperature	11
(S012) Hysteresis of high temperature alarm	12
(S013) Alarm limit max temperature	13
(S014) Hysteresis of max temperature alarm	14
(S015) Alarm limit low humidity	15
(S016) Alarm limit high humidity	16
(S017) Alarm delay (humidity - temperature)	17
(S018) Intrusion-vibration alarm delay	18
(S019) Limit supply temp in freecooling mode	19
(S020) Language selection	20
(S027) Password user	21
Serial number (low byte: character 1; high byte: character 2)	22
Serial number (low byte: character 3; high byte: character 4)	23
Serial number (low byte: character 5; high byte: character 6)	24
Serial number (low byte: character 7; high byte: character 8)	25
Serial number (low byte: character 9; high byte: character 10)	26
Serial number (low byte: character 11; high byte: character 12)	27
Serial number (low byte: character 13; high byte: character 14)	28
Serial number (low byte: character 15; high byte: character 16)	29
Serial number (low byte: character 17; high byte: character 18)	30
Serial number (low byte: character 19; high byte: character 20)	31
Hours of evaporator fan activity or hours of fan activity for custom 13 and 16 (low bytes)	32
Hours of evaporator fan activity or hours of fan activity for custom 13 and 16 (high bytes)	33
Hours of condenser fan activity or hours of conditioner 1 activity for custom 13 and 16 (low bytes)	34
Hours of condenser fan activity or hours of conditioner 1 activity for custom 13 and 16 (high bytes)	35
Hours of compressor activity or hours of conditioner 2 activity for custom 13 and 16 (low bytes)	36
Hours of compressor activity or hours of conditioner 2 activity for custom 13 and 16 (high bytes)	37
Hours of freecooling activity (low bytes)	38
Hours of freecooling activity (high bytes)	39
Alarm 1/50 - Alarm index (*) (latest alarm)	40

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Alarm 1/50 - Year	41
Alarm 1/50 - Day (low byte) and month (high byte)	42
Alarm 1/50 -Minute (low byte) and hour (high byte)	43
Alarm 2/50 - Alarm index (*)	44
Alarm 2/50 - Year	45
Alarm 2/50 - Day (low byte) and month (high byte)	46
Alarm 2/50 -Minute (low byte) and hour (high byte)	47
Alarm 3/50 - Alarm index (*)	48
Alarm 3/50 - Year	49
Alarm 3/50 - Day (low byte) and month (high byte)	50
Alarm 3/50 -Minute (low byte) and hour (high byte)	51
Alarm 4/50 - Alarm index (*)	52
Alarm 4/50 - Year	53
Alarm 4/50 - Day (low byte) and month (high byte)	54
Alarm 4/50 -Minute (low byte) and hour (high byte)	55
Alarm 5/50 - Alarm index (*)	56
Alarm 5/50 - Year	57
Alarm 5/50 - Day (low byte) and month (high byte)	58
Alarm 5/50 -Minute (low byte) and hour (high byte)	59
Alarm 6/50 - Alarm index (*)	60
Alarm 6/50 - Year	61
Alarm 6/50 - Day (low byte) and month (high byte)	62
Alarm 6/50 -Minute (low byte) and hour (high byte)	63
Alarm 7/50 - Alarm index (*)	64
Alarm 7/50 - Year	65
Alarm 7/50 - Day (low byte) and month (high byte)	66
Alarm 7/50 -Minute (low byte) and hour (high byte)	67
Alarm 8/50 - Alarm index (*)	68
Alarm 8/50 - Year	69
Alarm 8/50 - Day (low byte) and month (high byte)	70
Alarm 8/50 -Minute (low byte) and hour (high byte)	71
Alarm 9/50 - Alarm index (*)	72
Alarm 9/50 - Year	73
Alarm 9/50 - Day (low byte) and month (high byte)	74
Alarm 9/50 -Minute (low byte) and hour (high byte)	75
Alarm 10/50 - Alarm index (*)	76
Alarm 10/50 - Year	77
Alarm 10/50 - Day (low byte) and month (high byte)	78
Alarm 10/50 -Minute (low byte) and hour (high byte)	79
Alarm 11/50 - Alarm index (*)	80
Alarm 11/50 - Year	81
Alarm 11/50 - Day (low byte) and month (high byte)	82
Alarm 11/50 -Minute (low byte) and hour (high byte)	83
Alarm 12/50 - Alarm index (*)	84
Alarm 12/50 - Year	85
Alarm 12/50 - Day (low byte) and month (high byte)	86

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Alarm 12/50 -Minute (low byte) and hour (high byte)	87
Alarm 13/50 - Alarm index (*)	88
Alarm 13/50 - Year	89
Alarm 13/50 - Day (low byte) and month (high byte)	90
Alarm 13/50 -Minute (low byte) and hour (high byte)	91
Alarm 14/50 - Alarm index (*)	92
Alarm 14/50 - Year	93
Alarm 14/50 - Day (low byte) and month (high byte)	94
Alarm 14/50 -Minute (low byte) and hour (high byte)	95
Alarm 15/50 - Alarm index (*)	96
Alarm 15/50 - Year	97
Alarm 15/50 - Day (low byte) and month (high byte)	98
Alarm 15/50 -Minute (low byte) and hour (high byte)	99
Alarm 16/50 - Alarm index (*)	100
Alarm 16/50 - Year	101
Alarm 16/50 - Day (low byte) and month (high byte)	102
Alarm 16/50 -Minute (low byte) and hour (high byte)	103
Alarm 17/50 - Alarm index (*)	104
Alarm 17/50 - Year	105
Alarm 17/50 - Day (low byte) and month (high byte)	106
Alarm 17/50 -Minute (low byte) and hour (high byte)	107
Alarm 18/50 - Alarm index (*)	108
Alarm 18/50 - Year	109
Alarm 18/50 - Day (low byte) and month (high byte)	110
Alarm 18/50 -Minute (low byte) and hour (high byte)	111
Alarm 19/50 - Alarm index (*)	112
Alarm 19/50 - Year	113
Alarm 19/50 - Day (low byte) and month (high byte)	114
Alarm 19/50 -Minute (low byte) and hour (high byte)	115
Alarm 20/50 - Alarm index (*)	116
Alarm 20/50 - Year	117
Alarm 20/50 - Day (low byte) and month (high byte)	118
Alarm 20/50 -Minute (low byte) and hour (high byte)	119
Alarm 21/50 - Alarm index (*)	120
Alarm 21/50 - Year	121
Alarm 21/50 - Day (low byte) and month (high byte)	122
Alarm 21/50 -Minute (low byte) and hour (high byte)	123
Alarm 22/50 - Alarm index (*)	124
Alarm 22/50 - Year	125
Alarm 22/50 - Day (low byte) and month (high byte)	126
Alarm 22/50 -Minute (low byte) and hour (high byte)	127
Alarm 23/50 - Alarm index (*)	128
Alarm 23/50 - Year	129
Alarm 23/50 - Day (low byte) and month (high byte)	130
Alarm 23/50 -Minute (low byte) and hour (high byte)	131
Alarm 24/50 - Alarm index (*)	132

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Alarm 24/50 - Year	133
Alarm 24/50 - Day (low byte) and month (high byte)	134
Alarm 24/50 -Minute (low byte) and hour (high byte)	135
Alarm 25/50 - Alarm index (*)	136
Alarm 25/50 - Year	137
Alarm 25/50 - Day (low byte) and month (high byte)	138
Alarm 25/50 -Minute (low byte) and hour (high byte)	139
Alarm 26/50 - Alarm index (*)	140
Alarm 26/50 - Year	141
Alarm 26/50 - Day (low byte) and month (high byte)	142
Alarm 26/50 -Minute (low byte) and hour (high byte)	143
Alarm 27/50 - Alarm index (*)	144
Alarm 27/50 - Year	145
Alarm 27/50 - Day (low byte) and month (high byte)	146
Alarm 27/50 -Minute (low byte) and hour (high byte)	147
Alarm 28/50 - Alarm index (*)	148
Alarm 28/50 - Year	149
Alarm 28/50 - Day (low byte) and month (high byte)	150
Alarm 28/50 -Minute (low byte) and hour (high byte)	151
Alarm 29/50 - Alarm index (*)	152
Alarm 29/50 - Year	153
Alarm 29/50 - Day (low byte) and month (high byte)	154
Alarm 29/50 -Minute (low byte) and hour (high byte)	155
Alarm 30/50 - Alarm index (*)	156
Alarm 30/50 - Year	157
Alarm 30/50 - Day (low byte) and month (high byte)	158
Alarm 30/50 -Minute (low byte) and hour (high byte)	159
Alarm 31/50 - Alarm index (*)	160
Alarm 31/50 - Year	161
Alarm 31/50 - Day (low byte) and month (high byte)	162
Alarm 31/50 -Minute (low byte) and hour (high byte)	163
Alarm 32/50 - Alarm index (*)	164
Alarm 32/50 - Year	165
Alarm 32/50 - Day (low byte) and month (high byte)	166
Alarm 32/50 -Minute (low byte) and hour (high byte)	167
Alarm 33/50 - Alarm index (*)	168
Alarm 33/50 - Year	169
Alarm 33/50 - Day (low byte) and month (high byte)	170
Alarm 33/50 -Minute (low byte) and hour (high byte)	171
Alarm 34/50 - Alarm index (*)	172
Alarm 34/50 - Year	173
Alarm 34/50 - Day (low byte) and month (high byte)	174
Alarm 34/50 -Minute (low byte) and hour (high byte)	175
Alarm 35/50 - Alarm index (*)	176
Alarm 35/50 - Year	177
Alarm 35/50 - Day (low byte) and month (high byte)	178

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Alarm 35/50 -Minute (low byte) and hour (high byte)	179
Alarm 36/50 - Alarm index (*)	180
Alarm 36/50 - Year	181
Alarm 36/50 - Day (low byte) and month (high byte)	182
Alarm 36/50 -Minute (low byte) and hour (high byte)	183
Alarm 37/50 - Alarm index (*)	184
Alarm 37/50 - Year	185
Alarm 37/50 - Day (low byte) and month (high byte)	186
Alarm 37/50 -Minute (low byte) and hour (high byte)	187
Alarm 38/50 - Alarm index (*)	188
Alarm 38/50 - Year	189
Alarm 38/50 - Day (low byte) and month (high byte)	190
Alarm 38/50 -Minute (low byte) and hour (high byte)	191
Alarm 39/50 - Alarm index (*)	192
Alarm 39/50 - Year	193
Alarm 39/50 - Day (low byte) and month (high byte)	194
Alarm 39/50 -Minute (low byte) and hour (high byte)	195
Alarm 40/50 - Alarm index (*)	196
Alarm 40/50 - Year	197
Alarm 40/50 - Day (low byte) and month (high byte)	198
Alarm 40/50 -Minute (low byte) and hour (high byte)	199
Alarm 41/50 - Alarm index (*)	200
Alarm 41/50 - Year	201
Alarm 41/50 - Day (low byte) and month (high byte)	202
Alarm 41/50 -Minute (low byte) and hour (high byte)	203
Alarm 42/50 - Alarm index (*)	204
Alarm 42/50 - Year	205
Alarm 42/50 - Day (low byte) and month (high byte)	206
Alarm 42/50 -Minute (low byte) and hour (high byte)	207
Alarm 43/50 - Alarm index (*)	208
Alarm 43/50 - Year	209
Alarm 43/50 - Day (low byte) and month (high byte)	210
Alarm 43/50 -Minute (low byte) and hour (high byte)	211
Alarm 44/50 - Alarm index (*)	212
Alarm 44/50 - Year	213
Alarm 44/50 - Day (low byte) and month (high byte)	214
Alarm 44/50 -Minute (low byte) and hour (high byte)	215
Alarm 45/50 - Alarm index (*)	216
Alarm 45/50 - Year	217
Alarm 45/50 - Day (low byte) and month (high byte)	218
Alarm 45/50 -Minute (low byte) and hour (high byte)	219
Alarm 46/50 - Alarm index (*)	220
Alarm 46/50 - Year	221
Alarm 46/50 - Day (low byte) and month (high byte)	222
Alarm 46/50 -Minute (low byte) and hour (high byte)	223
Alarm 47/50 - Alarm index (*)	224

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Alarm 47/50 - Year	225
Alarm 47/50 - Day (low byte) and month (high byte)	226
Alarm 47/50 -Minute (low byte) and hour (high byte)	227
Alarm 48/50 - Alarm index (*)	228
Alarm 48/50 - Year	229
Alarm 48/50 - Day (low byte) and month (high byte)	230
Alarm 48/50 -Minute (low byte) and hour (high byte)	231
Alarm 49/50 - Alarm index (*)	232
Alarm 49/50 - Year	233
Alarm 49/50 - Day (low byte) and month (high byte)	234
Alarm 49/50 -Minute (low byte) and hour (high byte)	235
Alarm 50/50 - Alarm index (*) (oldest alarm)	236
Alarm 50/50 - Year	237
Alarm 50/50 - Day (low byte) and month (high byte)	238
Alarm 50/50 -Minute (low byte) and hour (high byte)	239

NOTE: (*) See the table below:

ALARM	INDEX
MAX TEMPERATURE	0
HIGH TEMPERATURE	1
LOW TEMPERATURE	2
ANTIFREEZE	3
LOW HUMIDITY	4
HIGH HUMIDITY	5
LOW PRESSURE	6
HIGH PRESSURE	7
AIR FLOW	8
FIRE - SMOKE	9
INTR. - VIBRATION	10
POWER FAILURE	11
VOLTAGE OUT OF RANGE	12
DIRTY FILTER	13
COMPRESSOR THERMIC	14
HEATER THERMIC	15
EVAPORATOR FAN THERMIC	16
CONDENSER FAN THERMIC	17
LAN FAILURE	18
EVAP. FAN1 BLOCKED	19
EVAP. FAN2 BLOCKED	20
EVAP. FAN3 BLOCKED	21
EXT. ENABLE ABSENT	22
BAD WORKING	23
FREE COOLING	24
HUMIDITY SWITCH	25
LEVEL	27
BROKEN PROBE CH.IC1	28

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BROKEN PROBE CH.IC2	29
BROKEN PROBE CH.IC3	30
BROKEN PROBE CH. T1	31
BROKEN PROBE CH. T2	32
BROKEN PROBE CH. T3	33
BROKEN PROBE CH. T4	34
DIRTY FILTER 2	36
TM OUT OF RANGE	37
BROKEN AIR CONDITION 1	38
BROKEN AIR CONDITION 2	39
BROKEN AIR CONDITION	40
WRONG PHASE	41
DANFOSS COMPRESSOR COMMUNICATION ERROR	42
VOLTAGE OUT OF RANGE	43
TRIP LOCK	44
DRIVE TEMPERATURE HIGH STATUS	45
DISCHARGE TEMPERATURE HIGH STATUS	46
SUCTION PRESSURE LOW STATUS	47
CONDENSER PRESSURE LOW STATUS	48
CONDENSER PRESSURE HIGH STATUS	49
OUTPUT POWER LIMIT STATUS	50
EEV IN FAILURE	51
AMBIENT TEMPERATURE INVALID	52
SUCTION PRESSURE INVALID	53
CONDENSER PRESSURE INVALID	54
PERIPHERALS ERROR	55
OUT OF ENVELOPE	56
OVER CURRENT	57
OVER VOLTAGE	58
DRIVE TEMPERATURE HIGH	59
SUPPLY VOLTAGE LOW	60
DISCHARGE TEMPERATURE HIGH	61
DISCHARGE TEMPERATURE INVALID	62
INTERNAL ERROR	63
PLC COMMUNICATION ERROR	64
HOURS OF OPERATING OF FANS	65
RUNTIME ERROR	66
THERMOSTAT HIGH TEMP	67
CONDENSER PRESSURE	68
ALARM ACTIVE	69
FAN 1 ERROR	70
FAN 2 ERROR	71
FAN 3 ERROR	72
FC STOP BY WIND	73
FC STOP BY FIRE	74

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Read input registers (0×04)

With this function it's possible to read the value of the input/output analog channels.
The value is sent by two bytes, the first one is the MSB.
All the values are multiplied by 10. To get the real value it is necessary dividing by 10. For example, if the value of the parameter at address 1 is 115, the real value will be 11.5.

ModBus function 0×04: read input registers	ModBus address
Analog Inputs	
Internal relative humidity (IRH)	1
Pressure of condenser (PC)	2
External relative humidity (ERH)	3
Temperature of evaporator (TE)	4
Temperature of condenser (TC)	5
Internal temperature (TI)	6
External temperature (TAE)	7
Delivery air temperature (TM)	8
Delivery air temperature of comfort unit 1 (TM1) - Custom 13	9
Delivery air temperature of comfort unit 2 (TM2) - Custom 13	10
Internal temperature 1 (TI1) - Custom 9	11
Internal temperature 2 (TI2) - Custom 9	12
Analog Outputs	
FREECOOLING (%)	13
HUMIDIFIER (%)	14
FAN DC1 (%)	15
FAN DC2 (%)	16
FAN DC3 (%)	17
FAN AC (%)	18

Force single coil (0×05)

With this function it's possible to set the state of the machine, for example switching on/off the machine or reset the alarm. The ModBus address corresponds to the number of the bit.

ModBus function 0×01: read coil status	ModBus address
Switching off machine	1
Switching on machine	2
Reset alarms	3
Reset hours of evaporator fan activity or hours of fan activity for custom 13 and 16	4
Reset hours of condenser fan activity or hours of conditioner 1 activity for custom 13 and 16	5
Reset hours of compressor activity or hours of conditioner 2 activity for custom 13 and 16	6
Reset hours of freecooling activity	7

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ModBus error messages
If the board receives a fault request, it will send an error message.
Some causes are:
- Noise on serial line
- Request of not present data
- Request at an fault serial address, in this case the board will not answer
- Command code not existent
- Bad checksum, in this case the board will not answer

"Address field " in the error message
In the error message the address field is the same of the request.

Function code in the error message
The function code is get, setting to 1 the most significative bit of the function code in the request.

For example:
Function code in the request: 0×01 (read coil status)
Function code in the error messages: 0×81

Data in the error message
The data field is composed by 1 byte which shows the error code:

CODE	NAME	DESCRIPTION
01	ILLEGAL FUNCTION	The request function is not present
02	ILLEGAL DATA ADDRESS	The address of the request data is not present
03	ILLEGAL DATA VALUE	The value into the request is out of range or not possible
04	SLAVE DEVICE FAILURE	Typical for gateway: the slave board is not present because the address is fault

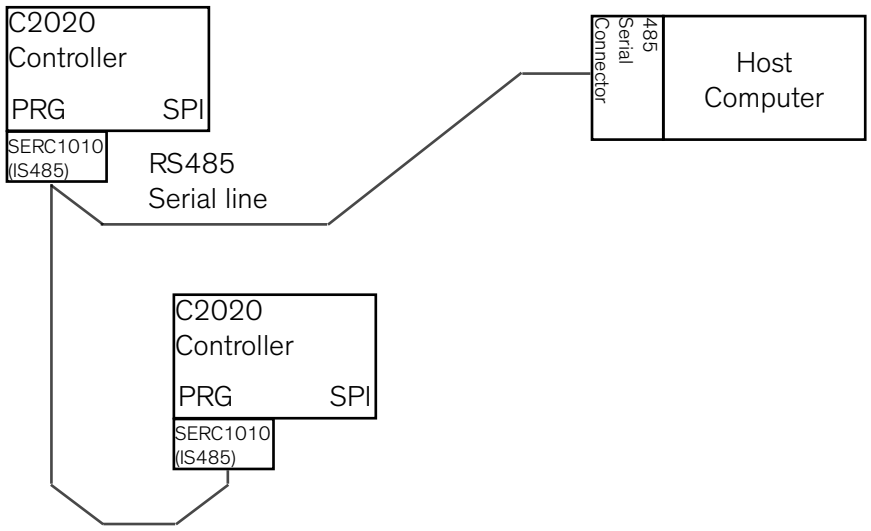
Checksum for error message
The checksum is composed by two bytes: the first one is the LSB and the second one is the MSB.
The computation method of the checksum is the CRC16 (Cyclical Redundancy Checking).

6.5. SAIA-BUS Protocol

The parameters to be considered are:
- **M10** SELECT SERIAL SPEED 0=9.6, 1=19.2, 2=38.4: pre-set = 0;
- **M11** SELECT SAIA-BUS MODE 0=DATA, 1=PARITY: pre-set = 0;

In case of SAIA-BUS PROTOCOL, the parameter **M09** it must be = 4.
By the parameter **M10** it's possible to select the baud rate for the serial port.
Saia-Bus protocol has two modes to communicate and the parameter **M11** selects which mode.
In the system there isn't gateway to manage the communication, as shown in the figure below.

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6.6. SNMP Communication

In the case of SNMP communication, the parameter **M09** selects PEMS to manage the communication.
Using WIB1000, it's possible a SNMP monitoring.
Following the relative data point.

Analog inputs (SNMP address= 1)
All the values are multiplied by 10. For example the value 102 is 10.2.

AN-IN	SNMP Address	Trap message
Internal relative humidity (IRH)	1	No
Pressure of condenser (PC)	2	No
External relative humidity (ERH)	3	No
Temperature of evaporator (TE)	4	No
Temperature of condenser (TC)	5	No
Internal temperature (TI)	6	No
External temperature (TAE)	7	No
Delivery air temperature (TM)	8	No
Delivery air temperature of comfort unit 1 (TM1) - Custom 13	9	No
Delivery air temperature of comfort unit 2 (TM2) - Custom 13	10	No
Internal temperature 1 (TI1) - Custom 9	11	No
Internal temperature 2 (TI2) - Custom 9	12	No

Analog outputs (SNMP address= 2)
All the values are multiplied by 10. For example the value 102 is 10.2.

AN-OUT	SNMP Address	Trap message
FREECOOLING (%)	1	No
HUMIDIFIER (%)	2	No
FAN DC1 (%)	3	No
FAN DC2 (%)	4	No
FAN DC3 (%)	5	No
FAN AC (%)	6	No

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Digital inputs (SNMP address= 3)

DIG-IN	SNMP Address	Trap message
DIG IN - A1	1	No
DIG IN - A2	2	No
DIG IN - A3	3	No
DIG IN - A4	4	No
DIG IN - A5	5	No
DIG IN - A6	6	No
DIG IN - A7	7	No
DIG IN - A8	8	No
DIG IN - A9	9	No
DIG IN - A10	10	No
DIG IN - A11	11	No
DIG IN - A12	12	No
DIG IN - A13	13	No

Digital outputs (SNMP address= 4)

DIG-OUT	SNMP Address	Trap message
DIG – OUT R1	1	No
DIG – OUT R2	2	No
DIG – OUT R3	3	No
DIG – OUT R4	4	No
DIG – OUT R5	5	No
DIG – OUT R6	6	No
DIG – OUT R7	7	No
DIG – OUT R8	8	No
DIG – OUT R9	9	No
DIG – OUT R10	10	No
DIG – OUT R11	11	No
DIG – OUT R12	12	No
DIG – OUT R13	13	No

Parameters (SNMP address= 5)

(*): It means that the value is multiplied by 10. For example the value 102 is 10.2.

Parameter	SNMP Address	Trap message
(S001) Cooling set point	1	No
(S002) Second cooling set point	2	No
(S003) Heating set point	3	No
(S004) Second heater set point	4	No
(S005) Humidity set point	5	No
(S006) Cooling band	6	No
(S007) Heating band	7	No
(S008) Humidity band	8	No
(S009) Alarm limit low temperature	9	No
(S010) Hysteresis of low temperature alarm	10	No
(S011) Alarm limit high temperature	11	No
(S012) Hysteresis of high temperature alarm	12	No

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(S013) Alarm limit max temperature	13	No
(S014) Hysteresis of max temperature alarm	14	No
(S015) Alarm limit low humidity	15	No
(S016) Alarm limit high humidity	16	No
(S017) Alarm delay (humidity - temperature)	17	No
(S018) Intrusion-vibration alarm delay	18	No
(S019) Limit supply temp in freecooling mode	19	No
(S020) Language selection	20	No
(S027) Password user	21	No

States (SNMP address= 6)

If the value is equal to 1, it means that the state is active.

State	SNMP Address	Trap message
Machine OFF	1	No
Machine ON	2	No
Manual testing	3	No
Machine in EMERGENCY	4	No
Machine in STANDBY	5	No
Automatic testing	6	No

Alarms (SNMP address= 7)

If the value is equal to 1, it means that the state is active.
The trap message will be sent when the alarm change its state.

Alarm	SNMP Address	Trap message
MAX TEMPERATURE	1	Yes
HIGH TEMPERATURE	2	Yes
LOW TEMPERATURE	3	Yes
ANTIFREEZE	4	Yes
LOW HUMIDITY	5	Yes
HIGH HUMIDITY	6	Yes
LOW PRESSURE	7	Yes
HIGH PRESSURE	8	Yes
AIR FLOW	9	Yes
FIRE - SMOKE	10	Yes
INTRUSION - VIBRATION	11	Yes
POWER FAILURE	12	Yes
VOLTAGE OUT OF RANGE	13	Yes
DIRTY FILTER	14	Yes
COMPRESSOR THERMIC	15	Yes
HEATER THERMIC	16	Yes
EVAPORATOR FAN THERMIC	17	Yes
CONDENSER FAN THERMIC	18	Yes
LAN FAILURE	19	Yes
EVAPORATOR FAN1 BLOCKED	20	Yes
EVAPORATOR FAN2 BLOCKED	21	Yes
EVAPORATOR FAN3 BLOCKED	22	Yes
EXTERNAL ENABLE ABSENT	23	Yes

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BAD WORKING	24	Yes
FREE COOLING	25	Yes
HUMIDITY SWITCH	26	Yes
LEVEL	27	Yes
BROKEN PROBE CH. IC1	28	Yes
BROKEN PROBE CH. IC2	29	Yes
BROKEN PROBE CH. IC3	30	Yes
BROKEN PROBE CH. T1	31	Yes
BROKEN PROBE CH. T2	32	Yes
BROKEN PROBE CH. T3	33	Yes
BROKEN PROBE CH. T4	34	Yes
DIRTY FILTER 2	35	Yes
TM OUT OF RANGE	36	Yes
BROKEN AIR CONDITION 1	37	Yes
BROKEN AIR CONDITION 2	38	Yes
BROKEN AIR CONDITION	39	Yes
WRONG PHASE	40	Yes
DANFOSS COMPRESSOR COMMUNICATION ERROR	41	Yes
VOLTAGE OUT OF RANGE	42	Yes
TRIP LOCK	43	Yes
DRIVE TEMPERATURE HIGH STATUS	44	Yes
DISCHARGE TEMPERATURE HIGH STATUS	45	Yes
SUCTION PRESSURE LOW STATUS	46	Yes
CONDENSER PRESSURE LOW STATUS	47	Yes
CONDENSER PRESSURE HIGH STATUS	48	Yes
OUTPUT POWER LIMIT STATUS	49	Yes
EEV IN FAILURE	50	Yes
AMBIENT TEMPERATURE INVALID	51	Yes
SUCTION PRESSURE INVALID	52	Yes
CONDENSER PRESSURE INVALID	53	Yes
PERIPHERALS ERROR	54	Yes
OUT OF ENVELOPE	55	Yes
OVER CURRENT	56	Yes
OVER VOLTAGE	57	Yes
DRIVE TEMPERATURE HIGH	58	Yes
SUPPLY VOLTAGE LOW	59	Yes
DISCHARGE TEMPERATURE HIGH	60	Yes
DISCHARGE TEMPERATURE INVALID	61	Yes
INTERNAL ERROR	62	Yes
PLC COMMUNICATION ERROR	63	Yes
HOURS OF OPERATING OF FANS	64	Yes
RUNTIME ERROR	65	Yes
THERMOSTAT HIGH TEMP	66	Yes
CONDENSER PRESSURE	67	Yes
ALARM ACTIVE	68	Yes
FAN 1 ERROR	69	Yes
FAN 2 ERROR	70	Yes
FAN 3 ERROR	71	Yes
FC STOP BY WIND	72	Yes

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FC STOP BY FIRE	73	Yes
EVAPORATOR FAN 1 BROKEN	74	Yes
EVAPORATOR FAN 2 BROKEN	75	Yes
INVERTER (using STUSNP07.00 and following)	76	Yes
EEV DRIVER (using STUSNP07.00 and following)	77	Yes
WATER FLOW (using STUSNP07.00 and following)	78	Yes
INTERNAL USE 1 (using STUSNP07.00 and following)	79	Yes
INTERNAL USE 2 (using STUSNP07.00 and following)	80	Yes
INTERNAL USE 3 (using STUSNP07.00 and following)	81	Yes

Commands (SNMP address= 8)
These objects are only writeable.

Command	SNMP Address	Trap message
ON/OFF command. Setting this object and the machine is OFF, the machine will be switched on. Setting this object and the machine is ON, the machine will be switched off	1	No
Reset alarms	2	No

6.7. WEB Monitoring

Using the WIB1000 it's possible an HTTP monitoring.
Following the relative data point.

Window 2.a (INFO→value)
There will be shown:

Internal relative humidity (IRH)
Pressure of condenser (PC)
External relative humidity (ERH)
Temperature of evaporator (TE)
Temperature of condenser (TC)
Internal temperature (TI)
External temperature (TAE)
Delivery air temperature (TM)
Delivery air temperature of comfort unit 1 (TM1) - Custom 13
Delivery air temperature of comfort unit 2 (TM2) - Custom 13
Internal temperature 1 (TI1) - Custom 9
Internal temperature 2 (TI2) - Custom 9
FREECOOLING (%)
HUMIDIFIER (%)
FAN DC1 (%)
FAN DC2 (%)
FAN DC3 (%)
FAN AC (%)
(S001) Cooling set point
(S002) Second cooling set point
(S003) Heating set point
(S004) Second heater set point

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(S005) Humidity set point

State of the machine

Window 2.b (INFO→IO-rawdata)
There will be shown:

DIG IN - A1

DIG IN - A2

DIG IN - A3

DIG IN - A4

DIG IN - A5

DIG IN - A6

DIG IN - A7

DIG IN - A8

DIG IN - A9

DIG IN - A10

DIG IN - A11

DIG IN - A12

DIG IN - A13

DIG – OUT R1

DIG – OUT R2

DIG – OUT R3

DIG – OUT R4

DIG – OUT R5

DIG – OUT R6

DIG – OUT R7

DIG – OUT R8

DIG – OUT R9

DIG – OUT R10

DIG – OUT R11

DIG – OUT R12

DIG – OUT R13

Window 3.a (OPERATE→value)
It's possible to set:

(S001) Cooling set point

(S002) Second cooling set point

(S003) Heating set point

(S004) Second heater set point

(S005) Humidity set point

(S006) Cooling band

(S007) Heating band

(S008) Humidity band

(S009) Alarm limit low temperature

(S010) Hysteresis of low temperature alarm

(S011) Alarm limit high temperature

(S012) Hysteresis of high temperature alarm

(S013) Alarm limit max temperature

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(S014) Hysteresis of max temperature alarm
(S015) Alarm limit low humidity
(S016) Alarm limit high humidity
(S017) Alarm delay (humidity - temperature)
(S018) Intrusion-vibration alarm delay
(S019) Limit supply temp in freecooling mode
(S020) Language selection
(S027) Password user

Window 3.b (OPERATE→machine)
It's possible:

Switching on/off the machine
Resetting the alarms

7. Software personalization for custom application

7.1. Custom 1

Analog input

Logic ID	Description of application
IC1	Not Used
IC2	Condenser Pressure (PC)
T1	Evaporator Temperature (TE)
T2	Internal Temperature (TI)
T3	Air outlet Temperature (TM)
T4	External Air Temperature (TAE)
	Not connected
IC3	Not used

In addition to the normal control functions, there are the following features:

Alarms
- Freecooling alarm: If (TI > 12) and ((TM – TI) > 2), 'Warning' is visualized. The reset is automatic
- Low pressure alarm: It becomes manual reset after 2 automatic reset

Control
If TI > 40 °C, the slave starts even without master authorization. This ends when TI < 37 °C.
In freecooling mode, if TI (master) > 22 °C, the slave support is request. This is no more requested when TI < 18 °C.

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7.2. Custom 2

Standard control with different values of the setup parameters.

7.3. Custom 3

Standard control with different values of the setup parameters. Level alarm implemented (see alarm chapter and custom 4 paragraph).

7.4. Custom 4

Standard control with different values of the setup parameters. Level alarm implemented (see alarm chapter).

For custom 3 and 4, the signal of alarm is A3 DIG-IN, in substitution of signal for door open/intrusion. The condensed water at evaporator fan is collected into a tank; when the level of the condensed water is too high, the level alarm will be on. When the alarm is on, the compressor will be switch off.
The reset is automatic and it's delayed of 20 seconds from when there isn't the alarm condition.

7.5. Custom 5

The custom 5 has a dirty second filter alarm implemented, as the dirty filter but using the intrusion DIG-IN and the R12 relay. The alarm on A9 is 'warning' with automatic reset: EXTERNAL FAN ALARM.
The default value of parameters for Custom 5 are explained in the next paragraph.

7.6. Custom 6

Dirty second filter
The signal of alarm is the A3 DIG-IN. When the alarm works, after a minute its cause appears. The alarm is associated to the "common alarm" relay; the reset is automatic.
In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

ENGLISH	ALARM DIRTY FILTER 2

Hardware tests
If the machine is off, by the A4 DIG-IN it's possible to start a cycle to test the hardware of the machine. This cycle is composed by three phases which length is equal to the timer set in the manual control menu.

- Cooling: in the first phase the compressor, condenser fan and evaporator fan are switched on at their maximum speed. All the other devices are off.
- Heating: in the second phase the heater and the evaporator fan are switched on at their maximum speed. All the other devices are off.
- Freecooling: in the third phase the damper is at its maximum opening and the evaporator fan is switched on at its maximum speed. All the other devices are off.

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At the end of the cycle, the controller will be off.
During the cycle it's not possible to switch on the machine, but by the DIG-IN A4 it's possible to stop the cycle.

7.7. Custom 7

Freecooling
In addition to what is already present, it's necessary to integrate the control to limit the supply temperature, in case of freecooling mode.

Execute a proportional control on the supply probe, through the parameters **S19** (as minimum opening 0%) and **S19**+**M42** (as maximum opening 100%). The result value has to be compared with the result of the freecooling temperature control and it has to be considered as an output which with the lower value. In this way we guarantee a supply minimum temperature as set in **S18** parameter. All the other controls must remain the same.
In case of two units, the same control is done, considering their supply probes.

This function is to be integrated on all the custom applications, except custom 1.

Select unit right or left
A parameter for select right or left units has been added.

If **I01**=0, then:	If **I01**=1, then:
I23 = TI	**I23** = No connection
I24 = No connection	**I24** = TI
I15 = 0	**I05** = 100
I16 =100	**I06** = 0

If possible, execute this function in custom 7 application, leaving the possibility to change manually the configuration defined by **I01** parameter.
Every time the **I01** parameter is defined, the analogic channels configuration is set as defined in **I01** parameter (in case of custom 7 application).

Analogic output
In the I/O menu, 4 new masks were added to define the logic of AN-OUT.
The integral control for freecooling output was added (mask **M37** - **M38**) and it has effect to both units.
The two functions are to be integrated in all custom applications.

Comfort mode
The A9 DIG-IN is connected to a key to reduce the noise in the shelter.
When A9 changes the state, the evaporator fan goes to a maximum speed of 50% for 20 minutes.
The display will show "COMFORT MODE" instead of "SYSTEM ON"
If anti-freezing control requires a speed higher than 50%, the fan will go to the required value.

7.8. Custom 8

Setup values as standard. Smoke Alarm has automatic reset after 30 seconds of no alarm condition.

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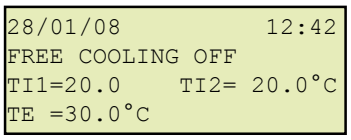
7.9. Custom 9

There are changes from the standard application: new channels TI1 and TI2 are selected by I/O Setup (note that TM and TC cannot be used).

When Max(TI1, TI2) > **S01**, then TI becomes Max(TI1, TI2) .
When Min(TI1, TI2) < **S03**, then TI becomes Min(TI1, TI2)

TI1 and TI2 are showed in the mask where normally TE and TM are showed. TE is showed in the line under it.
Bypass condenser fan speed limitation if PC > **M115**, return to normal condition when PC < (**M115** – 1.5).
This control is now also the standard.

Visualization on CO3 user
There will be a special mask.
Internal temperature 1 and internal temperature 2:



Visualization on EO3 user
In normal mode are showed some special masks (page 12 and 13):

Page 12 - Internal temperature 1: “TI1_XXX” (XXX = °C or DIS)
Page 13 - Internal temperature 2: “TI2_XXX” (XXX = °C or DIS)
Page 14 - Firmware version and custom: “STUTL2XX_YY_09” (XX_YY = Firmware version)

7.10. Custom 10

As standard version, with different setup parameters. Only the sw version is different.

7.11. Custom 11

There is a change from the standard application: master must not ask freecooling support if the compressor is on.

7.12. Custom 12

There are changes from the standard application:
– Low pressure on A9 instead of A13 DIG-IN.
– Fire alarm on A7 DIG-IN.
– Low voltage alarm not managed.
– New alarm on A6 DIG-IN (Wrong Phase).
– When ‘Wrong Phase’ alarm occurred, the system goes as the Off state condition.
– Manual reset pressing ESC.

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7.13. Custom 13

Custom for Free-Air control.

7.14. Custom 14

System configuration

1. DIG-OUT to enable the comfort unit, is configurable by I/O Setup parameter **I71**.
2. DIG-IN for comfort alarm is always A3 (instead of opened door)
3. The configuration must be 1 TLC + 1 Comfort unit: sequencing system is not possible.

Control

Enable/disable comfort unit is programmable using special menu where, for every day of the week, it's possible to set the starting and the stopping time.

The comfort unit can be in one of the following states (in priority order):

States:	Conditions:	Comfort unit:	TLC:
Forced Off	There is one of these conditions: • TI<**S01** (2.5 degrees of Hysteresis) • TAE>**M133** (1 degrees of Hysteresis) • TAE<**M134** (1 degrees of Hysteresis) • The system is off or stand-by. • Fire alarm or comfort alarm in progress	Switched off	Enabled
Forced On	If it's not in the above state and TI>**M135** (normal condition when TI<**S01**)	Switched on	Enabled
On	If it's not in one of the above states and there is one of these conditions: • It's enabled (day programming) and TLC is not in free cooling mode • TLC is broken.	Switched on	Disabled
Off	If it's not in one of the above states	Switched off	Enabled

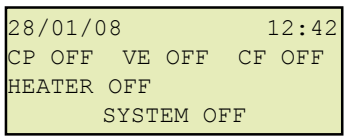
Day programming menu

In maintenance setup a new menu is added (only for this custom). For every day of the week, we will have 5 parameters: starting time (hours and minutes), stopping time (hours and minutes) and enable/disable. All these parameters are showed in one mask.

Pressing the SET key, the field "day of the week" start to flash (enable/disable). It can be changed using the UP/ DOWN keys. Pressing the ON/OFF key, we go to the next field (starting hour). Pressing UP/DOWN keys, we can change it. Pressing again ON/OFF key we go to the "starting minutes" field and so on (stopping hour, stopping minutes). Pressing the SET key, we memorize the last field selected and we go out from the setting mode. Pressing UP we go to the next day of the week.

Visualization on CO3 user

There will be a special mask.
Internal temperature 1 and internal temperature 2:



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Visualization on EO3 user
In normal mode is showed a special mask (page 13):

Page 13 - Comfort status: "CF_XXX" (XXX = ON or OFF)
Page 14 - Firmware version and custom: "STUTL2XX_YY_14" (XX_YY = Firmware version)

7.15. Custom 15

There are changes from the standard application: it comes from custom 9. TI1 and TI2 are selected by I/O Setup (note that TM and TC can not be used). In Cooling mode, the error of the control instead of (TI-**S01**) is the maximum between (TI1-**S01**) and (TI2-**S02**). In Heating the error is based on (TI1-**S01**). TI1 and TI2 are showed in the mask where normally are showed TE and TM. TE is showed in the line under it.

7.16. Custom 16

Custom for Free-Air control.

7.17. Custom 17

Same control of standard version but with level alarm implemented on A7.

7.18. Custom 18

Same control of custom 15 but with level alarm implemented on A7.

7.19. Custom 19

- Control: Same control of standard application
- Alarm: Fire - Smoke alarm

If this alarm occurs, the controller has to operate like when the freecooling mode is disabled (cooling has to be enabled and the freecooling damper has to be closed). The reset is manual.

7.20. Custom 20

- Control: Same control of standard application.
- Alarm: Air flow alarm - this alarm is bypassed.

7.21. Custom 21

- Control: Same control of standard application.
- Alarm:
  - Air flow alarm: this alarm is bypassed.
  - External enable: the input for this alarm is logical or between A4 and A12 (air flow alarm), instead of A4.

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7.22. Custom 22

Same functionality of customs 15 and 19.

7.23. Custom 23

This custom manages a Free-Air fan connected to AN-OUT V3.

Free air fan
The parameters involved are:
– **M01** AUTOMATIC LEAD LAG ADDRESS: pre-set = 0
– **M03** NUMBER OF PRESENT UNITS: pre-set = 1
– **M188** ENABLE CONTROL OF SEQUENCING SYSTEM: pre-set = YES

The Free-Air fan control is enabled when the board is a stand alone unit (**M01**=0 and **M03**=1) or when the board is the master unit of a master-slave system (**M01**=1 or 2, **M03**=2 and **M188**=NO) and when the board is the master unit of a master-slave system (**M01**=1, **M03**=2 and **M188**=YES). In a master-slave system, the control of the Free-Air fan connected to the master unit it's independent from the lead lag management and the temperature values used by free air fan control are always those read by the master unit probes. In a sequencing system, the free air fan control is always disabled.

Ambient conditions
The parameters involved are:
– **M39** MIN IN-OUT TEMP. DIFF. FOR FREECOOLING: pre-set = 10 °C
– **M40** MIN EXTERNAL TEMP. ENABLE FREECOOLING: pre-set = -25 °C
– **M41** MAX EXTERNAL TEMP. ENABLE FREECOOLING: pre-set = 60 °C
– **M44** FREECOOLING OFF IF COMPRESSOR ON: pre-set = YES

Conditions to enable Free-Air fan:	Conditions to disable Free-Air fan:
TI - TAE > **M39** **M40** < TAE < **M41**	(TI - TAE) < (**M39** - 1) or TAE < (**M40** - 1) or TAE > (**M41** + 1)

Note that if parameter **M44** is set to YES, the TAE used to control the Free-Air fan is the last TAE sampled with the condenser fan on.

Fan regulation
The parameters involved are:
– **M138** FREE AIR FAN MINIMUM SPEED: pre-set = 0 %
– **M139** FREE AIR FAN MAXIMUM SPEED: pre-set = 100 %

When the Free-Air fan is blocked or the unit is in a state different from on, the Free-Air fan is disabled. When the unit is in emergency state and TAE > TI, the Free-Air fan speed is set to the minimum speed (**M138**).
In a master-slave system, if the master and the slave units are in a state different from on and emergency, the Free-Air fan connected to the master unit is disabled.

Conditions to enable the Free-Air fan:	Conditions to disable the Free-Air fan:
If ((Fan Speed ≥ **M138**) and (Fan Speed > 0))	If (Fan Speed = 0)

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The Free-Air fan speed is limited by the parameters **M138** and **M139** as described below:
If (Fan Speed < **M138**), Fan Speed = **M138**
If (Fan Speed > **M139**), Fan Speed = **M139**

Two control mode are available: P control and PI control.

P Control
The parameters involved are:
– **S01** COOLING SET POINT: pre-set = 25 °C
– **S06** COOLING BAND: pre-set = 5 °C
– **M137** FREE AIR FAN CONTROL MODE: pre-set = 0
– **M140** FREE AIR FAN START VALUE: pre-set = 0
– **M141** FREE AIR FAN MAXIMUM VALUE: pre-set = 100 %

P control mode can be enabled by setting parameter **M137** to 0.
When P control mode is enabled, the behaviour of Free-Air fan speed is as described below:

If:		SPEED:
(TI≤(**S01**+**S06***(**M140**/100)))		0
(TI≥(**S01**+**S06***(**M141**/100)))		100 %
((TI>(**S01**+**S06***(**M140**/100))) (TI<(**S01**+**S06***(**M141**/100))))	and	(100/(**M141**-**M140**))*((((TI-**S01**)*100)/**S06**)-**M140**)

PI Control
The parameters involved are:
– **S01** COOLING SET POINT: pre-set = 25 °C
– **M137** FREE AIR FAN CONTROL MODE: pre-set = 0
– **M142** FREE AIR FAN PROPORTIONAL BAND: pre-set = 20 °C
– **M143** FREE AIR FAN INTEGRAL TIME: pre-set = 200 Sec

PI control mode can be enabled by setting parameter **M137** to 1.
When PI control mode is enabled, the behaviour of the Free-Air fan speed is determined by parameters **S01**, **M142** and **M143**.

Note that when the freecooling damper control mode is set to PI, the set point of the freecooling damper is equal to
S01+(**M31**/100)***S06**.

Compressor
In night mode the compressor is disabled.

Air change mode
The parameters involved are:
– **M144** ENABLE AIR CHANGE: pre-set = NO
– **M145** FREE AIR FAN SPEED IN AIR CHANGE MODE: pre-set = 50 %

Air change mode can be enabled by setting parameter **M144** to YES.
When air change mode is enabled, the Free-Air fan is enabled for 15 minutes at a speed equal to **M145** every 8 hours of non-functioning (Free-Air fan disabled).
The air change mode cannot be enabled when the Free-Air fan is blocked or the unit is in a state different from ON (stand alone mode).

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Manual control
The speed of Free-Air fan can be controlled manually by the menu VE speed in manual control. The speed of Free-Air fan (V3) is set equal to the speed of evaporator fans (V1 e V2).

Alarms
- High temperature: if the high temperature alarm occurs in night mode, the compressor is enabled.
- Broken probe TI: when this alarm occurs, the Free-Air fan is blocked.
- Broken probe TAE: when this alarm occurs, the Free-Air fan is blocked.
- Fire - smoke: when this alarm occurs, the Free-Air fan is blocked.
- Intrusion - vibration: when this alarm occurs, the Free-Air fan is blocked.
- Free-Air fan blocked:

The parameter involved is:
– **M82** EVAPORATOR FAN CONFIGURATION: pre-set = 7

To enable this alarm, the parameter **M82** must be set in according to the following table:

Fans configuration	Fan present
4	VE3
5	VE3 & VE1
6	VE3 & VE2
7	VE3 & VE2 & VE1

When this alarm occurs the following message will be displayed on the screen:

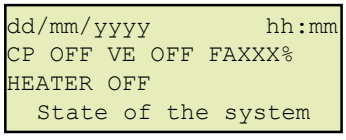
ENGLISH	ALARM FREE AIR BLOCKED

- Freecooling:
  This alarm occurs when TI > 12 °C and (TM - TI) > 2 °C.
  This alarm is delayed of 5 seconds from the appearing of its cause.
  It's possible to connect the alarm to a relay and/or to associate it to a "common warning" or to a "common alarm" relay by **I69**. The reset is automatic.

  When this alarm occurs, the following message will be displayed on the screen:

ENGLISH	ALARM FREE COOLING

Visualization on CO3 user
In the fourth screen (d) it's shown the status of Free-Air fan.



Status of free air fan:
- OFF
- XXX%

Visualization on EO3 user
In normal mode is showed a special mask (page 13):

Page 13 - Free air fan status: "FA_XXX" (XXX = % or OFF)
Page 14 - Firmware version and custom: "STUTL2XX_YY_23" (XX_YY = Firmware version)

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7.24. Custom 24

Night mode
The parameter involved is:
– **M146** ENABLE FREECOOLING IN NIGHT MODE: pre-set = NO

With parameter **M146** it's possible to select if the freecooling is enabled in night mode (**M146** set to YES). The cooling mode is always disabled. If there aren't the conditions to enable freecooling, the freecooling damper is set to 0 %.
If parameter **M146** is set to NO, in night mode the machine goes in stand-by mode.

Heating
The parameters involved are:
– **M147** DELAY FOR DISABLE FANS FROM HEATER SWITCH OFF: pre-set = 1 min
– **M154** MAXIMUM FANS SPEED IN HEATER MODE: pre-set = 10 %

When the heating is on, the fan speed is equal to the value set by parameter **M154** and the damper is closed. When the heater switches off (TI reaches **S03**-**M64***S07), the fans are switched off after a time equal to the parameter **M147**. When the temperature drops or when TI reaches **S03**-**M64***S07, the fans are switched on before the heater.

Dead zone
In dead zone the damper is always closed.

Recirculation
In recirculation mode (**S03**-**M64***S07<TI<**S01**+**M136**) the damper is always closed and the fans speed is set equal to the parameter **M88**.

Cooling
In cooling mode, the damper is always closed. When the compressor is ON, the fans speed is set to **M90**; otherwise when the compressor is OFF the fans speed is set to **M88**.

Freecooling
The parameters involved are:
– **M150** DELAY FOR OPEN DAMPER FROM COMPRESSOR SWITCH OFF: pre-set = 180 sec
– **M155** MAXIMUM VALUE FOR FANS IN FREECOOLING: pre-set = 100 %

If it's not enabled the assisted freecooling, in freecooling mode, when the compressor is on, the damper is always closed and the fans speed is set to **M90**. When the compressor switches off, if the ambient conditions allow the freecooling mode and it's not enabled the assisted freecooling, the damper remains closed for a period equal to parameter **M150**.
In freecooling mode, the damper works like in damper mode (**M49** set to 0).

Fans speed starts to increase when TI reaches the value:	Fans speed ends to increase when TI reaches the value:
TI = **S01** + (**M31** / 100) * **S06**	TI = **S01** + (**M155** / 100) * **S06**

Auxiliary mode
The parameters involved are:
– **M151** EMERGENCY TEMPERATURE: pre-set = 33 °C
– **M152** DIFFERENTIAL TEMPERATURE IN EMERGENCY MODE: pre-set = 1 °C

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TI ≤ **S01**+**M136**: The damper is closed and the fans speed is set to 0 %.

S01+**M136** ≤ TI < **S01**+**M31***S06**: Recirculation mode.

S01+**M31***S06** ≤ TI < **M151**: Freecooling mode is enabled if **M40** < TAE < **M41**, TI-TAE > **M39**, Internal humidity < **S05**+**M68***S08**. In freecooling mode the fans speed is set equal to the parameter **M88** and the damper is fully open. If there are not the conditions for freecooling mode, the unit works in recirculation mode.

TI ≥ **M151**: Freecooling mode is enabled if TI-TAE > **M152**. In freecooling mode the fans speed is set equal to **M88** and the damper is fully open. If there are not the conditions for freecooling mode, the unit works in recirculation mode.

The auxiliary mode has a higher priority than the emergency mode for the control of the evaporator fans.

Emergency mode
The parameters involved are:
– **M151** EMERGENCY TEMPERATURE: pre-set = 33 °C
– **M152** DIFFERENTIAL TEMPERATURE IN EMERGENCY MODE: pre-set = 1 °C
– **M153** ENABLE DAMPER IN EMERGENCY MODE: pre-set = NO

TI ≤ **S01**+**M136**: The damper is closed and the fans speed is set to 0 %.

S01+**M136** ≤ TI < **S01**+**M31***S06**: Recirculation mode.

S01+**M31***S06** ≤ TI < **S01**+**M55***S06**: Freecooling mode is enabled if TAE > **M40**, TAE < **M41**, TI-TAE > **M39**.
If there aren't the conditions for freecooling mode, the unit works in recirculation mode.

S01+**M55***S06** ≤ TI < **M151**: By parameter **M153** it's possible to select if the damper must be open or closed. The fans speed is set equal to 100%.

TI ≥ **M151**: Freecooling mode is enabled if TI-TAE > **M152**. In freecooling mode the fans speed is set equal to 100% and the damper is fully open. If there are not the conditions for freecooling mode, the unit works in recirculation mode.

Alarms

- Group refrigeration: replaces the current group "common warning"
- Group general alarm: replaces the current group "common alarm".
- Compressor thermic
  The alarm reset is automatic.
  It's possible to connect the alarm to a relay and/or to associate it to "group refrigeration" or to "group general alarm" relay. The status of the unit when this alarm occurs is "emergency mode".
- High temperature
  It's possible to connect the alarm to a relay and/or to associate it to "group refrigeration" or to "group general alarm" relay. The status of the unit when this alarm occurs is "emergency mode".
- High pressure
  The alarm reset is automatic.
  It's possible to connect the alarm to a relay and/or to associate it to "group refrigeration" or to "group general alarm" relay. The status of the unit when this alarm occurs is "emergency mode".

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- Low pressure
  The alarm reset is automatic.
  It's possible to connect the alarm to a relay and/or to associate it to "group refrigeration" or to "group general alarm" relay. The status of the unit when this alarm occurs is "emergency mode".
- Air flow
  It's possible to connect the alarm to a relay and/or to associate it to "group refrigeration" or to "group general alarm" relay. The status of the unit when this alarm occurs is "emergency mode".
- Fire - smoke
  The alarm reset is automatic.
  It's possible to connect the alarm to a relay and/or to associate it to "group refrigeration" or to "group general alarm" relay. When this alarm occurs the damper is closed and the fans speed is set to 0 %.
- Intrusion - vibration
  It's possible to connect the alarm to a relay and/or to associate it to "group refrigeration" or to "group general alarm" relay.
- Power failure
  It's possible to connect the alarm to a relay and/or to associate it to "group refrigeration" or to "group general alarm" relay. The status of the unit when this alarm occurs is "auxiliary mode".
- Wrong phase
  The parameter involved is:
  – **I76** SELECT RELAY WRONG PHASE: pre-set = CA

The signal of alarm is A2 digital input. The alarm reset is automatic.
It's possible to connect the alarm to a relay and/or to associate it to "group refrigeration" or to "group general alarm" relay by parameter **I76**. The status of the unit when this alarm occurs is "emergency mode".
In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

ENGLISH	ALARM WRONG PHASE

7.25. Custom 25

Control
The parameters involved are:
- **M09** SERIAL PROTOCOL: pre-set = PEMS
- **M156** ENABLE DANFOSS COMPRESSOR: pre-set = NO

When custom 25 is enabled, the C2020 controller communicates with a PLC by Modbus protocol. The C2020 controller is the slave board. The baud rate is automatically set to 19200 bps.
When custom 25 is enabled, the Danfoss compressor must be enabled (**M156** set to YES) and the parameter **M09** must be set to a value different from MODBUS STULZ or MODBUS STANDARD.
Note: in this case it's not possible to connect the serial cable to WIB1000.

The following tables show all data points ModBus for the communication with the Danfoss compressor.

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Read coil status function

Address	Description	Note
171	WARNING	Send 1 to the PLC if a common warning is active; 0 otherwise
172	A03 - ALARM LOW PRESSURE	Send 1 to the PLC if the alarm is active; 0 otherwise
173	A05 - ALARM AIR FLOW	Send 1 to the PLC if the alarm AIR FLOW or EVAPORATOR FANX BLOCKED is active; 0 otherwise
174	A07 - ALARM HEATER THERMIC	Send 1 to the PLC if the alarm is active; 0 otherwise
175	A10 - ALARM DIRTY FILTER	Send 1 to the PLC if the alarm is active; 0 otherwise
176	A11 - ALARM HIGH TEMPERATURE	Send 1 to the PLC if the alarm is active; 0 otherwise
177	A12 - ALARM LOW TEMPERATURE	Send 1 to the PLC if the alarm is active; 0 otherwise
178	NOT USED	
179	A17 - ALARM LIMIT FAN HOURS	Send 1 to the PLC if the alarm is active; 0 otherwise
180	A18 - ALARM INTERNAL TEMPERATURE PROBE	Send 1 to the PLC if the alarm is active; 0 otherwise
181	A20 - ALARM EXTERNAL TEMPERATURE PROBE	Send 1 to the PLC if the alarm AMBIENT TEMPERATURE INVALID is active; 0 otherwise
182	A21 - ALARM SUPPLY TEMPERATURE PROBE	Send 1 to the PLC if the alarm is active; 0 otherwise
183	A23 - ALARM HIGH PRESSURE PROBE	Send 1 to the PLC if the alarm is active; 0 otherwise
184	A24 - ALARM LOW PRESSURE PROBE	Send 1 to the PLC if the alarm is active; 0 otherwise
185	A30 - ALARM CLOCK	Send always 0 to the PLC; alarm not present
186	ALARM	Send 1 to the PLC if a common alarm is active; 0 otherwise
187	A31 - ALARM HIGH PRESSURE	Send 1 to the PLC if the alarm CONDENSER PRESSURE is active; 0 otherwise
188	A35 - ALARM COMPRESSOR THERMIC	Send 1 to the PLC if the alarm COMPRESSOR THERMIC or HIGH PRESSURE is active; 0 otherwise
189	A75 - ALARM POWER FAILURE	Send 1 to the PLC if the alarm is active; 0 otherwise
190	FAN STATUS	Send the evaporator fan status to the PLC (0 = OFF; 1 = ON). The fan status is OFF when the fan is present and is running at a speed superior to M83but the correspondent tachometric signal input is absent.
191	DAMPER STATUS	Send the freecooling damper status to the PLC (0 = OFF; 1 = ON)
192	HEATER STATUS	Send the status of the digital input A2 to the PLC (0 = OPEN; 1 = CLOSED)
193	COMPRESSOR STATUS	Send the compressor status to the PLC (0 = OFF; 1 = ON). NOTE: The compressor is ON when the data point Modbus 40301 “Therm out compressor speed Hz (AOC DRIVE)” for the communication with the Danfoss compressor is greater than 0.
194	COMMUNICATION STATUS	Send 1 to the PLC

Read holding registers function

Address	Description	Note
3	HIGH PRESSURE PROBE	Send the high pressure read by Danfoss compressor (data point Modbus 40204 “Therm in PC (AOC DRIVE)”) to the PLC
4	LOW PRESSURE PROBE	Send the low pressure read by Danfoss compressor (data point Modbus 40206 “Therm in P0 (AOC DRIVE)”) to the PLC
5	INTERNAL TEMPERATURE	Send the internal temperature to the PLC
6	SUPPLY TEMPERATURE	Send the supply temperature to the PLC
7	EXTERNAL TEMPERATURE	Send the internal temperature read by Danfoss compressor (data point Modbus 40216 “Therm in ambient temperature (AOC DRIVE)”) to the PLC
8	COMPRESSOR VALUE	Send the compressor value read by Danfoss compressor (data point Modbus 40212 “Therm in compressor external speed PCT (AOC DRIVE)”) to the PLC

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Force single coil function

Address	Description	Note
24	SET FAN STATUS	Get the evaporator fan status from the PLC to set the status without bypass the delay times set by parameters(1 = ON; 0 = OFF). If the PLC asks to turn off the evaporator fans and the compressor is on, the compressor is turned off first, then the evaporator fans
25	SET DAMPER STATUS	Get the damper status from the PLC to set the status (1 = ON; 0 = OFF)
26	SET HEATER STATUS	Get the heater status from the PLC to set the status (1 = ON; 0 = OFF)
27	SET COMPRESSOR STATUS	Get the compressor status from the PLC to set the status without bypass the delay times set by parameters (1 = ON; 0 = OFF)
28	SET COMMUNICATION STATUS	Get communication status from the PLC (1 = ERROR; 0 = NO ERROR)
124	RESET ALARMS	Get the command from the PLC for reset the alarms (1 = RESET ALARMS; 0 = NO OPERATION)

Write single register function

Address	Description	Note
8	SET COMPRESSOR VALUE	Get the compressor value to send to Danfoss compressor (data point Modbus 40212 “Therm in compressor external speed PCT (AOC DRIVE)”) from the PLC. If data point Modbus 27 SET COMPRESSOR STATUS - FORCE SINGLE COIL FUNCTION is equal to 1(COMPRESSOR ON) then the minimum compressor value send to Danfoss compressor is 1 %.

When custom 25 is enabled the machine is always on; by pressing the ON/OFF key is not possible to switch off the machine. Also the stand-by mode is disabled.

When the evaporator fans are off, the compressor and the heater are always off. When the compressor is on (data point Modbus 40301 greater than 0) it isn’t possible to switch off the evaporator fans.

The normal control is disabled and all devices, with the exception of the condenser fan, are controlled by PLC described in the previous tables.

When the data point Modbus 28 is not updated by PLC to 0 for a time greater than **M179** (off line status) and the alarms fire - smoke and thermostat high temperature are not active, the freecooling damper is open completely; the heater, the compressor and the condenser fan are switched off and the evaporator fans are switched on to the maximum speed.

Visualization

The parameter involved is:

- **M179** DELAY FOR PLC COMMUNICATION ERROR ALARM: pre-set = 10 Sec

When custom 25 is enabled, in the fourth row of the first screen of the main menu it’s shown “on line”. When the data point Modbus 28 is not updated by PLC to 0 for a time greater than **M179**, then in the fourth row it’s shown “off line”.

In the fourth screen (d) of the main menu it’s shown the compressor value set by PLC (data point Modbus 8).

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Alarms

When custom 25 is enabled no alarm is associated to digital input A2.

- PLC communication error

  The parameters involved are:
  - **I99** SELECT RELAY PLC COMMUNICATION ERROR ALARM: pre-set = CA
  - **M179** DELAY FOR PLC COMMUNICATION ERROR ALARM: pre-set = 10 Sec

  The alarm will be active with a delay of **M179** seconds, if there is no communication with the PLC. It's possible to connect the alarm to a relay and/or to associate it to "common warning" or "common alarm" relay by **I99**. The reset is automatic.
  In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

ENGLISH	ALARM PLC COMM. ERROR

- Hours of operating of fans

  The parameters involved are:
  - **I100** SELECT RELAY HOURS OF OPERATING OF FANS ALARM: pre-set = CA
  - **M180** HOURS OF OPERATING OF FANS: pre-set = 50 Hour x 100

  This alarm occurs when the hours of evaporator fans activity become equal to setup parameter **M180**. When it's active, the machine goes in emergency mode (the machine is turned off immediately). It's possible to connect the alarm to a relay and/or to associate it to "common warning" or "common alarm" relay by **I100**. The reset is automatic.
  In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

ENGLISH	ALARM HOURS OPERATING FANS

- Low pressure: when this alarm is active, the compressor is switched off.
- High pressure: when this alarm is active, the compressor is switched off.
- Fire - Smoke

  The parameter involved is:
  - **M179** DELAY FOR PLC COMMUNICATION ERROR ALARM: pre-set = 10 Sec

  This alarm is enabled only when the data point Modbus 28 is not updated by PLC to 0 for a time greater than **M179**.
  The signal of alarm is A1 digital input. When it's active, the freecooling damper is closed and the heater, the compressor, the condenser fan and the evaporator fans are switched off.

- Power failure

  When this alarm is active, the machine goes in emergency mode but without switching off the evaporator fans.
- Compressor thermic: when this alarm is active, the compressor is switched off.
- Suction pressure invalid: when this alarm is active, the compressor is switched off.
- Condenser pressure invalid: when this alarm is active, the compressor is switched off.
- Thermostat high temperature

  The parameters involved are:
  - **I101** SELECT RELAY THERMOSTAT HIGH TEMPERATURE ALARM: pre-set = CA
  - **M179** DELAY FOR PLC COMMUNICATION ERROR ALARM: pre-set = 10 Sec

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This alarm is enabled only when the data point Modbus 28 is not updated by PLC to 0 for a time greater than **M179**.
The signal of alarm is A3 digital input.
When it's active and the alarm fire - smoke is not active: the freecooling damper is closed, the heater is switched off and the compressor, the condenser fan and the evaporator fans are switched on to the maximum speed.
It's possible to connect the alarm to a relay and/or to associate it to "common warning" or "common alarm" relay by **I101**. The reset is automatic.
In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

ENGLISH ALARM THERMOSTAT HIGH TEMP

- Internal temperature probe: when this alarm is active, no device is disabled.
- Condenser fan thermic: when this alarm is active, the compressor is switched off.
- Condenser pressure: when this alarm is active, the compressor is switched off.
- Danfoss compressor communication error
- When this alarm is active, the compressor is switched off and the data point Modbus 40301 for the communication with the Danfoss compressor is forced to 0.
- Ambient temperature invalid: when this alarm is active, the compressor is switched off.
- Peripherals error: when this alarm is active, the compressor is switched off.
- EEV IN failure: when this alarm is active, the compressor is switched off.
- Discharge temperature invalid: when this alarm is active, the compressor is switched off.
- Alarm active: when this alarm is active, the compressor is switched off.

7.26. Custom 26

- Control: Same control of standard application but with freecooling mode disabled
- Alarm: Power failure. If this alarm occurs, the freecooling mode will be enabled.

7.27. Custom 27

Same functionality of customs 23. On the fourth line of the information screen is not shown the name of the customer.

7.28. Custom 28

Control
Same control of standard application

Warning
Fc stop by wind

The parameter involved is:
- **I107** SELECT RELAY FC STOP BY WIND: pre-set = NO CONN.

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The signal of warning is A3 digital input. If this warning occurs, the freecooling will be switched off. The reset is automatic. It's possible to connect the warning to a relay and/or to associate it to "common warning" or "common alarm" relay by parameter **I107**.
In the following table the "warning description" is shown as it will appear on the LCD during warning condition or in the alarm history menu.

ENGLISH	WARNING FC STOP BY WIND

Alarm
Fc stop by fire

The parameter involved is:
- **I108** SELECT RELAY FC STOP BY FIRE: pre-set = CA

The signal of alarm is A1 digital input. If this alarm occurs, the freecooling will be switched off. The reset is manual.
It's possible to connect the alarm to a relay and/or to associate it to "common warning" or "common alarm" relay by parameters **I108**.
In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

ENGLISH	WARNING FC STOP BY FIRE

7.29. Custom 29

Control
Same control of standard application

Alarm
- Evaporator fan 1 broken

The parameter involved is:
- **I109** SELECT RELAY EVAPORATOR FAN 1 BROKEN: pre-set = CA

The signal of alarm is A7 digital input. The alarm will be active with a delay of 1 second. If this alarm occurs, the machine goes in emergency mode. The reset is manual at the fourth attempt within 4 hours (I.e. the reset is automatic for 3 attempts during 4 hours. If it occurs more than 3 times, the reset will be manual).
It's possible to connect the alarm to a relay and/or to associate it to "common warning" or "common alarm" relay by parameters **I109**.
In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

ENGLISH	WARNING EVAP. FAN 1 BROKEN

- Evaporator fan 2 broken

The parameter involved is:
- **I110** SELECT RELAY EVAPORATOR FAN 2 BROKEN: pre-set = CA

The signal of alarm is A12 digital input. The alarm will be active with a delay of 1 second. If this alarm occurs, the machine goes in emergency mode. The reset is manual at the fourth attempt within 4 hours (I.e. the reset is automatic for 3 attempts during 4 hours. If it occurs more than 3 times, the reset will be manual).

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It's possible to connect the alarm to a relay and/or to associate it to "common warning" or "common alarm" relay by parameters **I110**. In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

ENGLISH	WARNING EVAP. FAN 2 BROKEN

7.30. Custom 30

It manages free cooling units.

ANOUT2 has a value proportional to the free cooling.
ANOUT2 will be activated 60 seconds after free cooling is on.

System configuration
Default probe configuration (selected by I/O setup):
- Internal Temperature TI (T1)
- External Air Temperature TAE (T3)
- Internal Relative Humidity: IRH (IC2)

The comfort unit is not present and there isn't evaporator. There is free cooling fan.
On the relative alarm masks the evaporator word disappears.

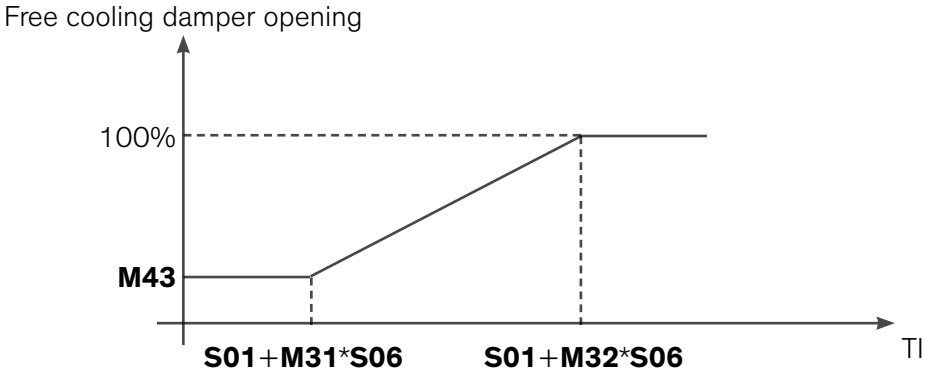
Control
- Freecooling control

The parameters involved are:
- **M86** MIN SWITCHING ON FOR EVAP. FAN: pre-set = 10 Sec
- **M87** MIN SWITCHING OFF FOR EVAP. FAN: pre-set = 10 Sec

The fan is switched off only if it's elapsed a time greater than **M86** from the last switch on.
The fan is switched on only if it's elapsed a time greater than **M87** from the last switch off.

If TAE < **M40**: fan and damper off
If (TI - TAE) < **M39**: fan and damper off

Off usually means: fan speed = **M88** and free cooling open = **M43.**
If the machine is off or fire alarm is occurred: fan speed = 0 and free cooling open = 0.
This custom uses **M49**=0 (only by damper) and min fan speed **M88** = 75.
Free cooling is modulated on damper opening, while the fans will be a fixed speed.

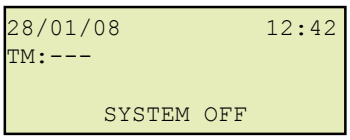


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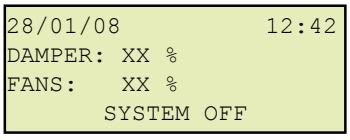
Alarms
• Probes alarm
TI stops all, TAE stops free cooling, TM bypass relative bad working alarm.

Visualization on CO3 user
There will be some special masks.

Status of TM



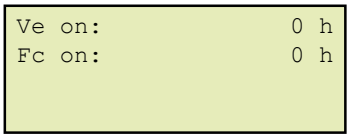
Damper opening and fan speed:



Visualization on EO3 user
In normal mode are showed some special masks (page 6, 9 and 10):

Page 6 - Supply temperature 1: “TS1_XXX” (XXX = °C or DIS)
Page 9 - Fans status: “FANS_XXX” (XXX = %)
Page 10 - Freecooling damper status: “FC_XXX” (XXX = %)
Page 13 - Firmware version and custom: “STUTL2XX_YY_13” (XX_YY = Firmware version)

Menu
• Counters menu on CO3 user
Hours of activity in counters menu:



• Counters menu on EO3 user
In counters menu there will be the hours of activity of two devices (with string rotation) as below:

Page 1 - Hours of fans activity (x100 h): “FANS_XXX”
Page 2 - Hours of freecooling damper activity (x100 h): “FC_XXX”

7.31. Custom 31

As standard application with the following differences.

Control
Inverter modulation on ANOUT2. Danfoss control methods are used to calculate the modulation.

Limitation of Inverter modulation depends on PC value:
If Modulation > 0 and PC > 38 bar: modulation will be the maximum between 34% and control modulation. The condition is reset when PC < 34 bar.
If Modulation is more the 5% K1 and K3 are ON (off when modulation come back zero).

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Alarms

- Inverter alarm

  The parameter involved is:

  – **I111** SELECT RELAY INVERTER ALARM: pre-set = CA

  The signal of alarm is A2 digital input. The alarm will be active with a delay of 1 second. If this alarm occurs, the machine goes in emergency mode. The reset is manual at the fourth attempt within 4 hours. (I.e. the reset is automatic for 3 attempts during 4 hours. If it occurs more than 3 times, the reset will be manual). It's possible to connect the alarm to a relay and/or to associate it to "common warning" or "common alarm" relay by parameters **I111**.
  In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

  ENGLISH WARNING INVERTER ALARM

- EEV driver alarm

  The parameter involved is:

  – **I112** SELECT RELAY EEV DRIVER ALARM: pre-set = CA

  The signal of alarm is A9 digital input. The alarm will be active with a delay of 1 second. If this alarm occurs, the machine goes in emergency mode. The reset is manual at the fourth attempt within 4 hours. (I.e. the reset is automatic for 3 attempts during 4 hours. If it occurs more than 3 times, the reset will be manual). It's possible to connect the alarm to a relay and/or to associate it to "common warning" or "common alarm" relay by parameters **I112**.
  In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

  ENGLISH WARNING EEV DRIVER ALARM

- Water flow alarm

  The parameter involved is:

  – **I113** SELECT RELAY WATER FLOW ALARM: pre-set = CA

  The signal of alarm is A3 digital input. The alarm will be active with a delay of 1 second. If this alarm occurs, the machine goes in emergency mode. The reset is manual at the fourth attempt within 4 hours. (I.e. the reset is automatic for 3 attempts during 4 hours. If it occurs more than 3 times, the reset will be manual). It's possible to connect the alarm to a relay and/or to associate it to "common warning" or "common alarm" relay by parameters **I113**.
  In the following table the "alarm description" is shown as it will appear on the LCD during alarm condition or in the alarm history menu.

  ENGLISH WARNING WATER FLOW ALARM

- Unit state changed: unit status change memorized on alarm history menu.

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