ST500 Energy

eliwell by Schneider Electric

Electronic controllers for centralised air-conditioning units

EN

CONTENTS

1 HOW TO USE THIS MANUAL

This manual is designed to permit quick, easy reference with the following features:

References

References column**:**
A column to the left of the text contains *references* to subjects discussed in the text to help you locate the information you need quickly and easily.

Cross references

Cross references:
All words written in *italics* are referenced in the subject index to help you find the page containing details on this subject; supposing you read the following text:
" If there are 2 compressors in the installation, the *minimum time* between the switching on and the switching off) of the two compressors is observed. "
The italics mean that you will find a reference to the page on the topic of compressors listed under the item compressors in the index.
If you are consulting the manual "on-line" (using a computer), words which appear in italics are hyperlinks: just click on a word in italics with the mouse to go directly to the part of the manual that discusses this topic.

Icons for emphasis

Some segments of text are marked by icons appearing in the *references* column with the meanings specified below:

Warning! : **information which is essential for preventing negative consequences for the system or a hazard to personnel, instruments, data, etc., and which users MUST read with care.**

Take note: information on the topic under discussion which the user ought to keep in mind

Tip: a recommendation which may help the user to understand and make use of the information supplied on the topic under discussion.

2 INTRODUCTION

2.1 General Description

Eliwell, a leading manufacturer for over a decade of control equipment for small and medium-size air conditioning units is proud to present Energy ST, the new *range* of compact devices with advance functions and groundbreaking applications for the HVAC market.

Single-circuit control of centralized air-conditioning systems with 1 or 2 compressors (steps) such as:

- Chillers, Heat Pumps, Close Control:
  - water-air;
  - air-water;
  - water-water;
  - air-air;
- Motorized condensers
  - air-cooled;
  - water-cooled.

2.1.1 Typical applications:

- Minimarkets,
- Industrial plants,
- Offices,
- Hotels,
- Residential buildings.

2.1.2 Technical data:

There are 6 *models* in the Energy ST 500 *range* providing up to 5 relay outputs, one *TRIAC* output, 2 PWM *analogue outputs*, a 0...10V/4...20mA configurable analogue output and an Open Collector digital output for an external relay. All inputs and outputs are independent and configurable, meaning they can be adapted to fit any system. Eliwell's standard 32x74mm format also ensures the utmost flexibility and ease of installation.

2.1.3 Main functions:

- Temperature control via the input or output probe;
- *Integrated boiler* or heating control;
- Integrated control of two electric heaters or heating system;
- Dynamic set point;
- *Automatic changeover*;
- Indoor ventilation control;
- Dynamic defrosting;
- Full diagnostics;
- Modulating water pump control;
- Adaptive" function for units with no accumulation;
- Antifreeze function with water pump on external probe;
- Control of non-uniform tandem compressors;
- Power limitation;
- Resources optimized in accordance with the external temperature.

2.2 Models and Features

-->See Annexe A - *Models* and *Accessories* and the Specifications chapter

3 USER INTERFACE (FOLDER PAR/UI)

The front panel of the device functions as the user interface and is used to perform all operations relating to the device.

3.1 Keys

There are 4 *keys* on the front panel. Each key has (see the two tables below):

- A "direct" action (indicated on the key)
- An "associated" function (indicated on the front panel of the device beside the key). In the manual, this is shown in square brackets (e.g. [UP])
- A "combined" action involving two *keys*. In the manual, this is shown in square brackets (e.g.[UP+DOWN])

3.1.1 Keys and associated functions

Key	Description Key	Press once (press and release)	Key [associated function]	Press and hold [press for about 3 seconds]	Menu / Comments
	**UP (UP)**	• Increases a value • Goes to the next *label*		[*Manual defrost* activation]	Functions menu see Functions chapter (*folder* FnC)
	**DOWN (DOWN)**	• Decreases a value • Goes to the previous *label*		[*Local ON/OFF*]	See *Local On/OFF* section --- See also Functions menu Functions chapter (*folder* FnC)
	**Esc(ape) Output** (Without saving new settings)	• Exit without saving new settings • Go back to previous level	**mode**	[Change mode] --- See section on Changing operating mode	Operating mode menu
	**Set Confirm** (save new settings)	• Confirms value / exit and save new settings • Move to next level (open *folder*, subfolder, parameter, value) • Open State Menu	**disp**	[Main *display*] --- See Main *Display* section	[Main *Display* Menu]
	ALL	Alarm acknowledgment			See *Manual alarm acknowledgment and reset* section
			By parameter (see parameters chapter, parameters *UI10*-11-12-13-14) the function [associated] can be enabled or disabled: • 0 = Key not enabled for the function • 1 = Key enabled for the function		

3.1.2 Local On/OFF

3.1.2.1 Device ‘On’ --> ‘OFF’

	Press the [DOWN] key for about 3 seconds from the main *display*
	The word OFF will appear on the *display*. All other LEDs will be off

3.1.2.2 Device ‘OFF’ --> ‘On’

	The word OFF will appear on the *display*. Press the [DOWN] key for about 3 seconds
	Energy ST500 will return to the “normal” screen

NOTE:
The *local ON/OFF* function is deactivated if the device has been turned OFF remotely or if a digital input is configured as a remote ON/OFF.

3.1.3 Keys – combined action

Symbol [function associated to the combined pressing of the *keys*]	Combination *Keys*	Combined pressing of *keys* Press once (press and release	[associated function]	[Menu] / Comments
		**[UP (UP) + DOWN (DOWN)]**	[Manual reset]	See *Manual alarm acknowledgment and reset* section
				
		**[Esc + SETPOINT]**	[Open *programming menu*]	[*Programming menu*]
				

3.1.3.3 Manual alarm acknowledgment and reset

Alarm messages blink. How to acknowledge an alarm is explained below.
All error messages are shown in the AL *folder* (see state Menu)

	An error message will be shown, alternating with the error alert and the main *display*. The ALARM LED will be permanently on.

	ALARM/ERROR ACKNOWLEDGMENT
	An error can be acknowledged by pressing any key once. After pressing any key, the alarm LED will start to blink.
	MANUAL RESET
	To manually reset an alarm, press the “up” and “down” *keys* together [UP+DOWN] - - - - - - - - - N.B: resetting an active alarm* will save the alarm in the AL *folder* (see state Menu). * i.e. manual reset (alarm)
	The device will return to the main *display*.

3.2 LEDs and Display

The *display* has 18 icons (LEDs) split into 3 categories (+ decimal point):

- Decimal point
- States and *Operating Modes*
- Values and Units of Measure
- Loads

3.2.1 Display

Values of up to 4 figures or 3 figures plus a sign can be displayed.

3.2.2 LED: decimal point

Values are always shown in tenths of a degree/bar.

3.2.3 LED: States and Operating Modes

LED states and *Operating Modes*	Icon	Colour	Colour	Permanently on	Blinking
 The *display* shows the value/resource set for the "main *display*". In the event of an alarm, it will alternate with the alarm code Exx. (when more than one alarm occurs at the same time, the one with the lowest number will be shown first - see *Alarms* and Diagnostics chapter)		Alarm	Red	Active alarm	Alarm acknowledged
		Heating	Green	Heating mode	Antifreeze with heat pump active Remote heating mode
	(Missing Icon)	Cooling		Cooling mode	Remote cooling mode
		Standby		Local standby mode (from keyboard)	Remote standby
		Defrost		Defrost active	*Manual defrost* activated
		Economy		Configurable ---- See Parameters chapter ---- Ui /dS *folder* Parameters *UI07* /*dS00*	Configurable ---- See Parameters chapter ---- Ui /dS *folder* Parameters *UI07* /*dS00*

3.2.4 LED: Values and Units of Measure

LED Unit of measure	Icon		Colour	Permanently on	Blinking
 Values can be displayed with a decimal point by setting parameter **Ui08** see parameters chapter, Ui *folder*)		Clock (RTC)	Red	Shows current time (24hr format)	Set time
	°C	Degrees centigrade		/	/
	Bar	Pressure (Bar)		/	/
	%R.H	Relative humidity (% RH)		Not used	Not used
	ABC	Menu (ABC)		Menu navigation	/

3.2.5 LED: utilities

LED utilities		Colour	Permanently on	Blinking
		Amber	Configurable (°) ---- See Parameters chapter ---- Ui *folder* Parameters *UI00..UI07*	Configurable (°°) ---- See Parameters chapter ---- Ui *folder* Parameters *UI00..UI07*

(°) permanently on: utility active
(°°) blinking:

- example *UI00..UI07*= 1 (Compressor 1) indicates:
  - safety timing
  - power limited to 50%
  - block compressor
- example *UI00..UI07*= 2 (step 2) indicates: safety timing

default **configuration**
LEDs for utilities are all configurable (see parameters chapter, *folder* Ui). The factory settings are listed in the table below:

LED symbol on *display*	LED	*Default*	*Default* icon on front panel
	LED 1 (first from left)	Compressor 1	
	LED 2	Output step 2	
	LED 3	Internal exchanger electric heater 1	
	LED 4	Internal exchanger electric heater 2	
	LED 5	Boiler	
	LED 6	External exchanger fan	
	LED 7	Internal circuit water pump	

3.3 First switch on

	When Energy ST500 is switched on for the first time, a lamp test is carried out to check the state and proper function of lamps. --- The Lamp Test lasts for a few seconds. During this short time, all LEDs and digits flash at the same time.
	After the lamp test, based on preselected settings, the following are displayed: • time, • real setpoint • parameter setpoint • the value of the analogue input selected (AI1...AI4) --- In the example, the current time is the main *display* (RTC)

3.4 Access to folders - menu structure

Access to folders is organised into menus.
Access is determined by the *keys* on the front panel (see relative sections).
Access to each individual menu is explained below (or in the sections indicated).
There are 4 menus:

- 'Main *Display*' menu → see 'Main *Display* Menu' section;
- 'Operating Mode' menu → see 'Operating Mode Menu';
- 'States menu' → see "States Menu' section;
- '*Programming Menu*' → see '*Programming Menu*' section.

There are 4 folders/submenus in the *Programming Menu*:

- Parameters Menu (Par *folder*) → see Parameters chapter
- Functions Menu (Fnc *folder*) → see Functions chapter;
- Password PASS
- Alarm codes EU

All menus and labels are listed in the table below:

MENU					
Main *Display*	Ai	AI1	Ai2	AI3	AI4
	di	Di01	Di02	...	Di05
	...				
	rtC	HOUr	dAtE	YEAr	
	...				
	Setr				
Operating mode	HEAt				
	COOL				
	StdBY				
States	Ai				
	di				
	...				
	CL	HOUr	dAtE	YEAr	
	...				
	Hr	*CP01*	CO02	PU01	PU02
Programming	**MENU**				
	Parameters	CF	*CF00*...CF78		
		UI			
		...	...	...	...
		AL	*AL00*...*AI48*		
	Functions	dEF			
		tA			
		St	OFF / On		
		CC	UL	dL	Fr
		EUr			
	Password				
	EU				

3.4.1 “Main Display” Menu

‘Main *Display*’ refers to the contents of the *default display*, i.e. when *keys* are not used.

In Energy ST500, the main *display* can be customized to suit personal requirements. The various contents can be selected from the “disp” menu which is opened by pressing and holding the [set] key for more than 3 seconds. The main *display* can be selected from:

- *analogue inputs* Ai1, Ai2, Ai3, Ai4 (when configured as *digital inputs*, the *display* will be defined on the basis of the state and logical parameter - digital input associations)
- rtC,
- Setpoint
  - SetP= set from parameter,
  - Setr= real with any decalibration;

Step by step instructions are provided below.

	To open the [disp] menu to modify the main *display* setup, press and hold the set key for at least 3 seconds. [set]
	Opens the blinking menu for the previous *display* (rtC, i.e. current time, in this case).
	To modify the *display*, use the “up” and “down” *keys* to scroll the menu and press the set key to confirm.
	On selection of your preferred *display*, press the set key to confirm. You will be automatically returned to the main *display* set.

3.4.2 “Operating Mode” menu

Instructions are provided below on how to change the operating mode.
There are three different *operating modes*:

- Standby mode (StbY)
- Heat mode (HEAT)
- Cool only mode (COOL)

	**For example, let's say you want to change from StbY to COOL mode** To change operating mode, press and hold the mode key for at least 2 seconds PS The main *display* is set as rtc (current time)
	A blinking menu will open containing the values StbY (standby), HEAt (heat) and COOL (cool).
 	Select your required operating mode and press the set key.
	You will be automatically returned to the main *display* and you will see that the Stby LED that was previously on has gone off and the COOL LED has come on.

3.4.3 'States' menu

From the states menu you can view values for each resource.
For some resources, a "dynamic" view is possible.

- For example, when declared as not present / probe not configured (see System Configuration chapter (*folder* Par/CF), parameter *CF01*=0), analogue input AI2 will not be displayed.
- For example the hours of functioning of compressor 2 - *CP02* – not available on single compressor machines.

Label							Visibility	Description	Change
Ai	Ai1	Ai2	Ai3	Ai4	//	//	Dynamic	*Analogue inputs*	//
di	di1	di2	di3	di4	di5	//	Dynamic	*Digital inputs*	//
AO	AO1	AO2	AO3	//	//	//	Dynamic	*Analogue outputs*	//
dO	dO1	dO2	dO3	dO4	dO5	dO6	Dynamic	*Digital outputs*	//
CL	HOUr	dAtE	YEAr					Clock	YES
AL	Er00	....	...	...	...	Er99	Dynamic	*Alarms*	//
SP	Value	//	//	//	//	//		Setpoint (set)	YES
Sr	Value	//	//	//	//	//		Real setpoint	//
Hr	*CP01*	*CP02*	PU01	PU02	//	//	Dynamic	Running time (hoursx10) compressor/pumps	YES

As you will be able to see from the table, the setpoint SP and time can be modified and viewed:

3.4.3.1 View Inputs/Outputs (Ai, di, AO, dO)

	Press the set key from the main *display*
	**Example of view for *Analogue Inputs* The same procedure applies for all other I/Os. ***** The *label* Ai will appear on the *display*. (Use the UP and DOWN *keys* to scroll the other labels until you find the *label* required)
	Press the set key to view the *label* for the first analogue input (Ai01in this case)
	Press the set key again to view the value in Ai01. Note that the °C icon lights up to indicate that the value shown is in degrees centigrade. ***For *digital inputs* / *analogue outputs* configured as digital (DI), the value will be 0/1 (0 indicates Off, 1 indicates On) ---------- Press the esc key to go back to the main *display*.

3.4.3.2 Setting the clock (CL)

Energy ST500 has a clock (RTC) to run the alarm log.
Instructions are provided below on how to set the time: the same procedure applies to change the date and year.

	To change the clock on your machine, press the set key from the main *display*.
	Pressing the set key once will open a list of the various folders. Use the “UP” and “DOWN” *keys* to find the CL *folder*.
	Press the set key to open the CL menu.

On entering this menu, you will see HOUr. Use the “UP” and “DOWN” *keys* to select the time, date or year.

Once you have decided what you want to set, press the [set]** key to open the modification menu for the variable selected.
**press and hold for about 3 seconds

To set the time, date and year, use the “UP” and “DOWN” *keys* to enter the required value.

Press the Esc key to exit the set clock menu and go back to the main *display*.

3.4.3.3 Alarm Display (AL)

	Press the set key from the main *display*
	The *label* Ai will appear on the *display*. Use the UP and DOWN *keys* to scroll the other labels until you find the AL *label*
	Press the set key to view the *label* of the first active alarm (if it exists)
	In this case, the first alarm is Er01. Use the UP and DOWN *keys* to scroll any other *alarms*. --- N.B: the menu is not cyclical. For example, if the active *alarms* are ER01, Er02 and Er03, the *display* will show: Er01 ->Er02->Er03 <-Er02<-Er01 N.B: -> UP, <-DOWN Press the esc key to go back to the main *display*.

3.4.3.4 Example of how to set the setpoint (SP)

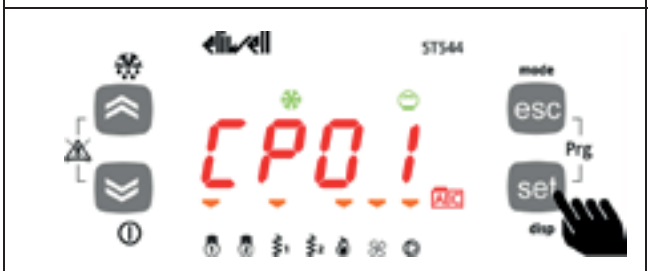
By way of example, we will change the setpoint value in COOL mode by 12.0 degrees centigrade to12.5 degrees centigrade.

	To change the setpoint on your machine, press the set key from the main *display*.

	Pressing the set key once will open a list of the various folders. Use the “UP” and “DOWN” *keys* to scroll the menu and find the SP *folder*.
	Press the set key to open the SP *folder*.
 	The first screen you see will be the COOL mode then the HEAT mode, using the “up” and “down” *keys* to scroll (shown beside each view).
	Let's say you want to change the COOL mode setpoint. Select COOL from the menu, then press the set key.
	The device will show the current machine setpoint, which in this case is 12.0 degrees centigrade). Use the “up” and “down” *keys* to increase or decrease it. For example, if you want to change the setpoint to 12.5 degrees, press the "up arrow" key until you reach the required value.

	Once you have reached the required setpoint, press the set key. The device will save the value 12.5.
	To get back to the main *display*, press the esc key or allow a 15 second timeout to elapse for each menu.

3.4.3.5 View and Reset compressor/pump time

	**Example *display* and reset time (hours x10) for Pump 2** Press the set key from the main *display*
	The *label* Ai will appear on the *display*. Use the UP and DOWN *keys* to scroll the other labels until you find the Hr *label*.
	Press the set key to view the first *label* - which in this case is the running time for compressor 1 (*CP01*)
	Scroll with the UP and DOWN *keys* to view (if the relative resources are present) the running time for compressor 2 (*CP02*) the pump running time (PU01, PU02)/ Press the set key to view the pump running time PU02.

	The tens of hours of functioning are 2. (Hours expressed in tens: 2 means 20 hours of operation). To clear pump running time PU02, press and hold the [set] key. To reset the hours of functioning of pump PU02, press and hold [set]. Note: Repeat the procedure described to reset the hours of functioning of the other resources. --- Press the esc key to go back to the main *display*.

3.4.4 Programming menu

Label						Description	Change	Comments
PAr	CF	Ui	St	...	Al	Parameters		
FnC	dEF	tA	St	CC	EUr	Functions		See Functions chapter (*folder* FnC)
PASS						Password		
EU	Eu00	...	...	...	...			

3.4.4.6 Parameters (folder PAr)

Modifying a parameter

Instructions are provided below on how to change a machine parameter. By way of example, let's look at the CF configuration parameters *folder*, parameter *CF00* (*folder* PAr/CF/*CF00*).

	Press the esc and set *keys* together to open the parameters menu. This will open the PAr menu.
	The PAr parameters menu contains all device parameters. Press the set key to view all folders.
	The first *folder* shown for the device is the CF configuration *folder*. Simply press the set key again to modify individual CF parameters.

	The *CF00* parameter will be shown on the device (factory *default* settings). Press the "up" key to scroll the various parameters or move to the next parameter (*CF01* in this case) or the "down" key to go back to the previous parameter (*CF47* in this case). *CF00*->*CF01*->*CF02*->...->*CF47*->*CF00* *CF47*<-*CF00*<-*CF01*->...<-*CF46*<-*CF47* N.B: -> UP, <-DOWN
	Press the set key to view the value of the parameter (*CF00* in this case).
	For parameter *CF00*, the value shown will be 2. Press the "up" and "down" *keys* to modify this value.
	Press the set key once you have entered the required value. ** Press the esc key to exit this *display* and go back to the previous level. **N.B. pressing the set key will confirm the value entered. Pressing the esc key will take you back to the previous level <u>without saving the value entered.</u>

3.4.4.7 Functions (FnC folder)

See Functions chapter (*folder* FnC)

3.4.4.8 Entering a password (PASS folder)

Levels of visibility
Four levels of visibility can be set by assigning suitable values to each parameter and *folder*, by **<u>serial, software</u>** (Param Manager or other communication softwares) **<u>or by programming key.</u>**
The visibility levels are:

- Value 3 = parameter or *folder* always visible
- Value 2 = **manufacturer level;** these parameters can only be seen by entering the manufacturer's password (see parameter *UI18*) (all parameters specified as always visible, parameters that are visible at the installation level, and manufacturer level parameters will be visible).
- Value 1 = **installation level**; these parameters can only be viewed by entering the installation password (see parameter *UI17*) (all parameters specified as always visible and parameters that are visible at the installation level will be visible)
- Value 0 = parameter or *folder* NOT visible

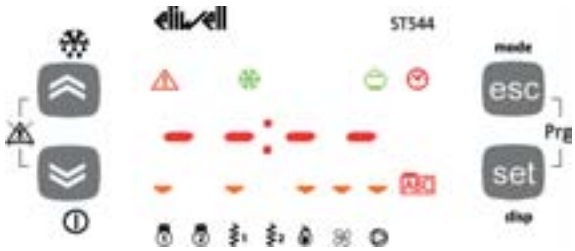
1. Parameters and/or folders with visibility level <>3 (i.e. password protected) will only be visible if the correct password is entered (installation or manufacturer) following the procedure outlined below:
2. Parameters and/or folders with visibility level =3 are always visible and no password is required; in this case, the procedure below is not required.

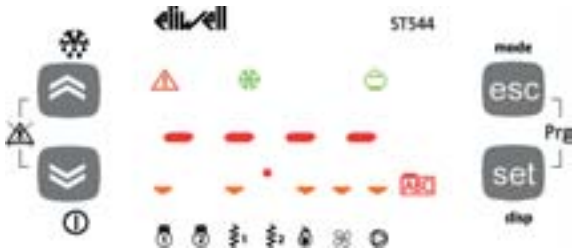
To view parameters visible for the given password, open the PASS *folder* (press esc and set together [esc+set] from the main *display* and search the *folder* using the up/down *keys*) and set the PASS value.

	Press the esc and set *keys* together from the main *display* to enter the PASS *folder*. [esc+set]
	Pressing the two *keys* will open the menu containing the list of folders. Use the “up” and “down” *keys* to scroll the list until you find the PASS *folder*.
	Press the set key to open the PASS *folder*. Enter the password (installation or manufacturer) from here, press the set key and exit. Now open and view parameters to change a value (see parameters chapter).

3.4.4.9 Alarm events (EU folder)

	Press the esc and set *keys* together from the main *display* to enter the PASS *folder*. [esc+set]
	Pressing the two *keys* will open the menu containing the list of folders. Use the “up” and “down” *keys* to find the EU *folder*.

	Press set to view the last alarm event - if it exists – EU00. N.B: EU00 indicates the last alarm recorded, EU01 the second last, and so on. Scroll with the UP and DOWN *keys* to view (if present) any other alarm events.
	Press the set key again to view details of the selected event (EU00 in this case).
	The first *label* will be shown (alarm code). With the UP and DOWN *keys* you can scroll: **Alarm code** (as previously indicated)
	**Alarm start time**
	**Alarm start date**
	**Alarm stop time** (in this case, the alarm is still active)

	**Alarm stop date** (in this case, the alarm is still active)
	**Type of alarm** (Automatic) or alternatively (manual)
	

4 SYSTEM CONFIGURATION (FOLDER PAR/CF)

Before doing anything, make sure the device is connected to a suitable external *transformer*. The following rules must be followed when connecting cards to each other and to the application:

- **Loads that exceed the maximum limits set forth herein must not be applied to outputs;**
- **When connecting loads, follow connection diagrams carefully;**
- **To avoid electric pairings, wire all low SELV utilities separately from high voltage ones.**

(°) SELV: SAFETY EXTRA LOW VOLTAGE

Instrument configuration is determined by the values of the parameters associated with inputs and outputs.

4.1 Configuration of analogue inputs

Analogue inputs

The *analogue inputs* referred to below as AI1...AI4 are 4 in total.
A further analogue input Ai5 is available on the terminal.
Using the parameters, a physical resource (probe, digital input, voltage/current signal) can be "physically" configured for each type of input:

- 4 inputs can be configured as *temperature probes*, an NTC type probe, or as *digital inputs*.
- 2 inputs (AI3., AI4) can be configured as *temperature probes*, an NTC type probe, as *digital inputs* or current/voltage input (signal 4-20mA / 0-10V, 0-5V, 0-1V).

A "logical" meaning can also be associated to each analogue input using the relevant parameter.
Inputs can be "physically" configured as specified in the table below.

Analogue inputs: Configuration table

Parameter	Description	Value						
		0	1	2	3	4	5	6
CF00	Type of input analogue AI1	Probe not configured	Probe configured as no voltage digital input	NTC sensor	//	//	//	//
CF01	Type of input analogue AI2	Probe not configured	Probe configured as no voltage digital input	NTC sensor	//	//	//	//
CF02	Type of input analogue AI3	Probe not configured	Probe configured as no voltage digital input	NTC sensor	4-20 mA	0-10 V	0-5 V	0-1 V
CF03	Type of input analogue AI4	Probe not configured	Probe configured as no voltage digital input	NTC sensor	4-20 mA	0-10 V	0-5 V	0-1 V
CF73	Type of input analogue AI5	Probe not configured	Not used	NTC sensor	//	//	//	//
			See *Configuration of digital inputs*					

N.B: // indicates that value is not present

Analogue input AI	Parameter	*Range*	Description
AI3	***CF04***	*CF05*...99.9	Analogue input AI3 full scale value
AI3	***CF05***	-50.0...*CF04*	Analogue input AI3 start of scale value
AI4	***CF06***	*CF07*...99.9	Analogue input AI4 full scale value
AI4	***CF07***	-50.0...*CF06*	Analogue input AI4 start of scale value

The values read by *analogue inputs* can be configured in parameters *CF08*...*CF11*

Parameter	Description	Unit of measure	*Range*
CF08	Analogue input AI1 differential	°C	-12.0..12.0
CF09	Analogue input AI2 differential	°C	-12.0..12.0
CF10	Analogue input AI3 differential	°C / Bar	-12.0..12.0
CF11	Analogue input AI4 differential	°C / Bar	-12.0..12.0
CF76	Analogue input AI5 differential	°C	-12.0..12.0

Study the following tables:

Table A – parameter association - *configuration of analogue inputs*

Parameter	Description	Value	Description	Notes
CF12	Configuration of analogue input AI1	0...6	See table B	If *CF00*=1 (AI1 configured as DI), set *CF12*=0
CF13	Configuration of analogue input AI2	0...6	See table B	If *CF01*=1 (A2 configured as DI) set *CF13*=0
CF14	Configuration of analogue input AI3	0...11	See table B	If *CF02*=1 (AI3 configured as DI) set *CF14*=0
CF15	Configuration of analogue input AI4	0...11	See table B	If *CF03*=1 (AI4 configured as DI) set *CF15*=0
CF77	Configuration of analogue input AI5	0...2	See table B	

Table B – analogue input logical meaning & parameter values *CF12*...*CF15*

Analogue input AI	Analogue input AI5 on terminal	Value	Description
AI1 AI2 AI3 AI4	AI5	0	Probe disabled
AI1 AI2 AI3 AI4	AI5	1	Internal exchanger water/air inlet temperature
AI1 AI2 AI3 AI4	AI5	2	Internal exchanger water/air outlet temperature
AI1 AI2 AI3 AI4	AI5	3	External exchanger temperature
AI1 AI2 AI3 AI4	AI5	4	External exchanger inlet water temperature
AI1 AI2 AI3 AI4	AI5	5	External exchanger outlet water temperature
AI1 AI2 AI3 AI4	AI5	6	External temperature
AI3 AI4	//	7	High pressure input
AI3 AI4	//	8	Low pressure input
AI3 AI4	//	9	Dynamic setpoint input
AI3 AI4	//	10	External exchanger pressure
AI3 AI4	//	11	Internal exchanger pressure

N.B: // indicates that value is not present

4.2 Configuration of digital inputs

Digital inputs

The no voltage *digital inputs* referred to below as DI1...DI5 are 5 in total.
These can be added to by AI1...AI4 if the latter are configured as *digital inputs* (via parameters *CF23*...26 respectively).

A total of 8 *digital inputs* is thus available.

Study the following tables:

Table A – parameter association - *configuration of digital inputs*

Parameter	Description	Value	Description	Notes
CF16	Configuration of digital input DI1	-32...+32	See table B	
CF17	Configuration of digital input DI2	-32...+32	See table B	
CF18	Configuration of digital input DI3	-32...+32	See table B	
CF19	Configuration of digital input DI4	-32...+32	See table B	
CF20	Configuration of digital input DI5	-32...+32	See table B	
CF23	Configuration of analogue input AI1 if configured as a digital input	-32...+32	See table B	Set to 0 if AI1 is NOT configured as a DI
CF24	Configuration of analogue input AI2 if configured as a digital input	-32...+32	See table B	Set to 0 if AI2 is NOT configured as a DI
CF25	Configuration of analogue input AI3 if configured as a digital input	-32...+32	See table B	Set to 0 if AI3 is NOT configured as a DI
CF26	Configuration of analogue input AI4 if configured as a digital input	-32...+32	See table B	Set to 0 if AI4 is NOT configured as a DI

Digital inputs: Configuration table

Table B – *Digital inputs: Configuration table*

The polarity of:
is defined as listed below:

	Value	Description
+	Positive	Active when contact closed
-	Negative	Active when contact open

Value	Description	Notes
0	Input disabled	
±1	High pressure pressure switch	
±2	Low pressure pressure switch	
±3	External exchanger fan thermoswitch	
±4	Internal exchanger fan thermoswitch	
±5	Internal circuit flow switch	
±6	External circuit flow switch	
±7	Compressor 1 thermoswitch	
±8	Compressor 2 thermoswitch	
±9	Internal circuit pump thermoswitch	
±10	External circuit pump thermoswitch	
±11	Compressor 1 oil pressure switch	
±12	Compressor 2 oil pressure switch	
±13	Remote ON/OFF	*Local ON/OFF* has no impact
±14	Remote Summe*r/W*inter	See also *digital temperature control*
±15	Power step 1 request	See also *digital temperature control*
±16	Power step 2 request	See also *digital temperature control*
±17	Auxiliary electric heater thermoswitch	
±18	Digital input heat step 1 request	See also *digital temperature control*
±19	Digital input heat step 2 request	See also *digital temperature control*
±20	Digital input cool step 1 request	See also *digital temperature control*
±21	Digital input cool step 2 request	See also *digital temperature control*
±22	End of defrost	
±23	Internal exchanger electric heater 1 thermoswitch	
±24	Internal exchanger electric heater 2 thermoswitch	
±25	External exchanger electric heater thermoswitch	
±26	Economy input	
±27	Remote STD-BY	
±28	General alarm	
±29	Block compressor 1	
±30	Block compressor 2	
±31	Power limited to 50%	
±32	*Block heat pump*	

If more than one parameter in the table is configured with the same value, the function is activated when at least one of the inputs is piloted (OR LOGICAL).

4.3 Configuration of digital outputs

Digital outputs

See the chapter on *electrical Connections* for the number and capacity of relays/open collectors and for information on the symbols used on labels supplied with the device.

- High voltage outputs (relays) are identified as DO1, DO2, DO3, DO4 and D06.
- The low voltage (SELV), open collector output is called DO5.

All *digital outputs* can be configured as outlined in the table below:

Table A – parameter association - configuration of outputs

Parameter	Description	Value	Description	Notes
CF45	Configuration of digital output DO1	-13...+13	See table B	Present in all *models*
CF46	Configuration of digital output DO2	-13...+13	See table B	Present in all *models*
CF47	Configuration of digital output DO3	-13...+13	See table B	Present in all *models*
CF48	Configuration of digital output DO4	-13...+13	See table B	Present in all *models*
CF49	Configuration of digital output DO5	-13...+13	See table B	Present in all *models* **(Open collector ouput)**
CF50	Configuration of digital output DO6	-13...+13	See table B	Present in *models* with 5 relays
CF51	Configuration of digital output AO1	-13...+13	See table B	See table A – *Analogue outputs* and *Models* ***CF34*=0 - *CF43***
CF52	Configuration of digital output AO2	-13...+13	See table B	See table A – *Analogue outputs* and *Models* ***CF35*=0 - *CF44***

Table B – Outputs: Configuration table
The polarity of:
is defined as listed below:

	Value	Description
+	Positive	Active when contact closed
-	Negative	Active when contact open

Relay and open collector output: Configuration table

Value	Description
0	Output disabled
±1	Compressor 1
±2	Output step 2
±3	Internal circuit water pump
±4	External circuit water pump
±5	Reversing valve
±6	Boiler
±7	Internal circuit electric heater 1
±8	Internal circuit electric heater 2
±9	External circuit electric heater
±10	Auxiliary electric heater
±11	External exchanger fan
±12	Recirculation fan
±13	Alarm

If multiple outputs are configured to run the same resource, the outputs will be activated in parallel.

4.4 Configuration of analogue outputs

Analogue outputs

See the chapter on Electric Connections for the number and type of *analogue outputs* used and for information on the symbols used on labels supplied with the device.

There are 4 *analogue outputs*. 1 high voltage one and 3 low (SELV) voltage ones, the exact number depending on the following *models* and with the following characteristics:

Table A – *Analogue outputs* and *Models*

	High voltage	SELV		*Models*					
Output	**2A 230V**	**PWM**	**0-10V / 4..20mA**	**ST542/C**	**ST543/C**	**ST544/C**	**ST551/C**	**ST552/C**	**ST553/C**
TC1	●			●	●	●			
AO1		●		●	●	●	●	●	●
AO2		●			●	●		●	●
AO3			**?**			●			●

***Triac* analogue output (TC1)**

Available only in *models* with 4 relays
High voltage output generally used to pilot fans or water pumps.
The output can be configured for proportional operation (constant speed variation) or as ON/OFF.

Remote control switches downstream from the *Triac* are NOT permitted.

The TC1 output can be configured as described in the table "*Analogue Output TC1 - AO1 AO2 : configuration table*"

Configuration of low voltage (SELV) analogue output

- AO1 always available
  - If configured as digital, see parameter *CF51*
- AO2 see *models* chapter
  - If configured as digital, see parameter *CF52*

  They can be configured as:
  - PWM (via CFS modules) or
  - open collector (On/Off).

- AO3 - low voltage (SELV) output to pilot external modules to run fans
  Can be used to pilot 4-20mA fans or 0-10V fans (via parameter *CF30*)

To configure, see the table below. All *analogue outputs* can be configured as digital or proportional.

Table B – *Analogue Outputs* – Configuration parameters

Analogue output TC1 - AO1 AO2 : Configuration table

Output	Parameter	Description	Values	Notes
TC1 Only on *models* where this is provided.	***CF33***	Enabling analogue output TC1	0= Output configured as 'digital' 1= Output configured as *triac* (proportional)	If=1 see parameters *CF36* – *CF39* – *CF42*
	CF36	*Phase shift* analogue output TC1	0...90	Has a meaning if ***CF33*=1** *phase shift* values to pilot *Triac* with cut-off in the event of inductive loads.
	CF39	Analogue output TC1 *pulse length*	5...40 units (347...2776 µs)	Has a meaning if ***CF33*=1** *pulse length* to pilot *Triac* (1 unit = 69.4 µs).
	CF42	Configuration of analogue output TC1	-13...+13 if digital (see polarity) 14...15 if proportional	See table entitled Configuration of analogue output
AO1	***CF34***	Enabling analogue output AO1	0= Output configured as 'digital' 1= Output configured as *Triac* (for pulse pilot)	If=1 see parameters *CF37* – *CF40* - *CF43*
	CF37	*Phase shift* analogue output AO1	0...90	Active if ***CF34*=1**
	CF40	Analogue output AO1*pulse length*	5...40 units (347...2776 µs)	Active if ***CF34*=1** (1 unit = 69.4 µs).
	CF43	Configuration of analogue output AO1	-13...+13 if digital (see polarity) 14...15 if proportional	See table entitled Configuration of analogue output
AO2 Only on *models* where this is provided.	***CF35***	Enabling analogue output AO2	0= Output configured as 'digital' 1= Output configured as *Triac* (for pulse pilot)	If=1 see parameters *CF38* – *CF41* - *CF44*
	CF38	*Phase shift* analogue output AO2	0...90	Active if ***CF35*=1**
	CF41	Analogue output AO2 *pulse length*	5...40 units (347...2776 µs)	Active if ***CF35*=1** (1 unit = 69.4 µs).
	CF44	Configuration of analogue output AO2	-13...+13 if digital (see polarity) 14...15 if proportional	See table C entitled Configuration of analogue output

Low voltage (SELV) analogue output AO3: Configuration table

Output	Parameter	Description	Values	Notes
AO3 Only on *models* where this is provided	***CF27***	Type of output analogue AO3	0=0-10V analogue output - voltage 1=4-20mA Analogue output - current 2=0-20mA Analogue output - current	See table entitled Configuration of analogue output
	CF30	Configuration Analogue output AO3	-13...+13 if digital (see polarity) 14...15 if proportional	Modulated piloting or on/off via 10V external relay

Note:

- Parameters *CF37 CF38 CF40 CF41* have a meaning only if the outputs have been configured as *Triac* outputs (proportional).
- *Range CF39*/*CF40*/*CF41*: 5...40 units or 347...2776 µs (1 unit = 69.4 µs).

Parameters *CF37*- *CF42* – *CF43* – *CF44* see table C
Indicate the logical meaning of *Triac analogue outputs*.

The following can be piloted:

- loads with output modulation (values from 14 to 16) or
- loads with on/off type switching using
  - the *Triac* as switch (TC1 AO1 AO2)
  - the output as switch 0-10V (AO3)

Table C – *Analogue Outputs*: Configuration table

Polarity is defined below:

	Value	Description
+	Positive	Active when contact closed
-	Negative	Active when contact open

Analogue output configuration table

	Value	Description	Type
	0	Output disabled	//
See also Input/Output Polarity	±1	Compressor 1	Digital (ON/OFF)
	±2	Output step 2	
	±3	Internal circuit water pump	
	±4	External circuit water pump	
	±5	Reversing valve	
	±6	Boiler	
	±7	Internal circuit electric heater 1	
	±8	Internal circuit electric heater 2	
	±9	External circuit electric heater	
	±10	Auxiliary electric heater	
	±11	External exchanger fan	
	±12	Recirculation fan	
	±13	Alarm	
	14	External exchanger fan	Proportional
	15	Not permitted	//
	16	Modulating pump circuit	Proportional

4.5 Serial configurations – Protocol parameters

Present on all 2 serial *models*:

- TTL: channel for
  - o *Multi Function Key* connection to up/download parameters
  - o serial communication with personal computer
- KEYB: channel for serial communication with standard Eliwell terminal. 12 VDC power supply (2400, and ,8,1).

Serial TTL - referred to as COM1 – can be used to

- configure parameters with Param Manager software using Eliwell protocol
- configure device parameters, states, and variables with Modbus via Modbus protocol
- supervise using *VarManager* software via Modbus protocol.

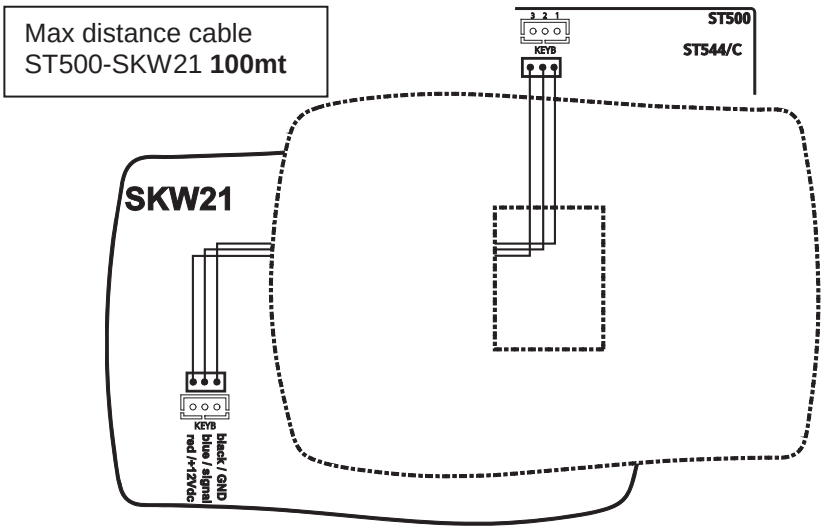
See the table below:

Parameter	Description	Value	
		0	**1**
CF54	**Select COM1 (TTL) protocol**	Eliwell	Modbus
Parameter	**Description**	***Range***	
CF55	**Eliwell protocol controller address**	**0...14**	
CF56	**Eliwell protocol controller family**		
CF63	**Modbus protocol controller address**	**1...255**	
Parameter	**Description**	**Values**	
CF64	**Modbus protocol Baudrate**	• 0=1200 baud • 1=2400 baud • 2=4800 baud • 3=9600 baud • 4=19200 baud • 5=38400 baud • 6=58600 baud • 7=115200 baud	
CF65	**Modbus protocol parity**	• 0= STX • 1= EVEN • 2= NONE • 3= ODD	

4.6 Output for terminal

KEYB – this output manages the LCD terminal with integrated room temperature control

Refer to the following connection diagram:



wiring ST500	wiring SKW21	description
1	GND / black	Ground / Black
2	Signal / Blue	Signal / blue
3	+12Vdc /red	12V~ Supply from ST500
KEYB	-	KEYBoard (terminal) Max distance 100mt

For more information:
--> See instruction sheet 9IS24081 SKW21 LCD terminal / Terminale LCD / GB-I
--> See manual
- **8MA00210 SKW21 Terminale LCD ITA**
- **8MA10210 SKW21 LCD Terminal GB**

5 OPERATING MODES – TEMPERATURE CONTROL (FOLDER PAR/TR)

Temperature control parameters can be viewed and configured in *folder* **tr** (see User Interface and Parameters chapter).

Compressor control – Temperature control
Energy ST500 has three types of temperature control:
Temperature control parameters can be viewed and configured in *folder* **tr** (see User Interface and Parameters chapter).
The type of temperature control can be configured in parameter *tr00*:

- **Proportional:** Calculates the power the unit must supply in relation to the distance of the ai*r/w*ater temperature from the setpoint.
  - o *tr00*=0 *Proportional temperature control*
- **Differential:** Calculates the power the unit must supply in relation to difference in temperature between two *analogue inputs*
  - o *tr00*=1 *Temperature control differential*
- **Digital (motor condensing)**
  - o *tr00*=2 *Digital temperature control*

The regulation algorithm calculates the load to be supplied through the compressors for both heating and cooling.

Instructions are provided in the following sections on how to set parameters used to control utilities based on temperature/pressure readings taken by the probes.

Regulation algorithm in cool mode

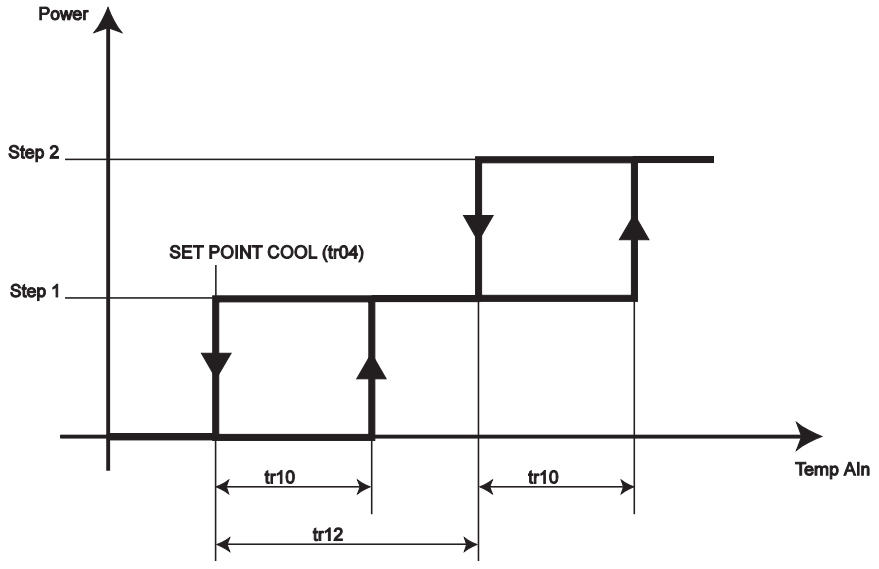
5.1 Proportional temperature control

5.1.1 Proportional temperature control in COOL mode

The compressor is controlled by an analogue input and by the cooling setpoint.
Cooling setpoint: this is the reference setpoint when the device works in cool mode.

The probe **AIn** used by the temperature regulator can be selected in parameter ***tr02*.**

Proportional diagram in COOL



N.B: Always set *tr12*> *tr10*

Power	power
***Step 1**	Step 1
***Step 2**	Step 2
***Only for machines with two compressors or partialized compressor.**	
AIn temp.	temperature read by the probe selected for temperature control in Cool.

Regulation algorithm in heat mode

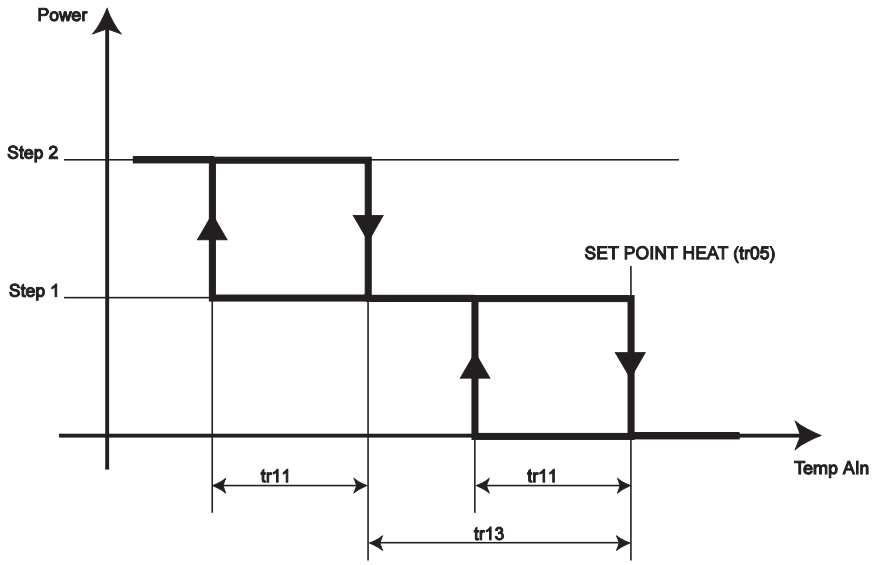
5.1.2 Proportional temperature control in HEAT mode (HEAT PUMP)

The compressor is controlled by an analogue input and by the Heating setpoint.
Heating setpoint: this is the reference setpoint when the device works in heat mode.

N.B.: temperature control is enabled in HEAT mode only if: ***tr01*** **(enable heat pump) = 1 (heat pump present)**
See also *Block Heat Pump*

Probe **AIn** used in temperature control can be selected in parameter ***tr03***:

Proportional diagram in HEAT



N.B: Always set *tr13*> *tr11*

Power	power
***Step 1**	Step 1
***Step 2**	Step 2
***Only for machines with two compressors or partialized compressor.**	
AIn temp.	temperature read by the probe selected for temperature control in Heat.

A compressor will always be off if:

- It is not associated with a relay (power output)
- Compressor block active (see alarm table)
- Safety timing is in progress
- The boiler is active
- A time delay is active between pump on and compressor on (*safety timings*)
- Preventilation is in progress in cooling mode
- Energy ST500 is on standby or off
- *CF12*...15 = 0 (probe absent)

5.2 Temperature control differential

Temperature control differential can be enabled by configuring *tr00*=1.
The purpose of the *temperature control differential* is, for example, to make sure that the difference between the external temperature and the temperature of a liquid that is being heated or cooled is always the same. To do this, the difference between the values read by probe 1 and by probe 2 are used (temperature control value = probe 1 – probe 2); the probes used for temperature control can be selected by configuring parameters *tr14* and *tr15* appropriately:

Temperature control in Cool mode - Parameter *tr14*
Configuration of probes used in the *temperature control differential* - see table:
Temperature control depends on the set-point set for Cool mode and the differential value equal to probe 1 – probe 2

Temperature control in Heat mode – Parameter *tr15*
Temperature control depends on the set-point set for Heat mode and the differential value equal to probe 1 – probe 2

COOL	HEAT	Value	Probe 1	Probe 2
tr14 Select probe for *temperature control differential* in Cool	***tr15*** Select probe for *temperature control differential* in Heat	0	NTC input for internal exchanger water/air inlet temperature **(*CF12*...*CF15*=1)**	NTC input Outdoor temperature **(*CF12*...*CF15*=6)**
		1	NTC input for internal exchanger water/air outlet temperature **(*CF12*...*CF15*=2)**	
		2	NTC input for external exchanger water/air inlet temperature **(*CF12*...*CF15*=3)**	
		3	NTC input for external exchanger water/air outlet temperature **(*CF12*...*CF15*=4)**	

5.3 Digital temperature control

Digital temperature control can be enabled by configuring *tr00*=2.
The operating mode selected and power required depend on the state of *digital inputs* configured for this type of temperature control.
Safety timings, settings (compressor ON delay, pump ON, ..) and *alarms* are normally active.
See the table below for the parameter - digital input configuration association for this function. For the full list, see the chapter entitled *System Configuration (folder Par/CF)* – subchapter *Configuration of Digital Inputs* - Table A.

Parameters	Value		
CF16*..*CF20 ***CF23*..*CF26***	±14	Remote Summe*r/W*inter	Type 1 thermostat
	±15	Power step 1 request	
	±16	Power step 2 request	
	±18	Digital input heat step 1 request	Type 2 thermostat
	±19	Digital input heat step 2 request	
	±20	Digital input cool step 1 request	
	±21	Digital input cool step 2 request	

Digital input configuration depends on the type of thermostat used.
N.B.:

- If two *digital inputs* have been configured as request step 1 heat and step 1 cool, when activated at the same time, a configuration error occurs;
- If a digital input has been configured as request heat and the digital input for summe*r/w*inter is in the summer position, a configuration error occurs;
- Temperature control depends directly on the activation of *digital inputs* which must be activated in a logical sequence. For example, power steps must be activated and deactivated in the fixed sequence 1-2 and 2-1.

5.4 Block heat pump

The *block heat pump* function allows **energy savings** by disabling the heat pump in specific operating conditions, such as:

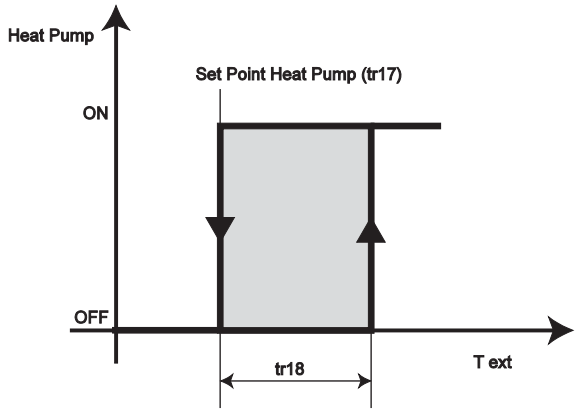
- when the installation is not working efficiently due to the external temperature **(*Block heat pump* by external temperature)**
- when on account of the particular electricity supply agreement it would be useful to disable the heat pump at peak charge times **(*Block heat pump* with digital input)**

5.4.1 Block heat pump based on external temperature and/or parameter

If the external temperature is too low, heat pump performance will not be acceptable; hence, you can:

- Block the heat pump from parameter *tr16*:
- Set a set point (*tr17*) below which the heat pump will be disabled.

When the heat pump is blocked, the setpoint differentials for heaters in integrated use and boiler will be forced to zero.



Heat Pump	Heat pump state
T ext	External temperature

5.4.2 Block heat pump from digital input

If a digital input is configured as "*Block heat pump*" ***CF16..CF20*** **/** ***CF23..CF26*****=32** when it is activated, the heat pump will be deactivated.
When the heat pump is blocked, the setpoint differentials for heaters in integrated use and boiler will be forced to zero.

5.5 Economy function

The parameters for this function are as follows:

tr19	Setpoint differential in Cool from start of Economy
tr20	Setpoint differential in Heat from start of Economy

In Energy ST500, a digital input (DI1...DI5 or AI1...AI4 configured as *digital inputs*)) can be configured as Economy Input (*CF16*..C20, *CF23*...*CF26*=+26/-26)
If a digital input configured as Economy is active*, an offset is added to the operating setpoint (positive or negative). See the table below:

	Setpoint**	
	Cool	**Heat**
Digital input NOT ACTIVE (depending on polarity) *CF16*..C20, *CF23*...*CF26*= +26/-26	Cool setpoint	Heat setpoint
Digital input ACTIVE* (depending on polarity) *CF16*..C20, *CF23*...*CF26*=+26/-26	Cool setpoint + offset **(Cool setpoint + *tr19*)**	Heat setpoint + offset **(Heat setpoint + *tr20*)**

*active when contact open or closed, depending on polarity (i.e. positive or negative sign). See *Configuration of Digital Inputs*
**The cool and heat setpoints represent the real operating setpoints (i.e. those set in parameters *tr04* and *tr05* respectively), including any function decalibration enabled (such as the dynamic setpoint for example).

6 OPERATING STATES (FOLDER PAR/ST)

Once the installation has been configured, Energy ST 500 is ready to control utilities based on the temperature and pressure conditions read by the probes and the temperature control functions defined in the relative parameters.

Operating mode parameters can be viewed and configured in *folder* **St** (see User Interface and Parameters sections).

When EnergyST500 is not OFF or on StdBy, it is in heat or cool mode.

Operating modes

Three *operating modes* can be set in parameter *St00*:

- *St00*=0 Cool only **COOL**
- *St00*=1 Heat only **HEAT**
- *St00*=2 Heat and cool **HEAT + COOL**

Operating modes

Each operating mode is associated to operating states.
Operating states can be selected:

- from the keyboard - if *keys* are enabled in parameters:
  - UI 11 **Enable MODE function from key** To enable or disable the selection of operating mode from a key..
  - UI 13 **Enable ON/OFF from key.** To enable or disable the ON/OFF key to switch the device on or off.
- From appropriately configured *digital inputs*:
  - i.e. Remote ON/OFF
  - Remote STD-BY

		Operating mode		
		COOL	**HEAT**	**HEAT+COOL**
Operating state	Cooling	x	**NA**	x
	Heating	**NA**	x	x
	Standby (Stdby)	x	x	x
	Remote Standby (Stdby)	x	x	x
	OFF	x	x	x
	Remote OFF	x	x	x

If different states are requested at the same time, the following priorities are assigned (in increasing order):

		Current operating mode (current mode)			Operating mode after request
	Priority	**COOL**	**HEAT**	**HEAT+COOL**	
Action	1	Digital input configured as ON/OFF (§)	Digital input configured as ON/OFF (§)	Digital input configured as ON/OFF (§)	Remote OFF (§)
	2	ON/OFF key enabled (press and hold DOWN key)	ON/OFF key enabled (press and hold DOWN key)	ON/OFF key enabled (press and hold DOWN key)	OFF
	3	Digital input configured as Standby	Digital input configured as Standby	Digital input configured as Standby	Standby
	4	Mode key enabled (press and hold ESC key)	Mode key enabled (press and hold ESC key)	NA	Mode selected by user (see mode, change mode key)
	4'	NA	NA	Mode key enabled (*)	Standby (*)
	5	NA	NA	Select mode (**)	(**)
	6	NA	NA	Mode key enabled (press and hold ESC key)	Mode selected by user (see mode, change mode key)

(§) In this case the key [*local ON/OFF*] has no effect on the operating mode

(*) it will not be possible to switch from COOL mode to HEAT mode (HEAT *label* not visible by pressing and holding ESC key (Mode, change mode function))

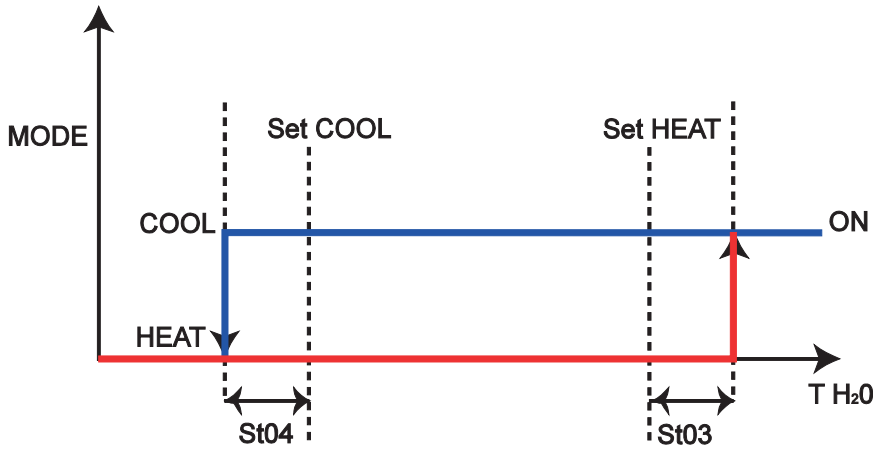
(**) it will not be possible to switch from HEAT mode to COOL mode (COOL *label* not visible by pressing and holding ESC key (Mode, change mode function))

6.1 Automatic changeover

The *automatic changeover* function can be enabled in parameter *St01*.

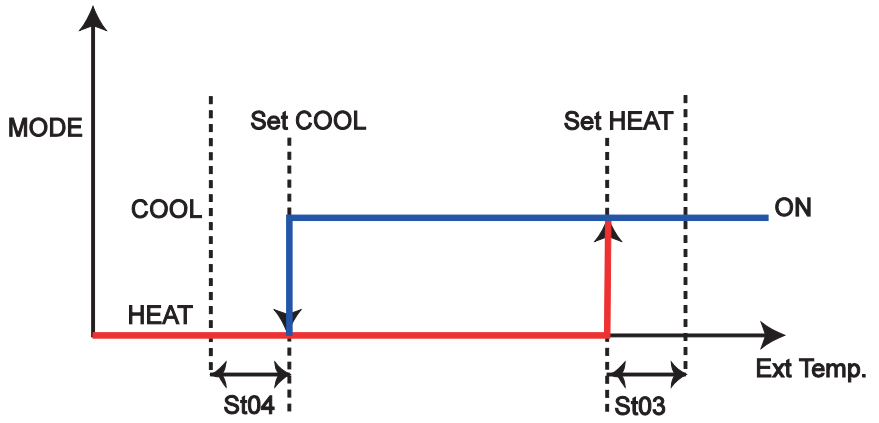
Heat or cool mode are activated via two different differentials that can be set in the relative parameter (Pa *St03* for the heat mode and Pa *St04* for the cool mode); in the neutral zone (between the two setpoints), the mode can be set from a key as well (if enabled) See the graph below for more details; in the example, the differentials are both positive but can also be set with a negative value.

6.1.1 Example of automatic changeover based on water temperature



MODE	Operating mode
T H2O	Water temperature
COOL SETPOINT	***tr04* - Temperature controller setpoint in Cool**
HEAT SETPOINT	***tr05* - Temperature controller setpoint in Heat**
St03	Differential for automatic mode change in Heat
St04	Differential for automatic mode change in Cool

6.1.2 Example of automatic changeover based on external air temperature



N.B.: *St04* is added to COOL setpoint; *St03* is added to HEAT setpoint.
N.B.: *St03*+*St04* < HEAT setpoint - COOL setpoint, or the sum of differentials must never be more than HEAT setpoint - COOL setpoint

6.2 Operating states table

Operating states and associated functions/algorithms enabled/disabled for each one are listed in the table below.
● Indicates the function enabled
Example: The *Hot Start function* can be enabled ONLY in HEAT mode

Function	Cooling COOL	Heating HEAT	Std-By and remote Std-By	OFF and remote OFF
User interface	●	●	●	● (°)
Temperature controller	●	●		
Select operating mode	●	●	●	
Compressor	●	●	●	
Internal circuit water pump	●	●	●	
Recirculation fan	●	●		
External exchanger fan	●	●	●	
External circuit water pump	●	●	●	
Internal circuit electric heaters	●	●	●	
External circuit electric heaters	●	●	●	
Auxiliary electric heaters	●	●	●	
Boiler		●	●	
Defrost		●		
Dynamic setpoint	●	●		
Economy	●	●		
Adaptive function	●	●		
Antifreeze with heat pump	●	●	●	
Hot Start		●		
Power limitation	●	●		
Record running time	●	●	●	●
Reset manual *alarms*	●	●	●	●
Manual defrost		●		
Copy card	●	●	●	●
Alarm History	●	●	●	●
Diagnostics	●	●	●	●
Serial communication	●	●	●	●

(§) In this case the key [*local ON/OFF*] has no effect on the operating mode

7 COMPRESSORS (FOLDER PAR/CP)

Energy ST can control installations with 1 refrigeration circuit featuring 1 or 2 compressors.
Each compressor is piloted by a device relay.

The compressors are on or off depending on the temperature control functions set (see Compressor Control - Temperature Control chapter).

Compressor parameters can be viewed and configured in *folder* **CP** (see User Interface and Parameters chapters).
The parameters are:

- *CP00*, *CP01* to define the type and number of compressors in the installation;
- *CP03*..*CP10* to set timings.

7.1 Type of compressors

Parameter ***CP00*** indicates the **type of compressor**

- *CP00*=0 ordinary compressor
- *CP00*=1 partialized 2 step

Parameter ***CP01*** indicates the **number of compressors in each circuit**

- *CP01*=1 1 compressor
- *CP01*=2 2 compressors

Configuring *digital outputs* as compressor:
The compressor or compressors, or compressor and its partialization is/are connected to one of the available relay outputs **D01...D04, D06 or to the D05 open collector output,** setting the following parameters:

- ***CF45...CF50***= 1 for compressor 1
- ***CF45...CF50***= 2 for compressor 2 or partialization

7.2 Compressor timings

Safety timings

The switching on and off of compressors must respect *safety timings* that can be set using the relative parameters as described below:

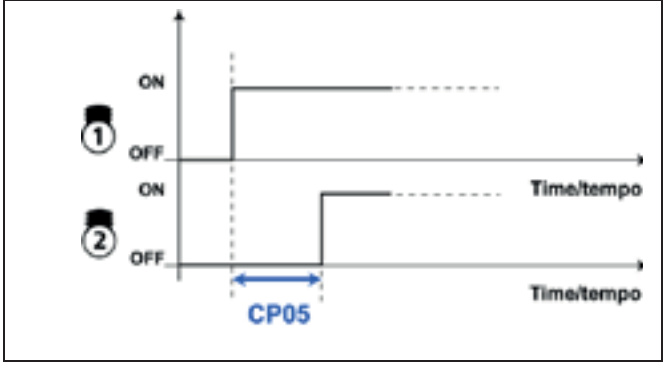
7.2.1 Minimum time between the switching on of more than one compressor (CP05)

If there are 2 compressors in the installation, the *minimum time* between the switching on (***CP05***) and the switching off (***CP06***) of the two compressors is observed.
The switch off delay between two compressors is not applied in the event of a **compressor shutdown alarm**, in which case they are stopped immediately.

ON-ON timing for more than one compressor

The second compressor will switch on, when requested, after the delay (in seconds) set in parameter *CP05* ***Minimum time*** **between the switching on of more than one compressor**– after the first one has switched on.

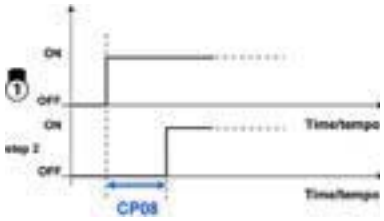
Minimum time **between the switching on of more than one compressor (*CP05*)**



7.2.2 FOR PARTIALIZED COMPRESSORS ONLY - Minimum ON step during increase in output (CP08)

If there is only one compressor in the installation, the *minimum time* between the switching on of the compressor and its partialization are observed (***CP08***).

Minimum ON step during increase in output (*CP08*)

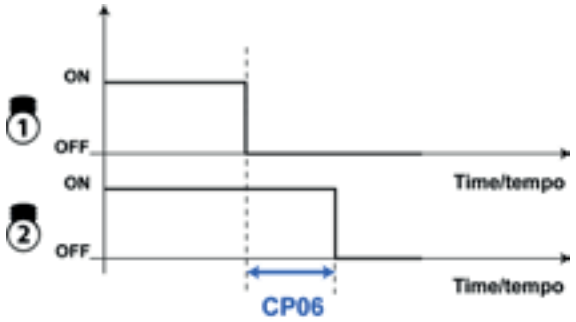


7.2.3 Minimum time between the switching off of more than one compressor (CP06)

OFF-OFF timing for more than compressor

The second compressor will switch off, when requested, after the delay (in seconds) set in parameter *CP06* ***Minimum time between the switching off of more than one compressor*** – after the first one has switched off.

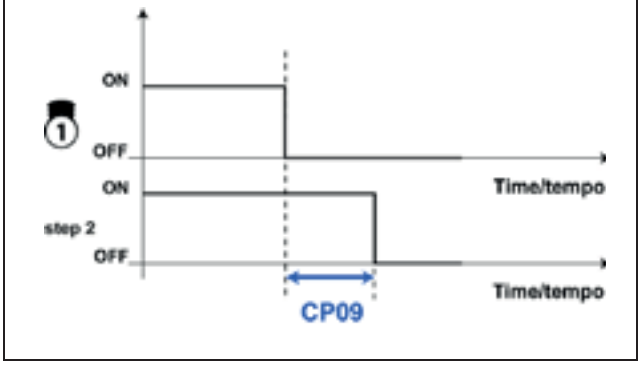
Minimum time **between the switching off of more than one compressor (*CP06*)**



7.2.3.1 FOR PARTIALIZED COMPRESSORS ONLY - Minimum ON step during decrease in output (CP09)

If there is only one compressor in the installation, the *minimum time* between the switching off of the compressor and its partialization are observed (***CP09***).

Minimum OFF step during decrease in output (*CP09*)



7.2.4 Minimum time between switching off and on of the same compressor (CP03)

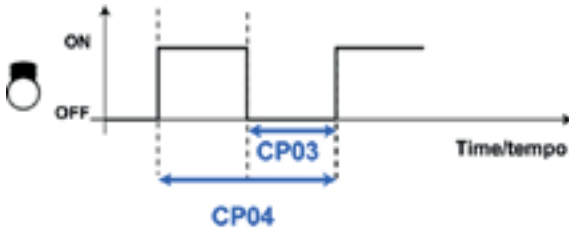
Compressor OFF-ON timing

After switching off, a compressor can switch back on again after the delay (in seconds) set in parameter *CP03* (**Minimum switch off-switch on time for the same compressor**);
This time delay also applies when Energy ST is started up.
When the device is switched on for the first time, the *default* sequence is run time 1 - see **Compressor on/off sequence/Run time sequence** (i.e. the device behaves as if *CP02*=5);

7.2.5 Minimum time between the switching on of the same compressor (CP04)

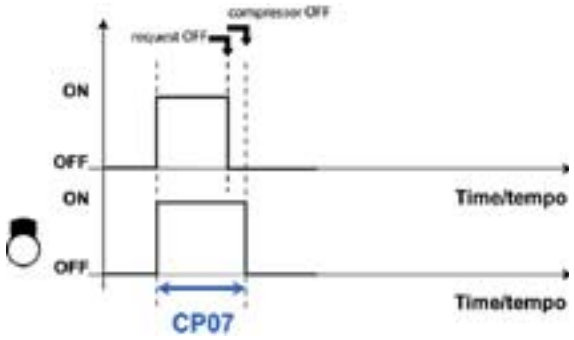
Compressor ON-ON timing

After switching off, a compressor can switch back on again after the delay (in seconds) set in parameter *CP04* (***Minimum time* between the switching on of the same compressor)**
This time delay also applies when Energy ST is started up.
When the device is switched on for the first time, the *default* sequence is run time 1 - see **Compressor on/off sequence/Run time sequence** (i.e. the device behaves as if *CP02*=5);



7.2.6 Minimum compressor ON time

The time required to switch the same compressor on is set in parameter *CP07* (**Minimum compressor switch on time**);



7.3 Compressor switch on/off sequence

7.3.1 Switch on/off sequence of partializations in single compressor installations.

Unvaried sequence

Partialization 1 is always inserted first followed by partialization 2 (*unvaried sequence*).

- Partialization 2 is only switched on if partialization 1 is already on.
- Partialization 1 is switched off only if partialization 2 is already off.

7.3.2 Switch on/off sequence of compressors in twin compressor installations.

The order in which compressors are inserted can be modified using *CP02*, the compressor switch on sequence:

- 0 = Balancing durations
- 1 = On sequence 1/2; off 2/1
- 2 = On sequence 2/1; off 1/2
- 3 = Limited sequence 1 (only compressor 1 available)
- 4 = Limited sequence 2 (only compressor 2 available)

Run time sequence

- 5 = Run time 1 sequence (based on *CP10* **Compressor run time for switch on sequence**) see table
- 6 = Run time 21 sequence (based on *CP10* **Compressor run time for switch on sequence**) see table

Run time sequence	
***CP02* = 5**	***CP02* = 6**
Run time 1 sequence	***Run time 2 sequence***
Real time < *CP10*: Switch on sequence: compressor 1→compressor 2 Switch off sequence: compressor 2→compressor 1	***Real time < CP10:*** *Switch on sequence:* *compressor 2→compressor 1* *Switch off sequence:* *compressor 1→compressor 2*
Real time> CP10: *Switch on sequence:* *compressor 2→compressor 1* *Switch off sequence:* *compressor 1→compressor 2*	***Real time> CP10:*** *Switch on sequence:* *compressor 1→compressor 2* *Switch off sequence:* *compressor 2→compressor 1*

N.B:

- When the device is switched on for the first time or in the event of a blackout, the sequence is set in *CP02*=5);
- When the machine is OFF or on std-by, the on/off sequences reflect the value assigned to parameter *CP02*.

7.4 Limiting output to 50%

The function is active on twin compressor machines only (*CP01*=1)

This function can be enabled by configuring a digital input as "limit output to 50%" (=31, see configuration *digital inputs*). When the digital input is activated, a compressor* is switched off thereby reducing energy consumption.

*N.B: the compressor that switches off depends on the on/off sequence selected (see compressor on/off sequence)

This function does not affect the state of all other resources.

N.B: If *PL00*=1 (see Limiting power chapter (*folder* Par/PL)) the digital input will be ignored.

7.5 Reversing valve management

The change of state between chiller and heat pump requires switching of the reversing valve.
In defrost mode, which can be activated during heating, the valve is in the Cool position because cycle inversion takes place.
In OFF mode, regardless of the output polarity configuration, the associated relay is deactivated.

8 INTERNAL CIRCUIT PUMP (FOLDER PAR/PI)

Energy ST can be configured to run an internal circuit water pump with ON/OFF or modulating function.

Internal circuit water pump parameters can be viewed and configured in *folder* **PI** (see User Interface and Parameters chapters).

The internal circuit water pump should be connected to the relative output - see table:

	Operation	
Output	**Digital**	**Modulating**
DO1 DO2 DO3 DO4 DO6	**x**	
D05	**x**	
TC1		**X Direct piloting**
AO1 AO2 AO3		**X Via external module**

The internal circuit water pump runs if:
- enabled via parameter (***PI00*** **- Enable internal circuit water pump** = 1). See Table 1.

The internal circuit water pump can run:
- continuously or
- when requested by the temperature controller by setting parameter *PI01* - **Select internal circuit water pump operating mode appropriately.**

See Table 2.

In the event of an alarm blocking the internal circuit water pump, the delay after the compressor switches off is not respected.
If an automatic reset flow switch alarm occurs, the internal circuit water pump is kept on to allow it to be reset. If the alarm becomes manual reset, the internal circuit water pump is switched off.

Table 1 (parameter *PI00*)

Parameter	Description	Value	
		0	**1**
PI00	**Enable internal circuit water pump**	Internal circuit water pump disabled	Internal circuit water pump enabled

Table 2 (parameter *PI01*)

Parameter	Description	Value			
		0	**1**	**2**	**3**
		Digital mode		**Modulating mode**	
PI01	**Select internal circuit water pump operating mode**	always on	on request	always on	on request
See diagram	**Summer mode**	//	**par *PI02* – *PI03* Diagram A**	**diagrams B-D**	
	Winter mode			**diagrams C-E**	

8.1 Operating modes

Always on digital mode

8.1.1 Always on digital mode

The internal circuit water pump is always active, unless

- one or more *alarms* are blocking the internal circuit water pump;
- the device is switched OFF locally or remote, and antifreeze with water pump is not active if enabled. (*)
- the device is switched to stand-by locally or remotely and antifreeze with water pump is not active if enabled. (**)

(*) The pump switches off immediately.
(**) The pump switches off after the set safety delay (e.g. after the delay following compressor shut-down)

Digital on request mode

8.1.2 Digital operation on request

The internal circuit water pump is switched on when requested by the temperature controller.
In addition*

- The compressor is switched on with a set delay (Pa ***PI02***) after the internal circuit water pump switches on.
- The internal circuit water pump is switched off with a delay (Pa ***PI03***) after the temperature controller enters the OFF state and from machine standby.
- During defrost, when the compressor is OFF, the circuit water pump stays on.
- The pump is on if internal circuit antifreeze heaters are active (if enabled in parameter ***PI22*** **– see table**. See also the heaters chapter, parameters *HI00*, *HI01*).

Table *PI22*

Parameter	Description	Value	
		0	**1**
PI22	**Enable internal circuit water pump on when antifreeze heaters active**	Internal circuit water pump disabled	Internal circuit water pump enabled

- The pump is on if the heaters are on in integrated use.
- The pump is on if the boiler is on

The internal circuit water pump is off if

- Temperature control is not requested (except for * - see above)
- One or more active *alarms* are blocking the internal circuit water pump;
- the device is switched OFF locally or remotely (*).

(*) The pump switches off immediately.

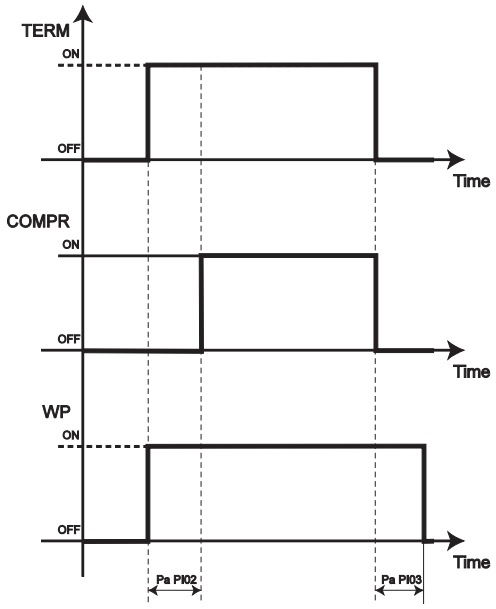


Diagram A

TERM: temperature controller	COMPR: compressor
WP: internal circuit water pump	Time: time in seconds
PI02: **Delay internal circuit pump on - compressor on**	*PI03*: **Delay compressor off - internal circuit pump off**

The internal circuit water pump is switched on when requested by the temperature controller.
In addition:

- the compressor is switched on with a delay (*PI02*, see table 3 par. *PI02-PI03*) after the internal circuit water pump is switched on
- the internal circuit water pump is switched off with a delay (*PI03*, see table 3 par. *PI02-PI03*)) after the compressor is switched OFF and after machine enters STD-BY state
- when the compressor is OFF during defrost, the internal circuit water pump stays on
- the internal circuit water pump is on during internal circuit antifreeze is this function is enabled in the relative parameter

Table 3 (par. *PI02-PI03*)

Parameter	Description
PI02	Delay internal circuit water pump on and compressor on
PI03	Delay compressor off - internal circuit water pump off.

8.1.3 Always on modulating mode

- The internal circuit water pump is controlled by a temperature probe at the outlet of the water-to-water heat exchanger.
- The modulating pump in the system is controlled continuously by one of the *analogue outputs* AO1 AO2 AO3 (°) or by the *triac* TC1.

(°) An external module converts the input analogue signal into a 230Vac power supply with phase capacity step to pilot 190W circulating pumps and 550 – 750 Watt centrifugal pumps.

Change pump operating mode and performance (from winter to summer and vice versa)
The pump may switch suddenly from winter to summer function with subsequent immediate change in speed.
For this reason, if the compressor stays on during the switch from winter to summer (for example), the pump will be managed in the same way as when the compressor is switched on in summer mode (see **Operation in summer mode**).
The same thing happens when switching from summer to winter mode.

Functioning in Summer mode* (see diagrams B-D)	**Functioning in Winter mode* (see diagrams C-E)**
Minimum speed internal circuit water pump	
The internal circuit water pump runs at minimum speed (*PI04*) if:	The internal circuit water pump runs at minimum speed (*PI10*) if:
the compressors are off as water temperature has been reached	
Maximum internal circuit water pump speed	
The internal circuit water pump runs at maximum speed (*PI05*) if:	The internal circuit water pump runs at maximum speed (*PI11*) if:
• the antifreeze heaters are active** • the system is in defrost mode	
The internal circuit water pump initially runs at maximum speed (*PI05*) for a time of *PI09*. At the end of the time, if the speed of the external exchanger fan is above *PI08*, the internal circuit water pump will function as shown in figure B-D.	The internal circuit water pump initially runs at maximum speed (*PI11*) for a time of P15. At the end of the time, if the speed of the external exchanger fan is above *PI14*, the internal circuit water pump will function as shown in figure C-E.
*COOL	*HEAT
** if enabled by parameter ***PI22***. Also see the heaters section, *HI00*, *HI01*	
*** considering a hysteresis of *PI24*	*** considering a hysteresis of *PI23*
(****) Fan speed control is on in any case; each time the external exchanger fan speed is less than *PI08*, the internal circuit pump will always be forced to maximum speed.	(****) Fan speed control is always on; each time the external exchanger fan speed is less than *PI14*, the internal circuit pump will always be forced to maximum speed.

The internal circuit water pump does not run if:

- any internal circuit water pump block alarm is active (including a manual reset flow switch alarm; see the Alarm Diagnostics table)
- it is switched off from the keyboard or remote input
- it is set to stand-by locally or remotely.

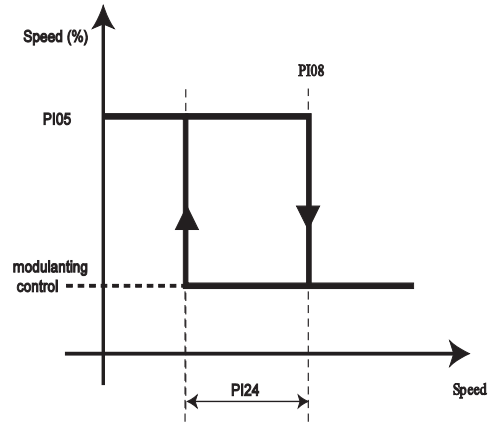
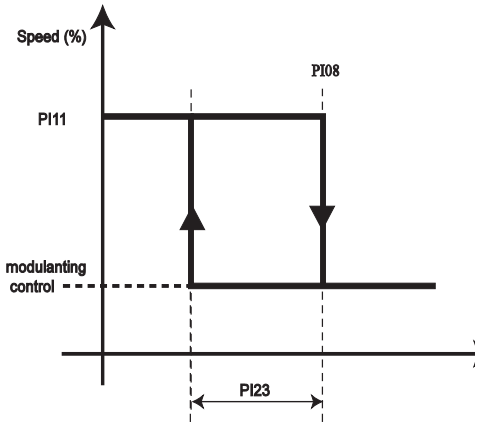
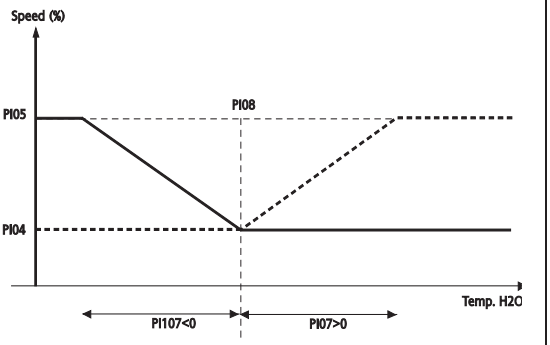
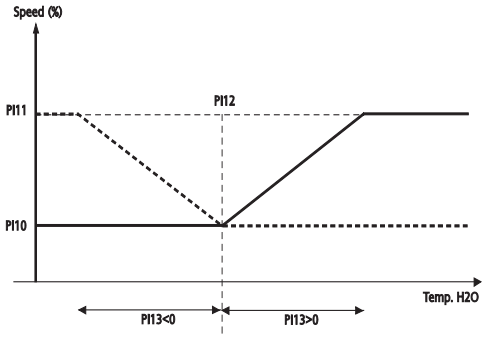
Diagram B	Diagram C
	

Diagram D	Diagram E
	

Parameter		
COOL	HEAT	Description
PI04	*PI10*	Minimum internal circuit water pump speed**
PI05	*PI11*	Maximum internal circuit water pump speed**
PI06	*PI12*	Minimum internal circuit water pump speed setpoint
PI07	*PI13*	Internal circuit water pump proportional band
PI08	*PI14*	Fan speed setpoint for modulation of internal circuit water pump
PI09	*PI15*	Internal circuit water pump *pick-up* time
PI24	*PI23*	Fan speed hysteresis to modulate internal circuit water pump

8.1.4 Modulating operation on request

Internal circuit water pump runs when:

- requested by temperature controller
- heaters are on in integrated use.
- the boiler is on

The internal circuit water pump doesn't run when:

- any type of internal circuit water pump block alarm is active (including manual reset flow switch alarm; see table in Alarm Diagnostics chapter
- switched off from the keyboard or remote input
- with compressor OFF with a delay equal to ***PI03*** **(see Table 3 par. *PI02*-*PI03*)**

Minimum internal circuit water pump speed in Cool/Heat**
The internal circuit water pump runs at minimum speed (*PI04*) if:
- the compressors are off as water temperature has been reached
- *alarms* are active that have forced the compressors OFF (see Alarm Diagnostics chapter)

Maximum internal circuit water pump speed in Cool/Heat**
The internal circuit water pump runs at maximum speed (*PI05*) if:
- internal circuit antifreeze heaters are on (if the function has been enabled in parameter ***PI22***. See table P122. See also the heaters chapter, parameters *HI00*, *HI01*)
- the system is in defrost mode

**depending on the operating mode.
For operating diagrams:
- See section entitled Always on modulating summer mode COOL (diagrams B-D)
- See section entitled Always on modulating winter mode HEAT (diagrams C-E)

The compressor is switched on with a delay *PI02* (see *digital operation on request*, diagram A)

8.2 Antifreeze operation with pump

The antifreeze function runs when:
- enabled via parameter (***PI19*** **- Enable antifreeze function with internal circuit water pump** = 1). See table 5.
- always on in any machine operating state except local or remote OFF, unless *alarms* block the pump.

To ensure the efficient operation of the pump, the following must be configured correctly:
- an analogue input, configured as NTC external temperature input
- a digital or analogue output, configured as pump

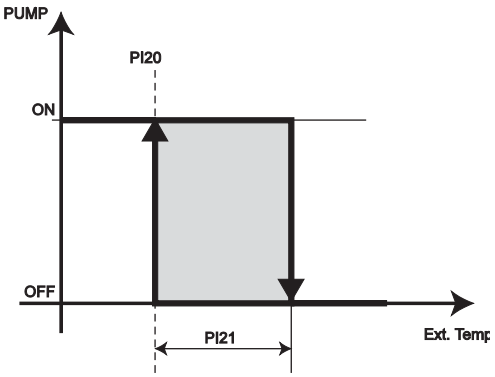
Input	Value		Output	Value
AI1	***CF00*=2, *CF12*=6**		**DO1 DO2 DO3 DO4 D05**	***CF45*...*CF48*= 3 *CF49*= 3**
AI2	***CF01*=2, *CF13*=6**		**DO6**	***CF50*=3**
AI3	***CF02*=2, *CF14*=6**		**TC1**	***CF42*=3, or 16**
AI4	***CF03*=2, *CF15*=6**		**AO1 AO2 AO3**	***CF43*=3, or 16 (*CF34*=1) *CF44*=3, or 16 (*CF35*=1) *CF30*=3, or 16**

Table 5 parameter *PI19*...P21

	Parameter	Description	Value	
			0	1
	PI19	**Enable antifreeze function with internal circuit water pump**	Function disabled	Function enabled
Diagram G	*PI20*	**Internal circuit water pump regulator setpoint for antifreeze**		
	PI21	**Internal circuit water pump regulator hysteresis for antifreeze**		

- The pump is activated when **Ext. Temp. < *PI20*.**
- The pump switches off when **Ext. Temp. > *PI20*+*PI21*.**
- Modulating pumps will run at maximum speed.

Diagram G - antifreeze function with pump



8.3 Periodical activation of the pump (Antilock)

This function prevents any mechanical faults due to extended disuse.

The antilock function is active when:

- enabled via parameter (***PI16* - Enable internal circuit water pump antilock function** = 1). See table 4.
- always active, even when in OFF (local and remote) and Std-by (local and remote) unless an alarm switches off the pump

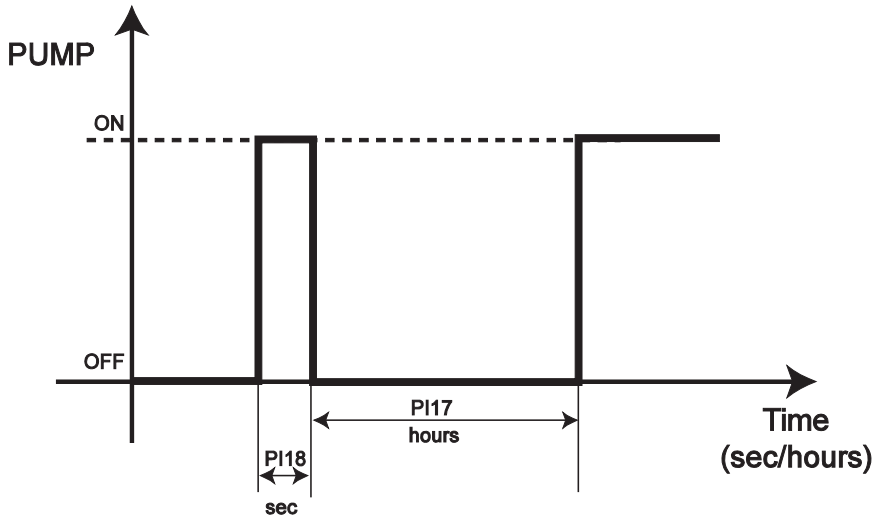
Table 4 parameter *PI16*..P18

Antilock	Parameter	Description	Value	
			0	1
	PI16	**Enable internal circuit water pump antilock function**	Function disabled	Function enabled
Diagram F	*PI17*	**Internal circuit water pump idle time due to antilock**	Time in hours	
	PI18	**Internal circuit water pump on time for antilock**	Time in seconds	

If the pump remains off for a time >= ***PI17*** Energy ST500 forces its activation at maximum speed for the time in ***PI18*****. See Table 4 and diagram F**

The pump idle time count starts when the pump switches off and is reset if the pump is switched back on.

Diagram F Antilock



N.B: *PI17* in hours, *PI18* in seconds

9 RECIRCULATION FAN (FOLDER PAR/FI)

The recirculation fan parameters are visible and can be set up in *folder* **FI recirculation fan parameters** (see User Interface and Parameters chapters).

Energy ST500 can be configured to run an internal fan instead of the internal circuit water pump for machines with an air-to-air internal heat exchanger.

Recirculation fan management depends on incoming air temperature and the temperature control setpoint (Heat or Cool, depending on the operating mode selected).

If one or more of the electric heaters in the internal heat exchanger is on, the recirculation fan will be forced on.

The recirculation fan, or the functioning thereof, is active when:

- enabled via parameter (***FI00*** **- Enable recirculation fan** = 1). See Table 1.

9.1 Operating modes

The recirculation fan can run:

- continuously
- in response to request from temperature regulator

when set via parameter ***FI01*** **- Select recirculation fan function.**

During an antifreeze alarm in the internal circuit, the recirculation fan can be forced on by configuring ***AL14*** **- Enable force on recirculation fan during internal circuit antifreeze alarm**
See Table 2.

The recirculation fan is off when:

- a block fan alarm has been generated.
- during defrost.
- during hot-start.
- when the device is Off (local or remote).
- when the device is on Std-by (local or remote).

Table 1 Parameter *FI00*

Parameter	Description	Value	
		0	1
FI00	Enable recirculation fan	Recirculation fan disabled	Recirculation fan enabled

Table 2 Parameter *FI01*

Parameter	Description	Value	
		0	1
FI01	Select recirculation fan operation	Continuous (Always ON)	In response to request (ON with compressor ON)
AL14	Enable force recirculation fan on during internal circuit antifreeze alarm	Recirculation fan disabled	Recirculation fan enabled
See diagram	Summer COOLING mode	par *FI02* Diagram A	
	Winter HEATING mode	par *FI03* Diagram B	

Continuous operation

9.1.1 Continuous operation

The recirculation fan is always active, unless

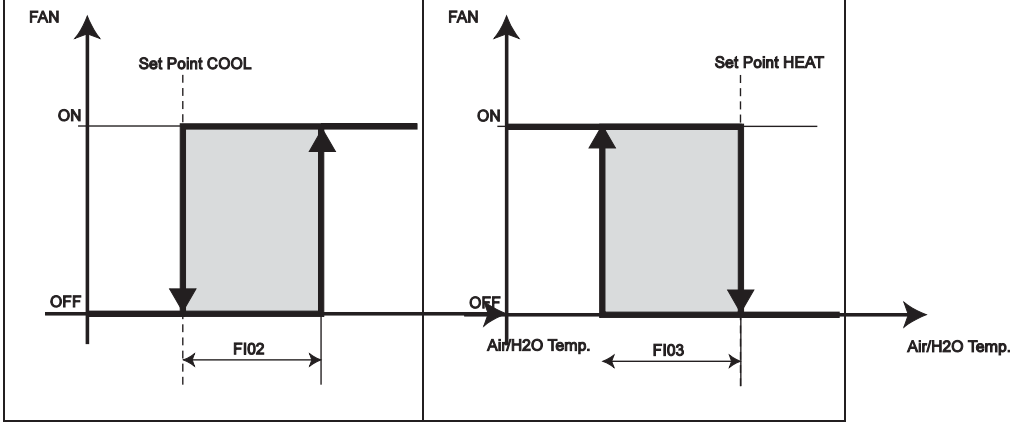
- one or more *alarms* block the recirculation fan;
- device switched OFF locally or remote **--> see postventilation**

9.1.2 Operation in response to request

Table 3 par. *FI02-FI03* and *FI07*

Parameter	state	Description
FI02	COOL	Recirculation fan regulator hysteresis in Cool mode
FI03	HEAT	Recirculation fan regulator hysteresis in Heat mode
FI04-FI06	HEAT	See *HOT START function*
FI07	HEAT	Postventilation time in Heat mode

Operation in summer mode* (See diagram A)	Operation in winter mode* (See diagram B)
Recirculation fan management depends on • the temperature of incoming air** (an analogue input must be configured accordingly)	
• Cool setpoint	• Heat setpoint
	HOT START See *HOT START function* and parameters *FI04-FI05- FI06*
	Postventilation If the heaters are on, the recirculation fan is switched off after a delay of ***FI07*** after the heaters are switched off. This postventilation time allows heat from the heaters to be dissipated and prevents them from breaking.
*COOL	*HEAT
** considering hysteresis *FI02*	** considering hysteresis *FI03*

Diagram A Cooling	Diagram B Heating
	

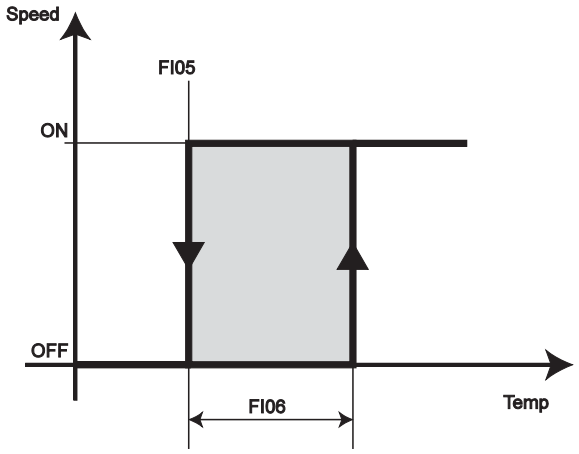
9.2 Hot Start function

This function exists in HEATING mode only and allows the recirculation fan to provide ventilation only if the internal heat exchanger is hot enough. It prevents any unpleasant gusts of cold air.

The *HOT START function* is active:
when enabled via parameter (***FI04*** - **Enable *Hot Start function*** = 1)
HEAT mode
if ***FI00*** - **Enable recirculation fan** = 1)
if a probe is configured as “internal heat exchanger output water or air temperature”

If the heat exchanger output probe is in error or not configured, the recirculation fan will come on after a delay equal to the value set in parameter ***FI08*** -**Delay compressor on - recirculation fan on.**

The diagram below illustrates this:
Diagram
HOT START



Speed Recirculation fan state	**Temperature** Internal exchanger water/air outlet temperature
FI05 **Hot Start regulator setpoint**	***FI06*** **Hot Start regulator hysteresis**

10 EXTERNAL EXCHANGER FAN (FOLDER PAR/FE)

External exchanger fan parameters can be viewed and configured in *folder* **FE Secondary exchanger fan parameters** (see User Interface and Parameters chapters).

The external exchanger fan runs when: enabled via parameter (***FE00*** **- Enable external exchanger fan** = 1). See table 2a.

Configuration of fan
The part being referred to is the fan unit on the outside of the heat exchanger that normally serves as a condenser. Obviously when the heat pump is in operation, this exchanger serves as an evaporator.

Firstly, the fan must be connected properly to the appropriate output (see connection diagram).

Various types of fan pilot modules can be connected to Energy ST500 depending on the relative availability.
See the table below:

Table 1

	TC	PWM	4-20mA	0-20mA	0-10V	Relay
	Direct	Indirect	Indirect	Indirect	Indirect	Direct
External module to pilot fans	NO	YES	Yes	Yes	Yes	NO

The fan output can be configured to run:
- proportionally or
- ON/OFF

via parameter (***FE01*** **- Enable external exchanger fan** = 1). See table 2a.

Table 2a - external exchanger fan parameters

Parameter	Description	Value	
		0	**1**
FE00	**Enable external exchanger fan**	Fan disabled	Fan enabled
FE01	**Select external exchanger fan operating mode**	ON/OFF	Proportional
FE02	**External exchanger fan *pick-up* time**	//	See ***PICK-UP***
FE03	**Enable external exchanger fan on with compressor off**	Fan off with compressor OFF	Fan on with compressor OFF
If *CF45*...*CF50* (Configuration of digital output DO1...DO6 =±11 (external exchanger fan), the meaning of *FE03* changes			
FE03	**Enable external exchanger fan on with compressor off**	0= fan (relay) off with compressor OFF; with compressor ON, the fan only comes on when the control input exceeds the cut-off threshold This applies to both cooling and heating. Preventilation is always run.	1= fan (relay) ALWAYS on; fan off in Std-By and OFF;
FE04	**Bypass time for external exchanger fan cut-off**		
FE05	**External exchanger fan preventilation time in Cool**		
FE06	**External exchanger fan preventilation time in Heat**		
FE07...FE16	**Summer COOLING mode**	**Table 2b Diagram A-C**	
FE17...FE26	**Winter HEATING mode**	**Table 2b Diagram B-D**	
Parameters CF	**See configuration parameters CF** Configuration of Inputs-Outputs chapter	//	***PHASE SHIFT***
Parameters CF	**See configuration parameters CF** Configuration of Inputs-Outputs chapter	//	***PULSE LENGTH***

Table 2b - external exchanger fan parameters

Parameter		Description
COOL	HEAT	
FE07	***FE17***	External exchanger fan minimum speed in Cool/Heat
FE08	***FE18***	Average speed external exchanger fan in Cool/Heat
FE09	***FE19***	Maximum speed external exchanger fan in Cool/Heat
FE10	***FE20***	Select probe for external exchanger fan regulation in Cool/Heat
FE11	***FE21***	External exchanger fan minimum speed setpoint in Cool/Heat
FE12	***FE22***	External exchanger maximum speed differential in Cool/Heat
FE13	***FE23***	External exchanger fan speed proportional band in Cool/Heat
FE14	***FE24***	Maximum external exchanger fan hysteresis in Cool/Heat
FE15	***FE25***	External exchanger fan cut-off hysteresis in Cool/Heat
FE16	***FE26***	External exchanger fan cut-off differential in Cool/Heat

The fan is switched off in local or remote OFF
If the output has been configured as proportional, the parameters
PICK UP, *PHASE SHIFT*, *PULSE LENGTH* all have a meaning.

Pick-up

Each time the external exchanger fan starts, the exchanger fan is supplied at the maximum voltage level, hence the fan runs at maximum speed for a time equal to ***FE02*** in seconds. At the end of this time, the fan continues at the speed set by the regulator.

Phase shift

Defines a delay to offset the various electrical properties of the fan drive motors. **See configuration parameters CF** Configuration of Inputs-Outputs chapter

Pulse length

Defines the duration in milliseconds of the pulse piloting the TC / or AO1, AO2 output. **See chapter on configuration parameters CF** Configuration of Inputs-Outputs

The fan can be configured to make it run independently or dependent on the compressor state; you can also decide if the fan should be on or not when the compressor is off **(par *FE03*).**
The cut-off can be bypassed for a time configurable in parameter ***FE04*;**
during this period, if the regulator requests the cut-off, the fan will run at minimum speed.

Operation in summer mode* (see diagram A - C)	**Operation in winter mode* (see diagram B - D)**
The fan is regulated on the input selected in:	
FE10 **see table 2b**	***FE20*** **see table 2b**
• 1 = High pressure input • 2 = Low pressure input • 3 = External exchanger pressure input • 4 = Internal exchanger pressure input	
In cooling mode, if the fan is activated when requested by the compressor (parameter *FE03*=0), permission to switch on the compressor is given only after the fan has been running for the *minimum time* set in parameter *FE05*; **see table 2a**	In heating mode, if the fan is activated when requested by the compressor (parameter *FE03*=0), permission to switch on the compressor is given only after the fan has been running for the *minimum time* set in parameter *FE06*; **see table 2a**
Preventilation is run to prevent the compressor from switching on at excessively high condensation temperatures.	
*COOL	*HEAT

COOL see table 2b par. *FE07...FE16*	HEAT see table 2b par. *FE17...FE26*
Diagram A	**Diagram B**
Diagrams for fan speed based on the regulation probe	

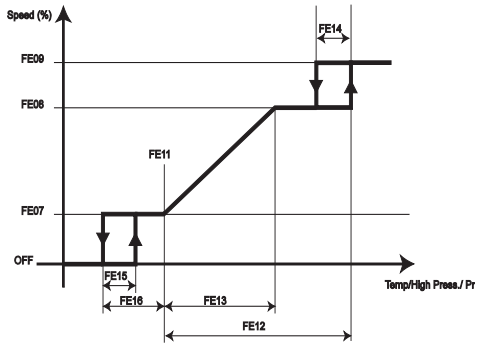
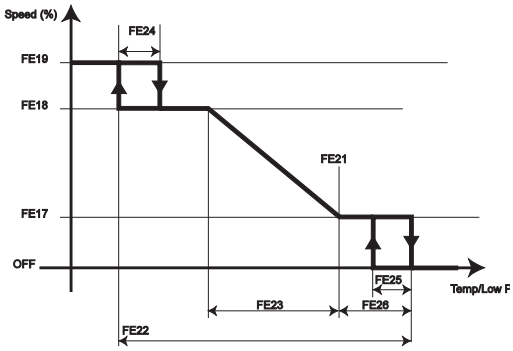
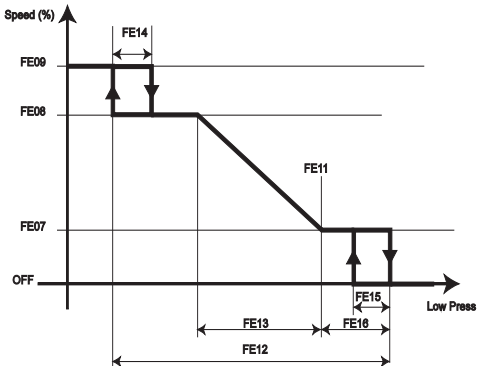
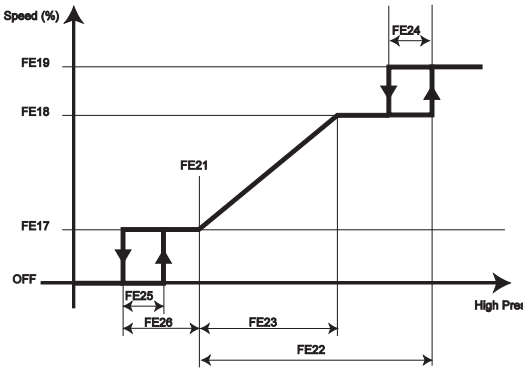

	

Diagram C	**Diagram D**
Diagrams for fan speed based on the regulation probe selected, i.e. High Pressure (diagram C) / Low pressure (diagram D) or external exchanger pressure.	
	
Temp: External exchanger temperature	**Temp: External exchanger temperature**
Low Press. : Low pressure	**High Press. : High pressure**
Press.: External exchanger pressure	**Press.: External exchanger pressure**

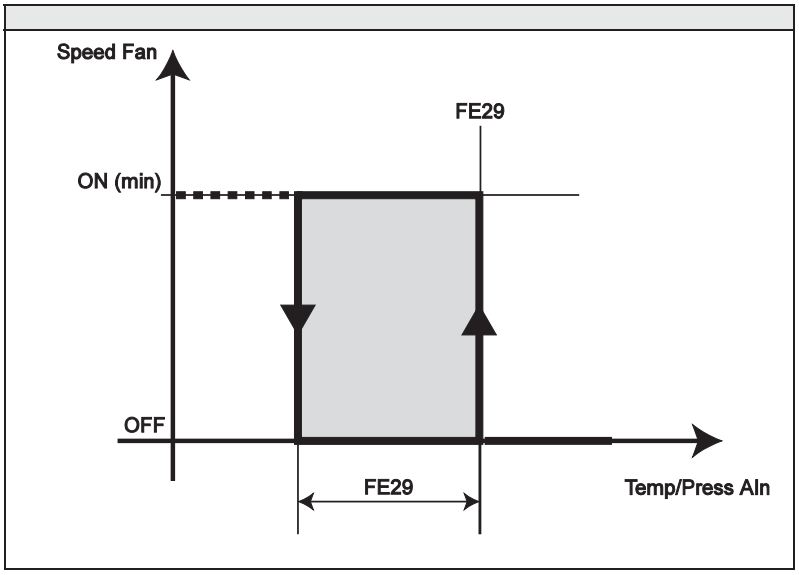
Fan control in defrost

The external exchanger fan can be enabled in defrost mode. The function is active if: enabled by parameter (***FE27*** – **Enable external exchanger fan in defrost = 1**). See table 2a.

Fan activation in defrost mode is useful because pressure at the external exchanger can reach alarm levels if the exchanger is not totally de-iced.
To avoid the overpressure alarm being generated in this situation, if the pressure/temperature read by the probe is above ***FE28*** **– External exchanger on set point in defrost**, the fans are run at minimum speed.
The probe for fan control in defrost mode is selected by parameter ***FE30*** **– Select probe for external exchanger fan regulation in defrost**.

Parameter	Description	Value	
		0	1
FE27	**Enable external exchanger fan on in defrost**	0= fan (relay) off in defrost. Fan switches on at end of defrosting.	1= fan (relay) on at minimum speed depending on: • configured probe for fan control in defrost (see ***FE30***) • activation set-point (***FE28***) • switching hysteresis (***FE29***)

Parameter	Description	Value			
		0	1	2	3
FE30	Select probe for external exchanger fan regulation in defrost	no probe	external exchanger temperature probe,	high pressure probe	external exchanger pressure probe



FE28	External exchanger on set point in defrost
FE29	External exchanger fan on hysteresis in defrost

11 EXTERNAL CIRCUIT PUMP (FOLDER PAR/PE)

Pump parameters can be viewed and configured in *folder* **PE** (see User Interface and Parameters chapters).

The pump runs when:

- enabled in parameter (***PE00*** **- Enable internal circuit water pump** = 1). See table 6.

Parameter	Description	Value	
		0	**1**
PE00	**Enable external circuit water pump.**	0= pump disabled	1= Pump enabled

12 INTERNAL EXCHANGER ELECTRIC HEATERS (FOLDER PAR/HI)

Parameters for internal circuit exchanger heaters can be viewed and configured in *folder* HI: Internal circuit electric heater parameters (see User Interface and Parameters chapters).

Antifreeze/integrated use heaters should be connected to a relay output (°) DO1..D04, D06 (see).

- They are active only when the relative parameter enabling them *HI00*, *HI02*=1 (see table)
- In Std-by the antifreeze heaters can be enabled by configuring *HI01*=1 (see table)
- In defrost mode, the anti-freeze electrical heaters can be enabled by configuring *HI03*=1 (see table)

Note. If there are no control probes (eg. Condensing units) the heaters should NOT be activated, except when *HI03*=1. The heaters are not temperature-controlled and therefore should be activated in defrost mode even if there are no probes.

(°) When configuring the machine with two internal exchanger electric heaters, configure two outputs:

- one output as internal exchanger heater 1
- one output as internal exchanger heater 2

Two internal exchanger electric heaters can be configured in parameter *HI04*

Heaters	Parameter	Description	Value	
			0	**1**
Antifreeze (°)	***HI00***	Enable *internal exchanger heaters for antifreeze*	Heaters disabled	Heaters enabled (°)
Antifreeze (Standby mode)	***HI01***	Enable internal exchanger heater regulator in standby for antifreeze	Heaters disabled	Heaters enabled
Integrated use	***HI02***	Enable integrated use of internal exchanger heaters	Heaters disabled	Heaters enabled
See Defrost chapter	***HI03***	Enable force heaters on during defrost.	Heaters enabled on request of temperature controller (antifreeze or integrated use)	Heaters ALWAYS enabled during defrost
Antifreeze	***HI05***	Select probe for heater control. Internal exchanger for antifreeze	Temperature water or air Internal exchanger inlet	Temperature water or air internal exchanger outlet
Antifreeze	***HI06***	Electric heater regulator setpoint Internal exchanger for antifreeze	*Range* set in parameters *HI07..HI08* Hysteresis set in parameter *HI09*	

Heaters	Parameter	Description	Value	
			1	**2**
Integrated use / antifreeze (heater 1 only) (°°)	***HI04***	Number of internal exchanger heaters	1 Heater enabled	2 heaters enabled

N.B.:
(°) set H00=1 even when heaters are to be integrated
(°°) FOR ANTIFREEZE, when configuring the machine with two internal exchanger electric heaters, only heater 1 will be activated.

12.1 Internal exchanger heaters for antifreeze

Internal exchanger antifreeze heaters are used in machines with a water-to-water exchanger.
Antifreeze heaters are enabled when:

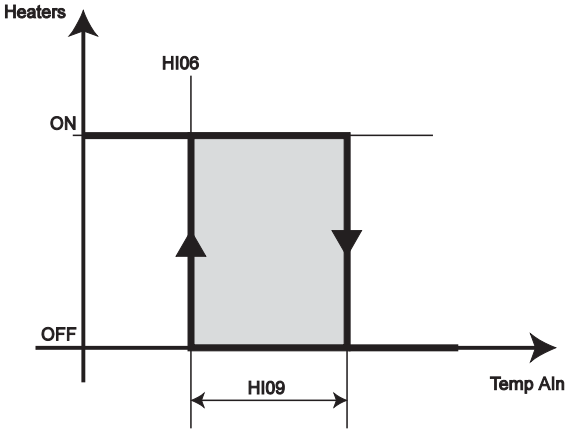
- enabled in parameter (***HI00*** **- Enable** ***internal exchanger heaters for antifreeze*** = 1)

(°°) FOR ANTIFREEZE, when configuring the machine with two internal exchanger electric heaters, only heater 1 will be activated.

- The regulation probe can be selected in parameter *HI05*
- The antifreeze setpoint can be set in parameter *HI06*

Settings during antifreeze

Settings can be done as shown in the figure;



AIn temp.	AIn probe temperature **See *HI05***
Heaters	Heater state **(°°) heater 1 only**

12.2 Internal exchanger heaters in integrated use

In integrated use, heaters are enabled when:
enabled in parameter (***HI02*** **- Enable internal exchanger heaters for integrated use** = 1) (°)
heating mode
gas inversion heat pumps

N.B.: for water inversion heat pumps, see **external electric heater circuit**
(°) set H00=1 even when heaters are to be integrated
(°°) When configuring the machine with two internal exchanger electric heaters, configure parameter *HI04* appropriately

Adjustment depends on the setpoint which is obtained by adding or subtracting a differential from the Heat setpoint, depending on the external temperature.
Parameter **HII4 Enable internal exchanger heater digital dynamic differential in integrated use** determines whether it is proportional to the external temperature or a fixed value (depending on external temperature).

Graphs for the proportional differential **Diagram A (*HI14*=0)** or the fixed one **Diagram B (*HI14*=1)** are provided below.

Diagram A
Differential proportional to the change in the external temperature (H14=0)

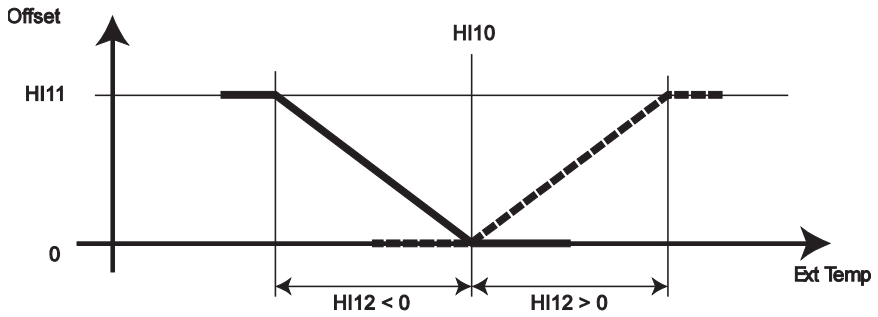
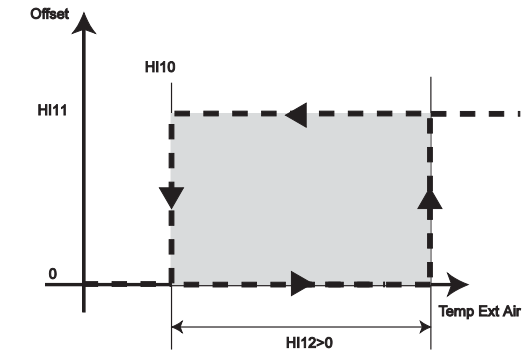
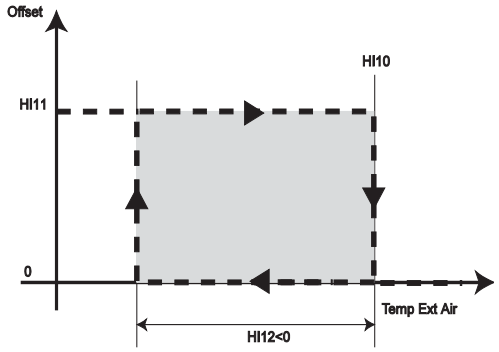


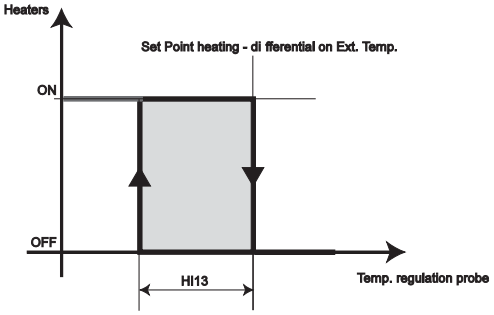
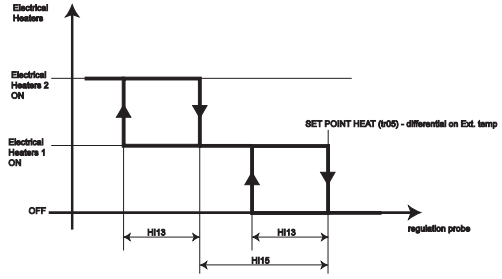
Diagram B
Fixed differential (*HI14*=1)

Fixed differential based on external temperature Band > 0	**Fixed differential based on external temperature Band < 0**
	
***HI12*>0**	***HI12*<0**

HEAT	
HI10	**Internal exchanger heaters dynamic differential setpoint in integrated use**
HI11	**Maximum dynamic differential *internal exchanger heaters in integrated use***
	If *HI11*=0 , adjustment depends on the heat setpoint which is based on the external temperature.
HI12	**Internal exchanger heater digital dynamic differential in integrated use**

Ext Air temperature	External air temperature
Offset	Differential

Adjustment in integrated use
Adjustments are made during integrated use as indicated below:

1 heater (*HI04*=1) (°°)	**2 heaters (*HI04*=2)**
	

HEAT	
HI06	**Internal exchanger heaters regulator setpoint for antifreeze**
HI13	**Internal exchanger heater regulator hysteresis for antifreeze**
HI15	**Differential setpoint primary exchanger heater 2 on in integrated use** **NOTE: *HI15* must be greater than *HI13***

Temp regulation probe	Temperature of regulation probe **See parameter *tr03*-Select temperature control probe in HEAT**
Heating setpoint	**See parameter *tr05*-Temperature control setpoint in HEAT**
Differential on Ext. Temperature	**See par. H14 and diagrams A/B**
Heaters	Heater state **(°°) heater 1**

13 EXTERNAL EXCHANGER ELECTRIC HEATER PARAMETERS (FOLDER PAR/HE) – ELECTRIC HEATERS

Parameters for external circuit heaters can be viewed and configured in folders **HE: External circuit electric heater parameters** (see User Interface and Parameters chapters).

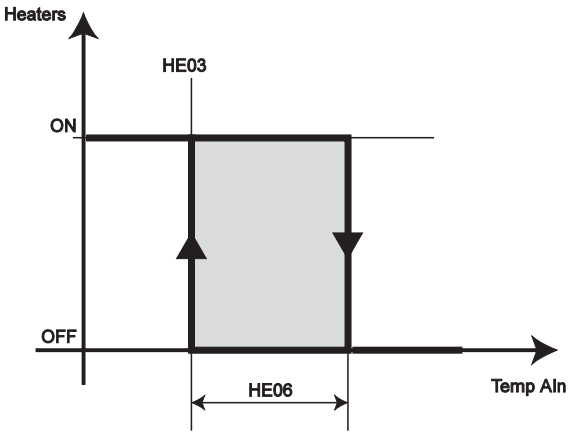
The heaters are used for the antifreeze function.

- They are active only when the relative parameter enabling them *HE00*=1 (see table).
- In Std-by the heaters can be enabled by configuring *HE01* (see table).
- The regulation probe can be selected in parameter *HE02*
- The setpoint can be set in parameter *HE03*.

Heaters	Parameter	Description	Value	
			0	1
External exchanger	***HE00***	Enable *external exchanger heaters* for antifreeze	Heaters disabled	Heaters enabled
External exchanger (Standby mode)	***HE01***	Enable external exchanger heater regulator in standby for antifreeze	Heaters disabled	Heaters enabled
External exchanger	***HE02***	Select probe to regulate *external exchanger heaters* during antifreeze	External exchanger inlet water temperature	External exchanger outlet water temperature
Heaters	**Parameter**	**Description**	**Value**	
External exchanger	***HE03***	External exchanger heater switch on setpoint for antifreeze	*Range* defined in parameters *HE04*..*HE05* Hysteresis defined in parameter *HE06*	

External exchanger heaters

Regulation is performed as shown in the figure:



HEAT	
HE03	External exchanger heater switch on setpoint for antifreeze
HE06	External exchanger heater regulator hysteresis for antifreeze

AIn temp.	AIn probe temperature **See *HE02***
Heaters	Heater state

14 AUXILIARY ELECTRIC HEATERS (FOLDER PAR/HA)

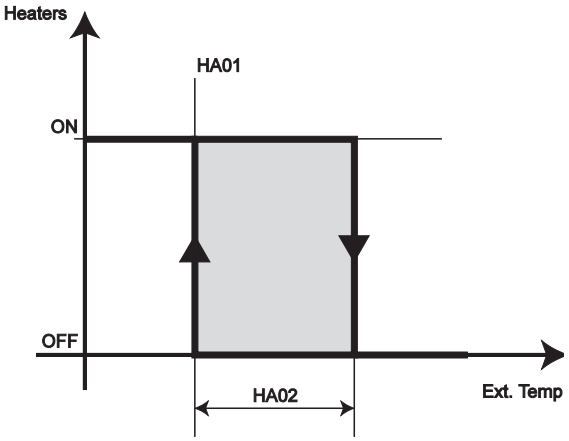
Parameters for *auxiliary heaters* can be viewed and configured in *folder* HA: Auxiliary electric heater parameters (see User Interface and Parameters chapters).

- They are active only when the relative parameter enabling them *HA00*=1 (see table)
- In Std-by the heaters can be enabled by configuring *HA01* (see table)
- The control probe is based on external temperature.
- The setpoint can be set in parameter *HA01*

Parameter	Description	Value	
		0	1
HA00	Enable *auxiliary heaters*	Heaters disabled	Heaters enabled
HA01	Enable auxiliary heater regulator	Heaters disabled	Heaters enabled
HA02	Auxiliary heater regulator hysteresis		

Auxiliary heaters

Regulation is performed as shown in the figure:



HE01	*Auxiliary heaters* switch on setpoint
HE02	Auxiliary heater regulator hysteresis

Ext. temp	External temperature
Heaters	Heater state

15 BOILER (FOLDER PAR/BR)

Boiler parameters can be viewed and configured in the **br** *folder* (see User Interface and Parameters chapters).
The Boiler is only active in HEAT mode.
The Boiler is enabled via parameter (***br00*** **- Enable boiler** = 1)

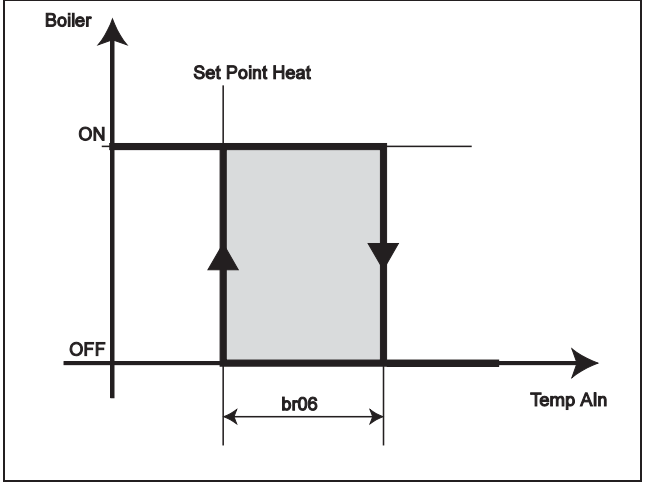
Two *operating modes* can be selected with parameter *br01*- **Enable *boiler in heating* only:** *integrated boiler* or heating.

Boiler		Parameter	Description	Value	
Heating	**Integrated use**			**0**	**1**
		br00	**Enable boiler**	Boiler disabled	Boiler enabled
		br01	**Enable *boiler in heating* only**	*Integrated boiler* **(set *tr01*=1)**	*Boiler in heating*
	X	***br02***	**Enable boiler digital dynamic differential**	Proportional **Diagram B**	Fixed **Diagram C**
	X	***br03***	**Boiler dynamic differential setpoint**	**Diagram B-C**	
	X	***br04***	**Boiler dynamic differential proportional band**		
	X	***br05***	**Maximum boiler dynamic differential**		
X	X	***br06***	**Boiler regulator hysteresis**		

15.1 Boiler in heating

- The device can be configured to run a boiler for use in heating installations;
- In this configuration, the device can be configured with no heat pump (*tr01*=0)
- Regulation is based on the regulation probe and heat setpoint (calibrated or not)

Heating boiler *br01*=1



***tr01*=0 not heat pump**
If *br02*=0 see diagram B / If *br02*=1 see diagram C

The boiler is off if:
- it is in cooling mode
- is OFF locally or by remote
- there is a boiler shutdown alarm (refer to *table of alarms*)

When the maximum boiler setpoint differential is set to 0, the setpoint equals the REAL heat setpoint.

Diagram B - Differential proportional to change in external temperature (*br02*=0)

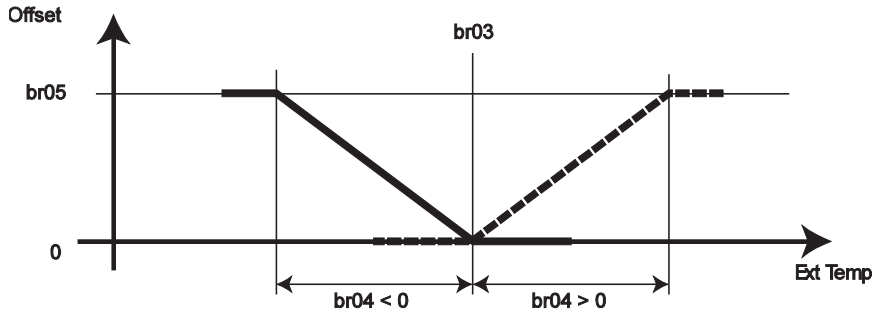
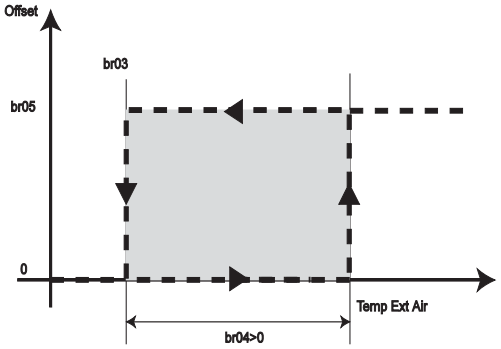
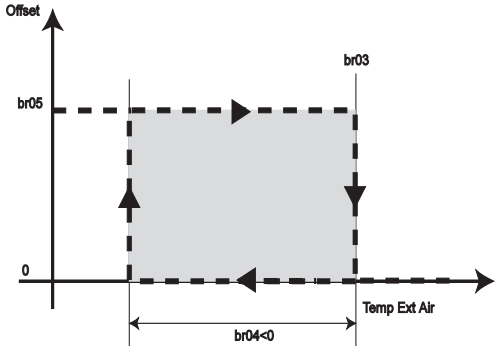


Diagram C - (Decalibration) fixed differential (*br02*=1)

fixed differential Band > 0	fixed differential Band < 0
	
***br04*>0**	***br04*<0**

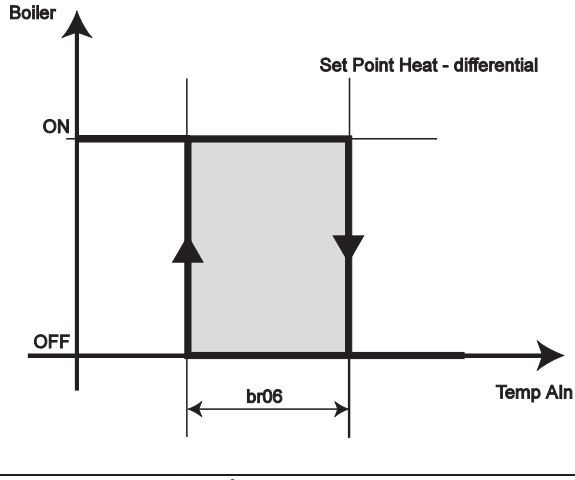
Ext Air temperature	External air temperature
Offset	Differential

15.2 Integrated boiler

- The device can be configured to run a boiler together with the heat pump.
- In this configuration, the device can be configured with heat pump present (*tr01*=1)
- Regulation is based on the regulation probe and heat setpoint, calculated as the difference from the Heat setpoint (°°)

(°°) In *integrated boiler* mode, the boiler setpoint can be set as a differential (fixed or proportionally variable depending on the external temperature) with respect to the REAL setpoint in heat mode; it is set via parameter *br02* **- Enable boiler digital dynamic differential**

***Integrated boiler br01*=0**



***tr01*=1 heat pump present**

If *br02*=0 see diagram B / If *br02*=1 see diagram C

NOTE:
If the heat pump locks, the differential with respect to the Heat setpoint is forced to zero.

16 DEFROST (FOLDER PAR/DF)

Defrost parameters can be viewed and configured in *folder* **dF** (see User Interface and Parameters sections).

The defrost function is active in HEAT mode only.

It is used to prevent ice from forming on the surface of the external exchanger.
Ice builds up on the external exchanger more often as a result of cold external air containing a high degree of humidity.
This significantly impairs the thermodynamic output of the machine and could damage the machine itself.

Defrosting is enabled when:
- enabled via parameter (***dF00*** **- Enable defrost function** = 1)
- the reversing valve is present

The start and end of defrost depends on the values read by probes and by the values set for the parameters described below:

Parameter	Description	Value	
		0	**1**
dF00	**Enable defrost function**	Defrost disabled	Defrost enabled

Defrost	Parameter	Description
Input	***dF01***	**Setpoint to enable interval count between defrosts**
Output	***dF02***	• **Deactivate defrost setpoint**
Input	***dF03***	**Cumulative interval between defrosts**
Input	***dF04***	**Compressor-valve-compressor delay before *start defrost***
Output	***dF05***	**Compressor-valve-compressor delay at end of defrost.**
Output	***dF06***	**Dripping time**
Output	***dF07***	**Maximum defrost time.**
Input	***dF08***	**Enable dynamic defrost differential**
Input	***dF09***	**Maximum dynamic defrost differential**
Input	***dF10***	**Defrost dynamic differential setpoint**
Input	***dF11***	**Dynamic defrost differential proportional band**
Input	***dF12***	**Select probe to enable interval count between defrosts**
Output	***dF13***	**Select probe to *end defrost***
Output	***dF14***	**Setpoint to clear cumulative time between defrosts**

During defrost, the internal exchanger heaters are enabled in accordance with the relative parameter.

Heaters	Parameter	Description	Value	
			0	**1**
See Electric Heaters section.	***HI02***	Enable force heaters on during defrost.	Heaters enabled on request of temperature controller (antifreeze or integrated use).	Heaters ALWAYS enabled during defrost

16.1 Start defrost

Defrost is started by temperature or pressure via a probe that can be selected in parameter ***dF12*** -"**Select probe to enable interval count between defrosts**".

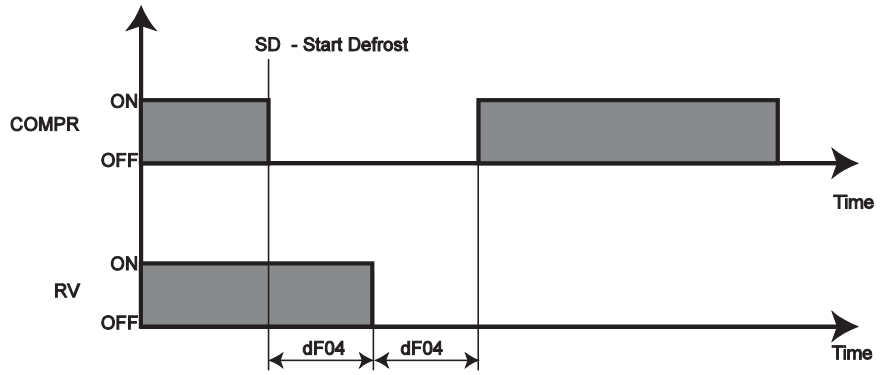
Pressure (or temperature) values for *start defrost* are given by:

- *start defrost*: parameter ***dF01*** **Setpoint to enable interval count between defrosts**

- If the temperature/pressure of the probe configured as *start defrost* falls below the value set in ***dF01*** **(Setpoint to enable interval count between defrosts** and the compressor is ON*, the count defined in**dF03 (Cumulative interval between defrosts);**
  N.B.: In the event of a probe error, defrost will start as defined in ***dF03***
- When the duration defined in ***dF03*** is reached, the device will start the defrost process.
- At this stage, if ***dF04*** **- compressor - valve - compressor delay before** ***start defrost*** = 0, then the compressor stays on. Otherwise, the adjustment illustrated in the diagram below is performed:

*one compressor in single compressor machines, at least one compressor in twin compressor machines

Start defrost diagram



This delay prevents any liquid from returning to the compressor.
In machines configured with two compressors, during defrost the compressors (steps) are both on.
This does not happen if one of the compressors is in alarm.
During this cycle, compressor *safety timings* are ignored.

16.1.1 Count mode

- The time count between defrosts is suspended when the temperature/pressure falls below the value set in *dF02*- Setpoint to enable interval count between defrosts) or when the compressor is switched off (one compressor in single compressor machines and at least one compressor in twin compressor machines).
- The count is cleared after one of the following events:
  - o A defrost cycle is run.
  - o A power failure.
  - o Change of operating mode.

The time count is also cleared when the temperature/pressure rises above the value set in ***dF14*** **- Setpoint to clear cumulative interval between defrosts**

16.1.2 Start defrost temperature offset

In particularly dry and cold climates, the *start defrost* temperature will be different from the actual temperature that the external battery is exposed to. The following regulator will directly offset the *start defrost* temperature/pressure by adding negative or positive values depending on the external temperature.

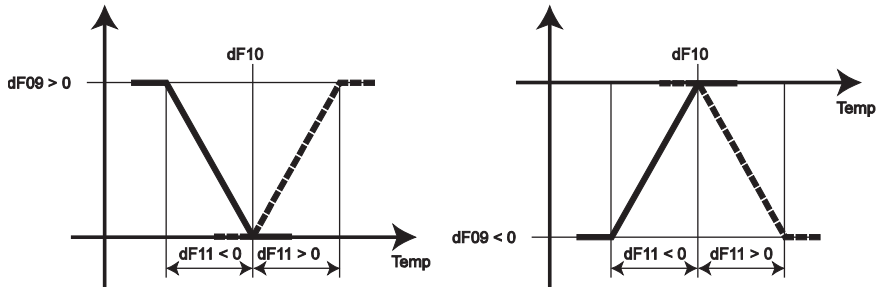
The regulator is active when:

- Activation parameter *dF08* - **Enable defrost dynamic differential** = 1
- A probe (analogue input) has been configured as external probe.

Decalibration of start defrost setpoint based on external temperature

The figure below shows how decalibration of the *start defrost* setpoint progresses based on external temperature.	
Positive offset	Negative offset.

Decalibration of start defrost setpoint based on external temperature



16.2 End defrost

End defrost can be controlled by temperature or pressure via

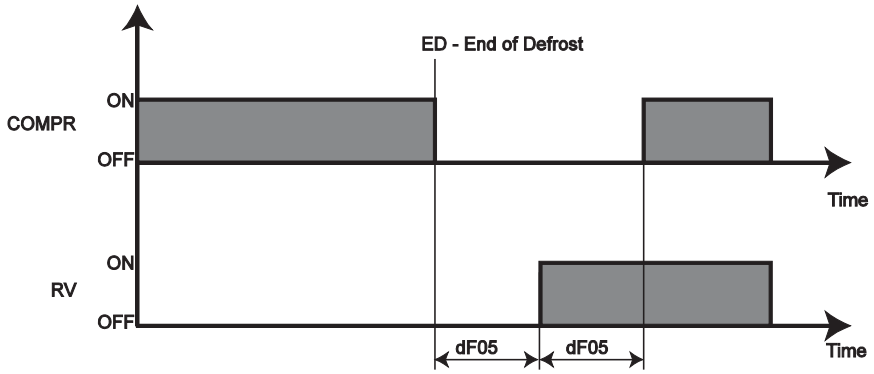
- a probe that can be selected in parameter ***dF13*** - "**Select probe to *end defrost***"
- and/or by Digital Input (in this case, a digital input must be configured as "*End Defrost*" **(value ±22)**
- and/or by time, if the probe configured for the output fails.

Defrost will end when:

- the temperature/pressure rises above ***dF02*** - **Deactivate defrost setpoint**
- the duration of the defrost reaches ***dF07*** - **Maximum defrost time**
- if the digital input configured as *end defrost* activates

at the end of defrost, if ***dF05*** - **Compressor - valve - compressor delay before the end of defrost** = 0, the compressor stays on. Otherwise, the adjustment illustrated in the diagram below is performed:

End defrost diagram



- At the end of defrost, the compressor *safety timings* are ignored and the external exchanger heater fan is switched on at maximum power for the time set in parameter ***dF06*** - **Dripping time**= 0.

16.2.1 Defrost when compressor stops

If an alarm stops the compressor in single compressor machines or both compressors in twin compressor machines, defrost starts as a result of this stop.

16.3 Manual defrost

EnergyST500 can force defrost manually by pressing and holding the [UP] key.
Manual defrost is possible when:

- ***dF00*** **- Enable defrost function** = 1
- ***UI10*** **-Enable defrost function from key**
- if the temperature / pressure of the external exchanger is less than the value set in parameter ***dF01*** **(Set point to enable interval count between defrosts)**

Defrost starts in the sequence described in the section "*Start Defrost*".

- The defrost LED is blinking.

End defrost takes place as described in the section "*End Defrost*".

16.4 Power failure during defrost.

If a power failure happens during defrost, the procedure will be cancelled. All timings will be cancelled and restarted.

17 DYNAMIC SETPOINT (FOLDER PAR/DS)

Dynamic setpoint parameters can be viewed and configured in *folder* **dS** (see User Interface and Parameters sections).
The regulator is used to modify the setpoint automatically depending on external conditions.
This modification is obtained by adding a negative or positive value to the setpoint (offset or differential) depending on:

- analogue input set as dynamic setpoint input
  N.B.: this applies to AI3 (*CF14*=9) and AI4 (*CF15*=9) only

or

- External temperature

This function has two purposes: to save energy or to run the machine at extreme external temperatures.

The dynamic setpoint is active when:

- Activation parameter *dS00*= 1
- Probes AI3 / AI4 (*analogue inputs*) have been configured as dynamic setpoint input (***CF14*/ *CF15*=9**) or
- Probes AI1 AI2 AI3 AI4 (*analogue inputs*) have been configured as External temperature (***CF12*...*CF14*=6**)

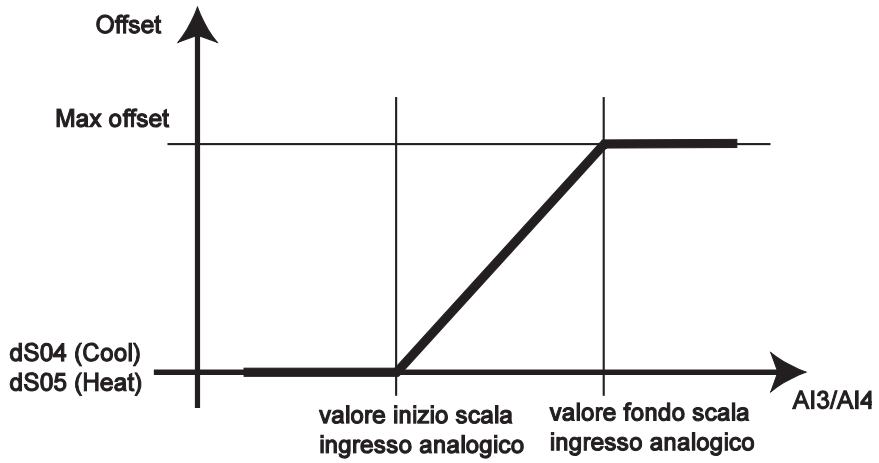
17.1 Modification (decalibration) of the setpoint based on the dynamic setpoint input

17.1.1 Modification (decalibration) of the setpoint based on the dynamic setpoint input with positive (offset).

The figure shown above shows decalibration in both cooling and heating modes:

- parameters for regulation in cooling *dS04*
- parameters for regulation in heating *dS05*

Modification based on the dynamic setpoint input with positive offset

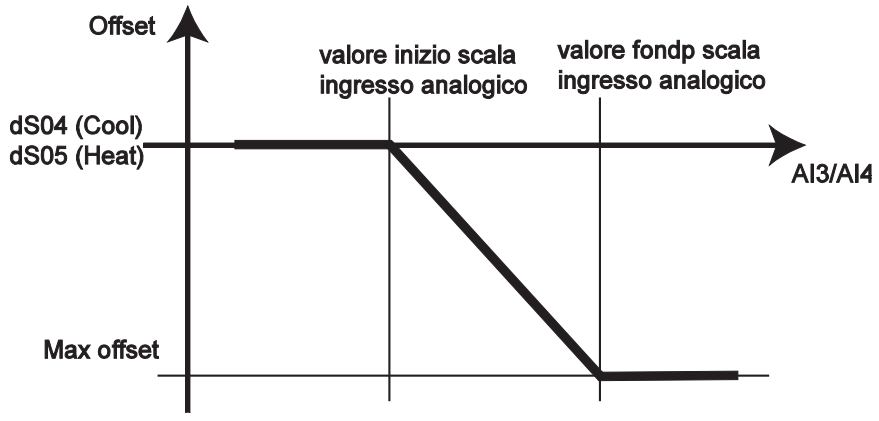


Positive Offset

17.1.2 Modification (decalibration) of the setpoint based on the dynamic setpoint input with Negative (offset)

See above

Modification based on the dynamic setpoint input with negative offset



Negative Offset

Cool mode	HEAT mode
//	*dS04* **Maximum temperature controller dynamic differential in Heat**
dS05 **Temperature controller dynamic differential setpoint in Cool**	//

17.2 Modification (decalibration) of the setpoint based on the external temperature

The setpoint can be decalibrated based on external temperature either proportionally or with a fixed decalibration; it is set by configuring parameter ***dS07*** - **Enable temperature controller dynamic differential** appropriately. It allows the digital dynamic differential of the temperature controller to be enabled.

- 0 = Proportional
- 1 = Fixed

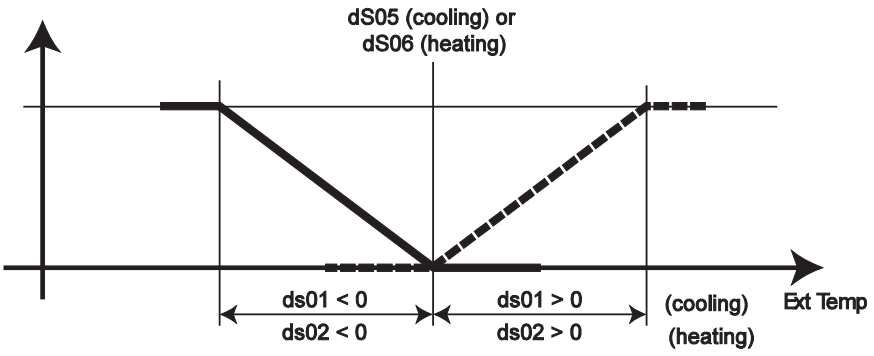
17.2.1 Modification (decalibration) of the setpoint based on the external temperature (dS07=0)

Proportional decalibration of the setpoint with positive differential (offset)
The figure shown above shows decalibration in both cooling and heating modes:

- parameters for regulation in cooling *dS01*, *dS05*
- parameters for regulation in heating *dS02*, *dS06*

Modification based on the external temperature with positive offset

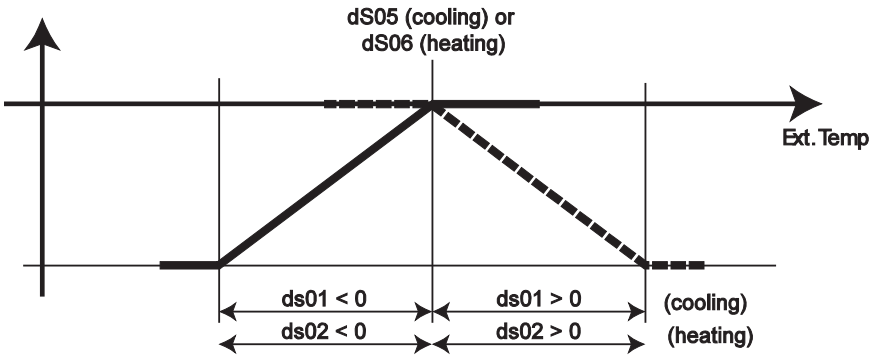
Positive Offset



Proportional decalibration of the setpoint with negative differential (offset)
See above

Modification based on the external temperature with negative offset

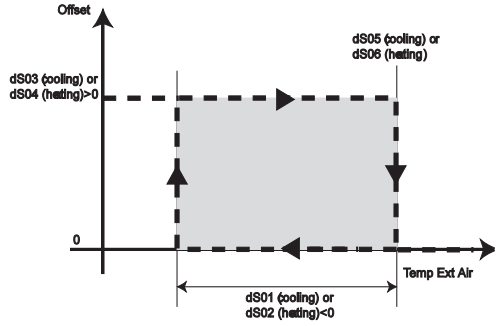
Negative Offset



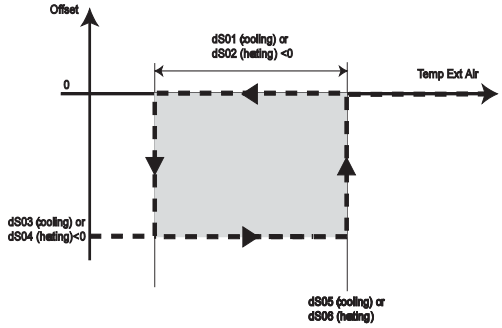
Cool mode	HEAT mode
dS01 **Temperature controller dynamic differential proportional band in Cool**	//
//	***dS02*** **Temperature controller dynamic differential proportional band in Heat**
//	***dS04*** **Maximum temperature controller dynamic differential in Heat**
dS05 **Temperature controller dynamic differential setpoint in Cool**	//
Ext Temp: External temperature	Ext Temp: External temperature

17.2.2 Fixed modification (decalibration) of the setpoint (dS07 = 1)

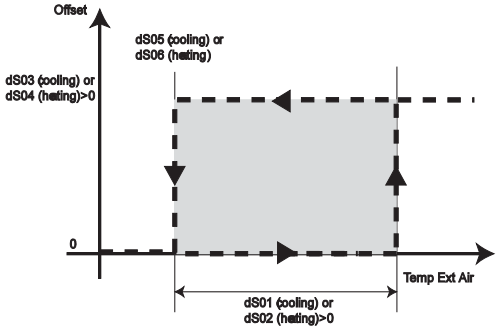
Differential > 0
Band < 0



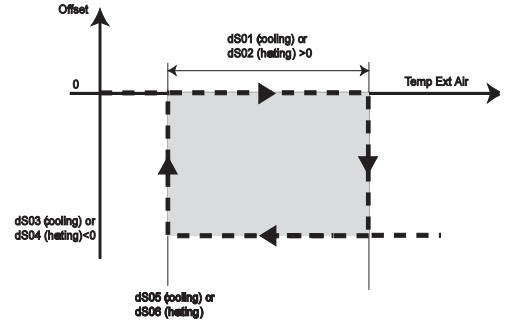
Differential < 0
Band < 0



Differential > 0
Band > 0



Differential < 0
Band > 0



COOL		HEAT	
dS01	Dynamic differential proportional band of temperature controller in Cool		
		dS02	Dynamic differential proportional band of temperature controller in Heat
dS03	Maximum dynamic differential of temperature controller in Cool		
		dS04	Maximum temperature controller dynamic differential in Heat
dS05	Dynamic differential setpoint of temperature controller in Cool		
		dS06	Temperature controller dynamic differential setpoint in Heat

Ext Air temperature	External air temperature
Offset	differential

18 ADAPTIVE (FOLDER PAR/AD)

Chillers generally contain a water accumulation tank.
The purpose of these tanks is to create sufficient thermal inertia to stop the compressor from repeatedly switching on and off in periods in which the temperature requirements in the area to be cooled are relatively few (switching repeatedly on and off will reduce the life time of compressors).
A water accumulator increases the thermal capacity and provides the inertia required to extend running time. Nevertheless, water accumulation is also a substantial cost and also adds to the minimum dimensions of the machine.

Adaptive function parameters can be viewed and configured in the **Ad** *folder* (see chapters on User Interface and Parameters).

18.1 Operating modes

By adjusting the setpoint and hysteresis, the *Adaptive function* simulates electronically the inertia of a water accumulator, meaning it can be used less.

Parameter	Description	0	1	2
Ad00	**Enable machine function without accumulation**	Accumulator disabled	Accumulator enabled	//
Ad01	**Accumulation offset type**	Setpoint	Hysteresis	Setpoint + hysteresis

***MT minimum time* and ET real time**
Note that compressor on/off times must respect safety time delays:

The function analyses actual running time of the compressor (ET) comparing it with the preset minimum running time (*MT*).

Minimum time MT

The *minimum time* (*MT*) is set in parameter *Ad07* - **Reference compressor on time for adaptive accumulation**

offset	Parameter	Description
	Ad07	**Reference compressor on time for accumulation offset**

Real time ET

Real running time (ET) is recorded automatically by the device

Type of plant	ET
2 compressors / Partialized compressor	Count [first compressor on / first partialization, last resource switched off]
Ordinary compressor	Count [compressor on, compressor off)

18.2 Adaptive function with setpoint modification

ET<MT example

If ET<*MT*:
when the compressor switches off, the operating setpoint is changed to a value equal to the adaptive offset (AO) according to the formula below:

- **AO=((*MT* – ET)* *Ad02*)/10 + *Ad03***

Adaptive function Setpoint modification in cooling

COOLING MODE

- ***ET<MT example***
  If the real running time (ET) is less than the *minimum time* (*MT*), each time the compressor switches off, the adaptive offset is subtracted from the setpoint.

Cycle 0:
- Setpoint for cycle 0: SET(0) = SET (COOL)
- Hysteresis for cycle 0: ISTERESI (0) = ISTERESI (COOL)
- Compressor ON: SET (0)+HYSTERESIS (0) ---> SET (COOL) +HYSTERESIS (COOL)**
- Compressor OFF: SET (0)

Cycle 1:
- Setpoint for cycle 1: SET(1) = SET (0) – AO(1) = SET(COOL)-AO(1)
- Compressor ON: SET (0)+HYSTERESIS (0) ---> SET (COOL) +HYSTERESIS (COOL)**
- Compressor OFF: SET (0) – AO(1) = SET (COOL)** – AO(1)

Cycle 2:
- Setpoint for cycle 2: SET(2) = SET (1) – AO(2)
- Compressor ON: SET (0)+HYSTERESIS (0) ---> SET (COOL) +HYSTERESIS (COOL)**
- Compressor OFF: SET (0) – AO(2) = SET (COOL)** – AO(2)

...

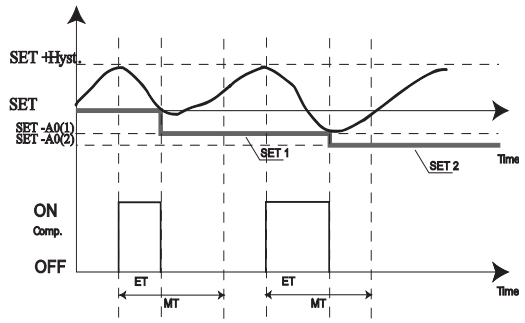
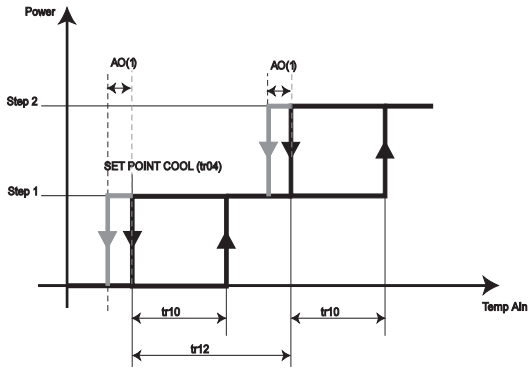
- **ET>*MT* example**
  Every time the real running time (ET) is greater than the *minimum time* (*MT*), at the end of the *minimum time* the setpoint is increased by a value equal to *Ad04* until the initial setpoint is reached.

Adaptive function
Modification of setpoint in heating

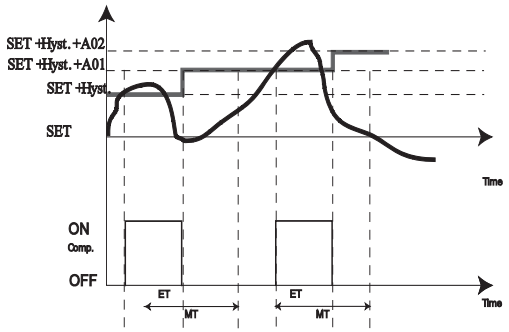
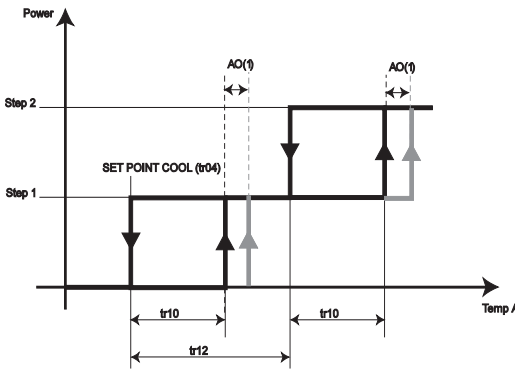
HEATING MODE
Same as heating example. The offset is ADDED to the setpoint:
- SET(0) = SET (HEAT)
- SET(1) = SET(HEAT)+AO(1)
- SET(2) = SET(HEAT)+AO(2)

...

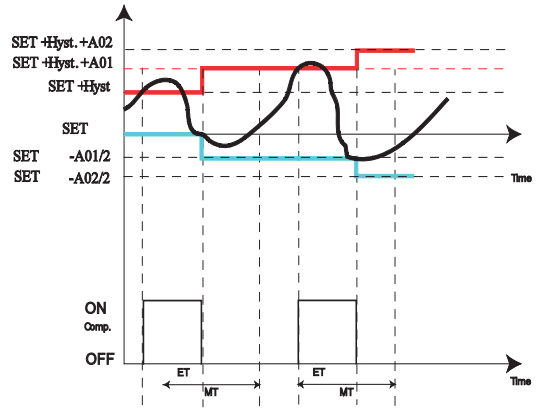
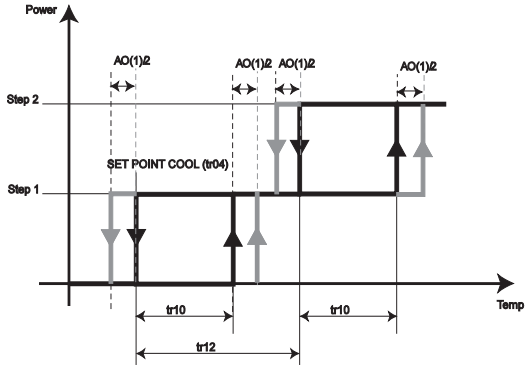
Note that in both modes, the compressor on temperature is the same for each operating cycle, even when the *adaptive function* is activated.
This extends the zone between the setpoint and on temperatures, reducing the number of times the compressor switches on and off and thereby reducing any overlap with safety times.

Cooling mode	
Adaptive function with setpoint modification **(*Ad01*=0)**	**Setpoint modification after calculation of AO1**
	
SET1 = SET(1), SET2=SET(2)	

18.3 Adaptive function with hysteresis modification

Adaptive function with hysteresis modification **(*Ad01*=1)**	**Hysteresis modification after calculation of AO1**
	

18.4 Adaptive function with setpoint and hysteresis modification

Adaptive function with setpoint and hysteresis modification (*Ad01*=2)	Setpoint and hysteresis modification after calculation of AO1
	

18.5 Setpoint regression

ET≥MT example

If ET ≥ *MT*:

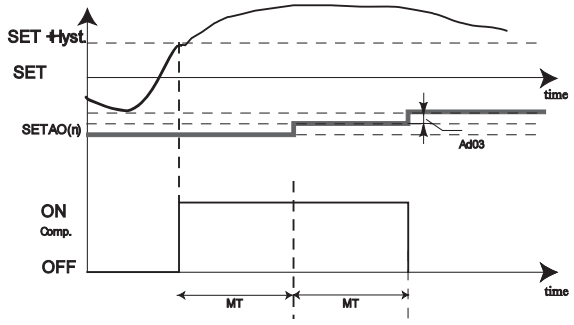
If the cycle time is long enough (and greater than *MT*), regression of the real setpoint occurs: for each interval of *Ad06* (from the start of the cycle), the setpoint is modified by the value set in *Ad03*.

- in cooling, the setpoint (real for cycle N) is increased:
  after *Ad06*: SET(N) + *Ad03*
  after 2**Ad06*: SET(N) + 2**Ad03*
  and so on until the maximum value (setpoint / hysteresis)
- in heating, the setpoint is reduced as above, down to the minimum value (setpoint / hysteresis).

Hence for long cycle times, the "adaptive" function balances out making the cycle times compatible with *compressor timings*.

Cooling mode

Setpoint regression



Parameter	Description	Parameter
Ad02	Accumulation offset constant	See **Modify setpoint offset calculation formula**
Ad03	Accumulator offset differential	See **Modify setpoint offset calculation formula** See ***Setpoint regression***
Ad04	Block accumulation offset setpoint in cooling mode	See ***Protection*** **in cooling mode**
Ad05	Block accumulation offset setpoint in heating mode	See ***Protection*** **in heating mode**
Ad06	Compressor on time for accumulation offset/regression	See ***setpoint regression***

Ad07	Reference compressor on time for accumulation offset	**See *minimum time MT***

18.6 Protection

COOL
If the outlet temperature < *Ad04* during general cycle n, the controller performs the following actions:

- Switches off the compressor (or compressors)
- Clears the adaptive offset AO(n) = 0; the next cycle recommences with the original setpoint and hysteresis

This adjustment can be considered a precursor of the antifreeze alarm (the cycle stops without generating an alarm) should the *adaptive function* lead to a very low real setpoint.
We recommend you set *Ad04* > *AL12* Internal circuit antifreeze alarm regulator setpoint

HEAT
If the outlet temperature > *Ad05* during general cycle n, the controller performs the following actions:

- Switches off the compressor (or compressors)
- Clears the adaptive offset AO(n) = 0; the next cycle recommences with the original setpoint and hysteresis

This adjustment can be considered a precursor of the high pressure alarm (the cycle stops without generating an alarm) should the *adaptive function* lead to a very high real setpoint.

To set *Ad05*, we recommend you refer to the high pressure safety devices in use (pressure switch configuration, type of refrigerant used, and so on).

19 ANTIFREEZE PARAMETERS WITH HEAT PUMP (FOLDER PAR/AF) - ANTIFREEZE

Antifreeze parameters can be viewed and configured in *folder* **AF** (see User Interface and Parameters chapters).
The function is always active in any machine operating state, i.e. cooling, heating and standby.
The antifreeze function with water pump and heat pump is enabled

- via parameter (***AF00*** **- Enable heat pump function in antifreeze** = 1)

The Heating LED flashes when this function is active.
For the antifreeze function, this function uses both the water pump and the heat pump.

Parameter	Description	Value	
		0	**1**
AF00	**Enable heat pump operation in antifreeze**	Heat pump disabled	Heat pump enabled

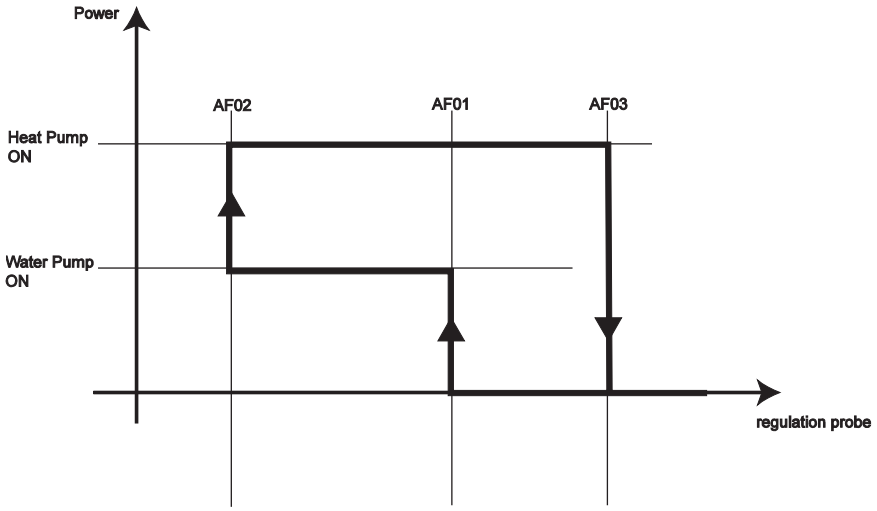
Enable water pump / heat pump

- The water pump activates (°) if the temperature read by the temperature control probe in COOL < ***AF01*** **water pump regulator setpoint for heat pump function in antifreeze**
- The heat pump activates when the temperature control probe is adjusted in HEAT mode if the temperature read by the temperature control probe in COOL mode < ***AF02*** **heat pump regulator setpoint in antifreeze**

Disable water pump / heat pump

- The water pump and heat pump will only disable if the temperature read by the temperature control probe in COOL mode exceeds *AF03* **-*Block heat pump* setpoint in antifreeze**

(°) water pump / heat pump will be activated if they were previously off; if they were on, they will stay on



20 POWER LIMITATION (FOLDER PAR/PL)

Power limitation parameters can be viewed and set in *folder* **PL** (see User Interface and Parameters chapters).

20.1 Operating modes

The power limitation function:

- protects the machine from high and low temperature situations when used with the temperature control probe;
- protects the machine from high pressure situations, when used with the high pressure probe;
- protects the machine from low pressure situations, when used with the low pressure probe;
- prevents the machine from running at a low efficiency level, when used with the external temperature.

The function is always active in any machine operating state, i.e. cooling, heating and standby.
The power limitation function is enabled in parameter (***PL00*** **-** Enable power limitation function = 1)

Parameter	Description	Value			
		0	**1**	**2**	**3**
PL00	Enable power limitation function	Power limitation disabled	Power limitation enabled	//	//
PL01	Select probe for power limitation	Internal exchanger water/air outlet temperature	High pressure	Low pressure	External temperature

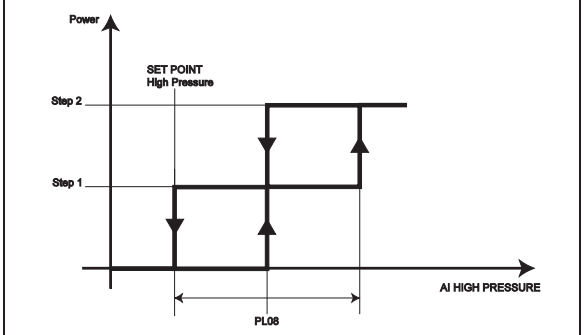
See diagram	Parameter	Description				Mode	
		Parameter description				**COOL**	**HEAT**
A	***PL02***	Setpoint	High pressure	For power limitation	**High Pressure SETPOINT**	**x**	**x**
B	***PL03***		Low pressure		**Low Pressure SETPOINT**	**x**	**x**
C	***PL04***		High water temperature		**Low H20 temp. SETPOINT**	**x**	**x**
D	***PL05***		Low water temperature		**Low H20 temp. SETPOINT**	**x**	**x**
E	***PL06***		External temperature	For power limitation in COOL	**Ext. temp SETPOINT COOL**	**x**	//
F	***PL07***		External temperature	For power limitation in HEAT	**Ext. temp SETPOINT HEAT**	//	**x**
A...F	***PL08***		Proportional band	Power limitation		//	//

Power limitation – 2 compressors

Diagrams **A...F** show the inhibition/enabling of two steps (twin-compressor machine or partialized compressor);
The pressure or temperature interval between inhibition/enabling of one step and the other depends on the proportional band and the number of resources present in the circuit.
The switching on/off of steps respects the operating logic set.

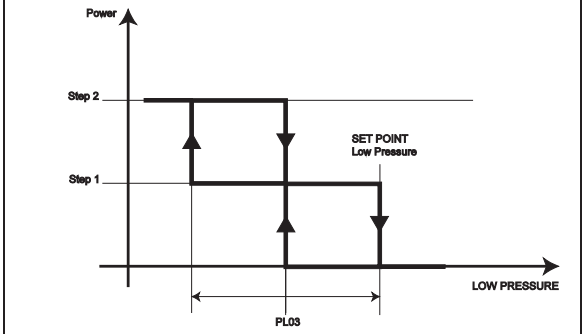
20.2 Power limitation – by high pressure probe (Cool and Heat)

Diagram A
by high pressure probe (Cool and Heat)
PL02 **High Pressure SETPOINT**



20.3 Power limitation – by low pressure probe (Cool and Heat)

Diagram B
by low pressure probe (Cool and Heat)
PL03 **Low Pressure SETPOINT**



20.4 Power limitation – by temperature control probe (Cool and Heat)

Diagram C
by high temperature of temperature control probe (Cool and Heat)
PL04 **High H2O temp. SETPOINT**

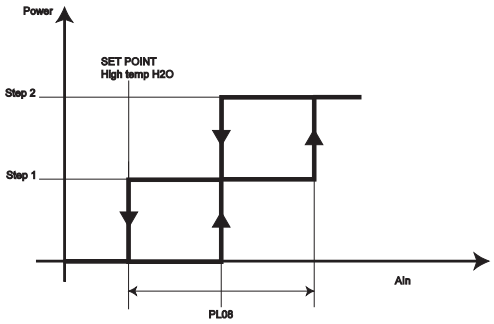
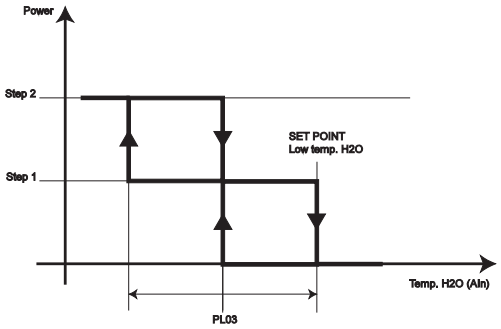
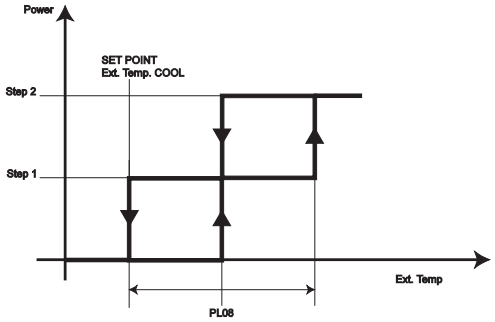
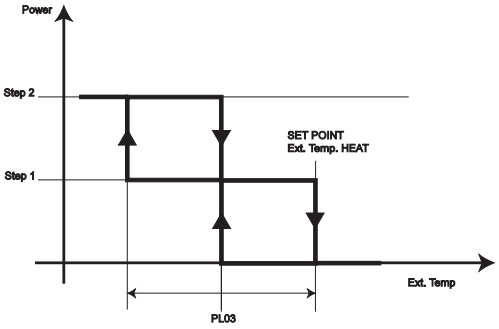


Diagram D
by low temperature of temperature control probe (Cool and Heat)
PL05 **Low temp. SETPOINT SETPOINT**



20.5 Power limitation – by external temperature (Cool and Heat)

Diagram E by high external temperature in Cool mode *PL06* Ext. SETPOINT COOL	Diagram F by high external temperature in Heat mode *PL07* Ext. temp. SETPOINT HEAT
	

21 ALARMS AND DIAGNOSTICS (FOLDER PAR/AL)

Alarms

"Energy ST500 " performs full installation diagnostics and signals a variety of *alarms*.

Parameters for alarm activation and acknowledgment can be viewed and configured in *folder* **AL (parameters *AL00*...*AL47*)** (see User Interface and Parameters chapter).

For some *alarms*, the signal can be excluded for a preset interval, set in the relative parameter.
For some *alarms*, the number of interventions can be counted: if the limit set in the parameter has been exceeded in the last hour, the alarm switches from automatic reset to manual reset.

Automatic reset
For automatic reset *alarms*, normal operation is restored as soon as the cause of the alarm has been removed.

Manual reset
Alarms can be manually reset by pressing and releasing the [UP + DOWN] *keys*
Normal operation can only be reset

- by pressing a key on the instrument keyboard and
- only if the cause of the alarm has been removed.

Alarm deactivation
Alarms can be acknowledged by pressing any key.
N.B: acknowledging an alarm has no effect on the alarm generated other than on the alarm LED that goes from fixed to flashing.

An alarm has two effects:

- It blocks the utilities concerned
- Message on *display* alternates with a message on the main *display*

The next two sections summarize *alarms* grouped by type (digital or analogue).
Alarm code and alarm parameters are in bold (PAr/AL *folder*)

Digital alarms

21.1.1 Digital alarms

Alarm code	Name of alarm	Bypass activation event	Bypass time	Automatic alarm activation time	Manual alarm activation time	Exit alarm deactivation time	Number of interventions per sample time
Er01	High Pressure Alarm	None	not present	not present	not present	not present	***AL03***
Er05	Low Pressure Alarm	Circuit compressor activated or reversal of 4-way valve *(NOTE 1)*	***AL02***	not present	not present	not present	***AL01***
Er20	Internal circuit flow meter alarm	Internal circuit pump activation	***AL05***	***AL06***	***AL04***	***AL07***	not present
Er25	External flow switch alarm	External circuit pump activation	***AL37***	***AL38***	***AL36***	***AL39***	not present
Er10	Compressor 1 thermoswitch	Compressor switched on	***AL09***	not present	not present	not present	***AL08***
Er11	Compressor 2 thermoswitch	Compressor switched on	***AL09***	not present	not present	not present	***AL08***
Er41	External exchanger fan thermoswitch	None	Not present	Not present	not present	Not present	***AL10***
Er40	Internal exchanger fan thermoswitch	None	Not present	Not present	not present	Not present	***AL35***
Er15	Compressor 1 oil pressure switch	Compressor 1 switched on	***AL48***	Not present	not present	Not present	***AL42***
Er16	Compressor 2 oil pressure switch	Compressor 2 switched on	***AL48***	Not present	not present	Not present	***AL42***
Er21	Internal circuit pump thermoswitch	None	Not present	Not present	not present	Not present	***AL40***
Er26	External circuit pump thermoswitch	None	Not present	Not present	not present	Not present	***AL41***
Er50	Internal exchanger electric heater thermoswitch	None	Not present	Not present	not present	Not present	not present

Alarm code	Name of alarm	Bypass activation event	Bypass time	Automatic alarm activation time	Manual alarm activation time	Exit alarm deactivation time	Number of interventions per sample time
Er51	Internal exchanger electric heaters thermoswitch 2	None	Not present	Not present	not present	Not present	not present
Er52	External exchanger electric heater thermoswitch	None	Not present	Not present	not present	Not present	not present
Er56	*Auxiliary heaters* thermoswitch	None	Not present	Not present	not present	Not present	not present

(NOTE 1) The bypass is activated by the reversal of the 4-way valve only if at least one compressor is on.
During defrost, the low pressure alarm is disabled if Pa *AL20* = 0.

21.1.2 Analogue alarms

NOTES

(NOTE 1) If no. interventions = 0, when the first event occurs there is a manual reset alarm.
(NOTE 2) Alarm bypass is active in heating mode only.

Alarm code	Name of alarm	Bypass activation event	Bypass time	SET activation	Hysteresis	Automatic alarm time (NOTE 1)	No. interventions time	Control sensor
Er03	High pressure (analogue)	None	None	***AL25***	***AL27***	Not present	***AL43***	High pressure probe
Er07	Low pressure (analogue)	Compressor switches on or 4-way valve reverses	***AL28***	***AL24***	***AL26***	Not present	***AL29***	Low pressure probe
Er30	Internal circuit antifreeze	On/Off (local or remote), input in heat mode *(NOTE 2)*	***AL15***	***AL12***	***AL13***	Not present	***AL11***	Internal exchanger water/air outlet temperature
Er31	External circuit antifreeze	On/Off (local or remote), input in heat mode *(NOTE 2)*	***AL47***	***AL45***	***AL46***	Not present	***AL44***	External exchanger water outlet temperature
Er35	High temperature	None	None	***AL21***	***AL22***	***AL23***	Automatic reset	Internal exchanger water/air outlet temperature

21.1.3 Table of Alarms

- The alarm signal consists of a code, the format being "Er**nn**" (nn is a 2-figure number identifying the type of alarm, eg: Er00, Er25, Er39....).
- When more than one alarm occurs at the same time, the one with the lowest number will be shown first; (e.g. simultaneous *alarms* Er00 and Er01). Er00 will be shown alternating between the *display* and the main screen.
- If the measurement on the main *display* is incorrect, in the event of an alarm, the alternate alarm code will alternate with "----".

All possible *alarms* are listed in the table below with their respective codes and the relative utilities blocked:

Alarm table key

column		
Alarm code	**N.B: codes are listed in increasing order (Er00, Er01) and some numbers are "skipped" (Er02 does not exist).**	
Name of alarm		
Notes	**CMP 1/2**	Compressor 1/power step 2
	PUMP 1/2	Pump 1/2
Alarm	**D**	Digital
	A	Analogue
		See *digital alarms* table
Reset	**AUTO**	Automatic
UTILITY	**OFF COMP1**	OFF compressor 1
	OFF COMP2	OFF compressor 2
	OFF (1)	When used for temperature control
	OFF (2)	When used for temperature control and/or antifreeze
	OFF RES1	OFF heater 1
	OFF RES2	OFF heater 2

Table of Alarms

Table of Alarms

Alarm code	Name of alarm	Notes	Digital/Analogue	Alarm type	COMPRESSORS	EXTERNAL EXCHANGER FAN	RECIRCULATION FAN	INTERNAL CIRCUIT PUMP	EXTERNAL CIRCUIT PUMP	INTERNAL EXCHANGER HEATERS	*EXTERNAL EXCHANGER HEATERS*	*AUXILIARY HEATERS*	BOILER
Er00	General alarm		**D**	AUTO	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Er01	High pressure (digital)		**D**	Events	OFF								
Er03	High pressure (analogue)		**A**	Events	OFF								
Er05	Low pressure (digital)		**D**	Events	OFF	OFF	OFF						
Er07	Low pressure (analogue)		**A**	Events	OFF	OFF	OFF						
Er09	No refrigerant		**A**	Events	OFF	OFF	OFF						
Er10	Compressor 1 safety thermoswitch	CMP 1	**D**	Events	OFF COMP1								
Er11	Compressor 2 safety thermoswitch	CMP 2	**D**	Events	OFF COMP2								
Er15	Compressor 1 oil pressure switch	CMP 1	**D**	Events	OFF COMP1								
Er16	Compressor 2 oil pressure switch	CMP 2	**D**	Events	OFF COMP2								

Alarm code	Name of alarm	Notes	Digital/Analogue	Alarm type	COMPRESSORS	EXTERNAL EXCHANGER FAN	RECIRCULATION FAN	INTERNAL CIRCUIT PUMP	EXTERNAL CIRCUIT PUMP	INTERNAL EXCHANGER HEATERS	*EXTERNAL EXCHANGER HEATERS*	*AUXILIARY HEATERS*	BOILER
Er20	Internal circuit flow switch		**D**	Time	OFF	OFF		OFF for manual reset alarm		OFF			OFF
Er21	Internal circuit pump thermoswitch	Pump 1	**D**	Events	OFF	OFF		OFF		OFF			OFF
Er25	External circuit flow switch		**D**	Time	OFF				OFF for manual reset alarm		OFF		
Er26	External circuit pump thermoswitch		**D**	Events	OFF				OFF		OFF		
Er30	Internal circuit antifreeze		**A**	AUTO	OFF	OFF							
Er31	External circuit antifreeze		**A**	AUTO	OFF	OFF							
Er35	High temperature		**A**	AUTO	OFF								
Er40	Internal exchanger fan safety thermoswitch		**D**	Events	OFF		OFF			OFF			
Er41	External exchanger fan safety thermoswitch		**D**	Events	OFF	OFF					OFF		
Er45	Error clock faulty			AUTO									
Er46	Error set clock			AUTO									
Er47	ST500 – remote keyboard communication error			AUTO									
Er50	Internal exchanger electric heater thermoswitch 1		**D**	AUTO						OFF RES.1 OFF RES.2		OFF	
Er51	Internal exchanger electric heaters thermoswitch 2		**D**	AUTO						OFF RES.1 OFF RES.2			
Er52	External exchanger electric heater thermoswitch		**D**	AUTO							OFF RES.1		
Er56	*Auxiliary heaters* thermoswitch		**D**	AUTO								OFF	
Er60	Internal exchanger water/air inlet temperature probe faulty			AUTO	See probe error table								
Er61	Internal exchanger water/air outlet temperature probe faulty			AUTO	See probe error table								
Er62	External exchanger temperature probe faulty			AUTO	See probe error table								
Er63	External exchanger inlet water temperature probe faulty			AUTO	See probe error table								

Alarm code	Name of alarm	Notes	Digital/Analogue	Alarm type	COMPRESSORS	EXTERNAL EXCHANGER FAN	RECIRCULATION FAN	INTERNAL CIRCUIT PUMP	EXTERNAL CIRCUIT PUMP	INTERNAL EXCHANGER HEATERS	*EXTERNAL EXCHANGER HEATERS*	*AUXILIARY HEATERS*	BOILER
Er64	External exchanger outlet water temperature probe faulty			AUTO	See probe error table								
Er68	External temperature probe faulty			AUTO									
Er69	High pressure transducer faulty			AUTO	See probe error table								
Er70	Low pressure transducer faulty			AUTO									
Er73	Dynamic setpoint input faulty			AUTO									
Er74	Internal exchanger transducer faulty			AUTO	See probe error table								
Er75	External exchanger transducer faulty			AUTO	See probe error table								
Er80	Configuration error			AUTO	See probe error table								
Er81	Compressor 1 exceeded running hours message	CMP 1		Manual									
Er82	Compressor 2 exceeded running hours message	CMP 2		Manual									
Er85	Pump 1 exceeded running hours message	PUMP 1		Manual									
Er86	Pump 2 exceeded running hours message	PUMP 2		Manual									
Er90	Alarm history records exceeded message			Manual									

Probe errors table *Probe errors table*

Probe error	Use	Machine block	NOTES
Internal exchanger air/water inlet temperature	Temp. control Cool	YES	
	Temp. control Heat (integrated heaters)	YES	
	Temp. control Cool differential	YES	
	Temp. control Heat differential	YES	
	Changeover	YES	
	Recirculation fan	NO	The fan switches ON/OFF depending on the compressor state
	Low refrigerant alarm	NO	The alarm is disabled
Internal exchanger water/air outlet temperature temperature		YES	
External exchanger temperature	Condensation control	NO	Fans ON/OFF 100% when requested by compressor
	Start defrost	NO	Timed start depending on compressor state
	Exit defrost	NO	Exit for time-out
External exchanger inlet water temperature	Temp. control Cool	YES	
	Temp. control Heat (integrated heaters/boiler)	YES	
	Temp. control Cool differential	YES	
	Temp. control Heat differential	YES	
External exchanger outlet water temperature		YES	
External temperature	Temp. control Cool differential	YES	
	Temp. control Heat differential	YES	
	Change over	NO	Changeover from key

Probe error	Use	Machine block	NOTES
	Antifreeze with H2O pump	NO	Pump forced on at 100%
	Internal exchanger electric heater setpoint	NO	Setpoint set from parameter
	Boiler setpoint	NO	Setpoint set from parameter
	Auxiliary electric heaters	NO	Heaters are forced ON
	Temperature/pressure offset for *start defrost*	NO	*Start defrost* at predefined setpoint
	Dynamic setpoint	NO	Setpoint set from parameter
High pressure input		YES	
Low pressure input		YES	
Dynamic setpoint input	Dynamic setpoint	NO	Setpoint set from parameter
External exchanger pressure		YES	
Internal exchanger pressure		YES	

22 PARAMETERS (PAR)

Every aspect of Energy ST500 can be configured via the parameters.

They can be modified by means of:
- *Multi Function key*
- Instrument keyboard
- Personal computer

The following sections analyse each parameter, divided into categories (folders), in detail.

Each *folder* is designated with 2 figures (example: CF, UI, etc).

	Folder label	**Acronym meaning (*label*)**	**Parameters**	**Parameters for:**
	CF	**C**on**F**iguration	*CF00... CF77*	Configuration
	Ui	**U**ser **i**nterface	*UI00...UI18*	User interface
	tr	**T**emperature control	*tr00...tr20*	Temperature control
	St	**St**atuses (*Operating modes*)	*St00...St04*	Operating states
	CP	**C**om**P**ressors	*CP00..CP10*	Compressor
Pump	**PI**	**P**ump (**I**nternal)	*PI00..PI24*	Internal circuit water pump
Fan	**FI**	**F**an (**I**nternal)	*FI00..FI08*	Recirculation fans (internal)
	FE	**F**an (**E**xternal)	*FE00..FE30*	External exchanger fans (external)
Pump	**PE**	**P**ump (**E**xternal)	*PE00*	External exchanger pump
Electric heaters	**HI**	Electric **H**eaters (**I**nternal)	*HI00*..H15	Internal exchanger electric heaters
	HE	Electric **H**eaters (**E**xternal)	*HE00..HE06*	External exchanger electric heaters
	HA	Electric **H**eaters (**A**uxiliary)	*HA00..HA02*	Auxiliary electric heaters
	br	**B**oile**r**	*br00...br06*	Boiler
	dF	**deF**rost	*dF00...dF14*	Defrost
	dS	**d**ynamic **S**etpoint	*dS00...dS07*	Dynamic setpoint
	Ad	**Ad**aptive	*Ad00..Ad07*	Adaptive (*adaptive function*)
	AF	**A**nti**f**reeze	*AF00..AF03*	Antifreeze
	PL	**P**ower **L**imitation	*PL00...PL08*	Power limitation
	AL	**AL**arm	*AL00..AL48*	*Alarms*

Visibility and value of Parameters
Energy ST500 is a "family" of controllers.
There are 6 hardware *models* (see Appendix, *Models* section) with varying numbers of inputs and outputs.
The 6 hardware *models* are grouped into 2 *Param manager models* (version with *TRIAC* and version with 5 relays). Depending on the model, some configuration parameters may not (usually) be visible and/or be of no significance given that the associated resource is not present.
See the table below.

	Param Manager	**Hardware**	**TC1**	**DO6**	**AO2**	**AO3**
Model	**ST54***	**ST542/C**	***CF33-CF36-CF39-CF42***	//	***CF35-CF38-CF41-CF44*** No significance	***CF27-CF30*** No significance
		ST543/C			***CF35-CF38-CF41-CF44***	***CF27-CF30*** No significance
		ST544/C				***CF27-CF30***
	ST5*	**ST551/C**	//	***CF50***	***CF35-CF38-CF41-CF44*** No significance	***CF27-CF30*** active
		ST552/C			***CF35-CF38-CF41-CF44***	***CF27-CF30*** No significance
		ST553/C				***CF27-CF30***

When not indicated otherwise, the parameter is always visible and modifiable, unless customised settings have been configured via serial.

N.B: parameters and *folder* visibility can both be managed (See *Folder* table).
If *folder* visibility is modified, the new setting will apply to all parameters in the *folder*.

22.1.1 Configuration parameters (CF)

CF00 **Type of analogue input AI1** – see table
To set analogue input AI1

0	Probe not configured
1	DI
2	NTC

CF01 **Type of analogue input AI2** – same as *CF00*
CF02 **Type of analogue input AI3** – see table
To set analogue input AI3

0	Probe not configured	**3**	4..20mA
1	DI	**4**	0-10V
2	NTC	**5**	0-5V
		6	0-1V

CF03 **Type of analogue input AI4** – same as *CF02*
CF04 **Analogue input AI3 full scale value**
To configure the full scale value with analogue input AI3
CF05 **Analogue input AI3 start of scale value**
To configure the start of scale value with analogue input AI3
CF06 **Analogue input AI4 full scale value**
To configure the full scale value with analogue input AI4
CF07 **Analogue input AI4 start of scale value**
To configure the start of scale value with analogue input AI4
CF08 **Analogue input AI1 differential**
CF09 **Analogue input AI2 differential**
CF10 **Analogue input AI3 differential**
CF11 **Analogue input AI4 differential**
To configure the differential in analogue input AI1...AI4
CF12 **Configuration of analogue input AI1** – see table
To set analogue input AI1

0	Not set
1	Internal exchanger water/air inlet temperature
2	Internal exchanger water/air outlet temperature
3	External exchanger temperature
4	External exchanger inlet water temperature
5	External exchanger outlet water temperature
6	External temperature

CF13 **Configuration of analogue input AI2** – same as *CF12*
CF14 **Configuration of analogue input AI3** – see table
To set analogue input AI3/AI4

0	Not set		
1	Internal exchanger water/air inlet temperature	**7**	High pressure input
2	Internal exchanger water/air outlet temperature	**8**	Low pressure input
3	External exchanger temperature	**9**	Dynamic setpoint input
4	External exchanger inlet water temperature	**10**	External exchanger pressure
5	External exchanger outlet water temperature	**11**	Internal exchanger pressure
6	External temperature		

CF15 **Configuration of analogue input AI4** – same as *CF14*
CF16 **Configuration of digital input DI1** – see table
To configure digital input DI1

0	Input disabled		
±1	High pressure switch	±17	Auxiliary electric heater thermoswitch
±2	Low pressure switch	±18	Digital input heat step 1 request
±3	External exchanger fan thermoswitch	±19	Digital input heat step 2 request
±4	Internal exchanger fan thermoswitch	±20	Digital input cool step 1 request
±5	Internal circuit flow switch	±21	Digital input cool step 2 request
±6	External circuit flow switch	±22	End of defrost
±7	Compressor 1 thermoswitch	±23	Internal exchanger electric heater 1 thermoswitch
±8	Compressor 2 thermoswitch	±24	Internal exchanger electric heater 2 thermoswitch
±9	Internal circuit pump thermoswitch	±25	External exchanger electric heater thermoswitch
±10	External circuit pump thermoswitch	±26	Economy input
±11	Compressor 1 oil pressure switch	±27	Remote STD-BY
±12	Compressor 2 oil pressure switch	±28	General alarm
±13	Remote ON/OFF	±29	Block compressor 1
±14	Remote Summe*r/W*inter	±30	Block compressor 2
±15	Power step 1 request	±31	Power limited to 50%
±16	Power step 2 request	±32	*Block heat pump*

CF17 **Configuration of digital input DI2**
To configure digital input DI2 – same as *CF16*
CF18 **Configuration of digital input DI3**
To configure digital input DI2 – same as *CF16*
CF19 **Configuration of digital input DI4**
To configure digital input DI4 – same as *CF16*
CF20 **Configuration of digital input DI5**
To configure digital input DI5 – same as *CF16*
CF23 **Configuration of analogue input AI1 when configured as digital input**
To configure analogue input AI1 when configured as digital input – same as *CF16*

Please Note: set to '0' if AI1 is not configured as digital input

CF24 **Configuration of analogue input AI2 when configured as digital input**
To configure analogue input AI2 when configured as digital input – same as *CF16*
Please Note: set to '0' if AI2 is not configured as digital input

CF25 **Configuration of analogue input AI3 when configured as digital input**
To configure analogue input AI3 when configured as digital input – same as *CF16*
Please Note: set to '0' if AI3 is not configured as digital input

CF26 **Configuration of analogue input AI4 when configured as digital input**
To configure analogue input AI4 when configured as digital input – same as *CF16*
Please Note: set to '0' if AI4 is not configured as digital input

CF27 **Type of analogue output AO3 - Visible only in *models* ST544/C, ST553/C**
It's analogue output AO3
- 0 = 0-10V
- 1 = 4-20mA
- 2 = 0-20mA

CF30 **Configuration of analogue output AO3 - Visible only in *models* ST544/C, ST553/C**
To configure analogue output AO3 – se table

0	Output disabled		
±1	Compressor 1	**14**	Proportional external exchanger fan
±2	Output step 2	**15**	Not permitted
±3	Internal circuit water pump	**16**	Internal circuit modulating pump
±4	External circuit water pump		
±5	Reversing valve		
±6	Boiler		
±7	Internal exchanger electric heater 1		
±8	Internal exchanger electric heater 2		
±9	External exchanger electric heater		
±10	Auxiliary electric heater		
±11	External exchanger fan		
±12	Recirculation fan		
±13	Alarm		

For visibility of parameters *CF33* – *CF44* See table at the beginning of this chapter.

CF33 **Enabling analogue output TC1**
Enables analogue output TC1
- 0 = Output configured as digital
- 1 = Output configured as *triac*

CF34 **Enable analogue output AO1**
Enables analogue output AO1
- 0 = Output configured as digital – see *CF51*
- 1 = Output configured as *triac* – see *CF37* - *CF40* - *CF43*

CF35 **Enabling analogue output AO2**
Enables analogue output AO2
- 0 = Output configured as digital – see *CF52*
- 1 = Output configured as *triac* – see *CF38* - *CF41* - *CF44*

CF36 ***Phase shift* analogue output TC1**
To enable *phase shift* of analogue output TC1

CF37 ***Phase shift* analogue output AO1**
To enable *phase shift* of analogue output AO1

CF38 ***Phase shift* analogue output AO2**
To enable *phase shift* of analogue output AO2

CF39 **Analogue output TC1 *pulse length***
Configures analogue output pulse

CF40 **Analogue output AO1*pulse length***
Configures analogue output AO1 pulse

CF41 **Analogue output AO2 *pulse length***
Configures analogue output AO2 pulse

CF42 **Configuration of analogue output TC1**
Configures analogue output TC1

CF43 **Configuration of analogue output AO1**
Configures analogue output AO1 – se table

0	Output disabled		
1	Compressor 1	**9**	External exchanger electric heater
2	Output step 2	**10**	Auxiliary electric heater
3	Internal circuit water pump	**11**	External exchanger fan
4	External circuit water pump	**12**	Recirculation fan
5	Reversing valve	**13**	Alarm
6	Boiler	**14**	Proportional external exchanger fan
7	Internal exchanger electric heater 1	**15**	Not permitted
8	Internal exchanger electric heater 2	**16**	Modulating pump circuit

CF44 **Configuration of analogue output AO2**
Configures analogue output AO2 – same as *CF43*

CF45 **Configuration of digital output DO1**
Configures digital output DO1 – see table

0	Output disabled		
1	Compressor 1	**8**	Internal exchanger electric heater 2
2	Power step	**9**	External exchanger electric heater
3	Internal circuit water pump	**10**	Auxiliary electric heater

	4	External circuit water pump	**11**	External exchanger fan
	5	Reversing valve	**12**	Recirculation fan
	6	Boiler	**13**	Alarm
	7	Internal exchanger electric heater 1		

CF46 **Configuration of digital output DO2**
Configures digital output DO2 – same as *CF45*

CF47 **Configuration of digital output DO3**
Configures digital output DO3 – same as *CF45*

CF48 **Configuration of digital output DO4**
Configures digital output DO4 – same as *CF45*

CF49 **Configuration of digital output DO5**
Configures digital output DO5 – same as *CF45*

CF50 **Configuration of digital output DO6 - Visible only in *models* ST551/C, ST552/C, ST553/C**
Configures digital output DO6 – same as *CF45*

CF51 **Configuration of digital output AO1**
Configures digital output AO1 – same as *CF45*

CF52 **Configuration of digital output AO2**
Configures digital output AO2 – same as *CF45*

CF54 **Select COM1 (TTL) protocol**
Configures the selection of COM1 (TTL) communication channel protocol.

- 0 = Eliwell
- 1 = Modbus

If *CF54*=0, the following *CF55*/*CF56* parameters should be configured:

CF55 **Eliwell protocol controller address**
Allows you to modify the Eliwell protocol controller address.

CF56 **Eliwell protocol controller family**
Allows you to modify the Eliwell protocol controller family.
CF55= device index in family (values from 0 to 14)
CF56 = device family (values from 0 to 14)
The two values *CF55* and *CF56* represent the network address of the device, which is indicated in the following format "FF.DD" (where FF=*CF56* and DD=*CF55*).

If *CF54*=1, the following parameters should be configured: *CF63*/*CF64*/*CF65*

CF63 **Modbus protocol controller address**
To modify the Modbus protocol controller address.
Values from 1 to 255. N.B: 0 (zero) is not included.

CF64 **Modbus protocol Baudrate**
To modify the Modbus protocol baud rate.

- 0=1200 baud
- 1=2400 baud
- 2=4800 baud
- 3=9600 baud
- 4=19200 baud
- 5=38400 baud (maximum speed, to be set using *VarManager* software)
- 6=58600 baud
- 7=115200 baud

CF65 **Modbus protocol parity**
Modbus parity
0= STX

- 1= EVEN
- 2= NONE
- 3= ODD

CF66 **Client code 1**
CF67 **Client code 2**
Parameters for exclusive use by client/user. The client can assign these parameters values that e.g. identify the type and/or model of the system, and its configuration etc.. Values from 0 to 255

CF68 **Firmware mask revision**
Indicates the revision number of the firmware mask. Read-only parameter.

CF72 **RTC present**
Presence of real time clock (RTC)

- 0 = RTC absent
- 1 = RTC present

CF73 **Type of analogue input AI5**

To set analogue input AI5

0	Probe not configured
1	Not used
2	NTC

CF76 **Analogue input AI5 differential**

To configure the differential in analogue input AI5

CF77 **Configuration of analogue input AI5**

0	Not set
1	Internal exchanger water/air inlet temperature
2	Internal exchanger water/air outlet temperature
3	External exchanger temperature
4	External exchanger inlet water temperature
5	External exchanger outlet water temperature
6	External temperature

22.1.2 User interface parameters (UI)

Configuration of utility LEDs

UI00 **Configuration of LED 1**
UI01 **Configuration of LED 2**
UI02 **Configuration of LED 3**
UI03 **Configuration of LED 4**
UI04 **Configuration of LED 5**
UI05 **Configuration of LED 6**
UI06 **Configuration of LED 7**

LED symbol on *display*	LED	Parameter	*Default*	*Default*	*Default* icon on front panel
	LED 1 (first from left)	*UI00*	1	Compressor 1	
	LED 2	*UI01*	2	Output step 2	
	LED 3	*UI02*	7	Internal exchanger electric heater 1	
	LED 4	*UI03*	8	Internal exchanger electric heater 2	
	LED 5	*UI04*	6	Boiler	
	LED 6	*UI05*	11	External exchanger fan	
	LED 7	*UI06*	3	Internal circuit water pump	
LED symbol on *display*	**LED**	**Parameter**			
	LED economy	*UI07*=0 *dS00*=0	*UI07*=0 *dS00*=1	*UI07*=1 *dS00*=0	NOT enabled (LED off)
	LED economy			*UI07*=1 *dS00*=1	Enabled (dynamic setpoint)

To configure LED 1...7

0	Output (LED) disabled	**7**	Internal exchanger electric heater 1
1	Compressor 1	**8**	Internal exchanger electric heater 2
2	Output step 2	**9**	External exchanger electric heater
3	Internal circuit water pump	**10**	Auxiliary electric heater
4	External circuit water pump	**11**	External exchanger fan
5	Reversing valve	**12**	Recirculation fan
6	Boiler	**13**	Alarm

UI07 **Configuration of Economy LED**

To configure the Economy LED (if=1 the economy LED on the *display* will be permanently on)

- 0 = LED disabled
- 1 = dynamic setpoint

UI09 **Select main *display***

To select to view the main *display*.

0	Analogue input 1	**4**	Clock
1	Analogue input 2	**5**	Setpoint set
2	Analogue input 3	**6**	Real setpoint
3	Analogue input 4		

UI10 **Enable *manual defrost* from key**

To enable or disable *manual defrost* ([UP] key) (*manual defrost* function) from a key.

0 = Key not enabled for the function
1 = Key enabled for the function

UI11 **Enable mode function from key**

To enable or disable mode selection ([esc] key) (mode function) from a key.

0 = Key not enabled for the function
1 = Key enabled for the function

UI12 **Enable disp function from key**

To enable or disable configuration of the main *display* from a key [set] (disp function).

0 = Key not enabled for the function
1 = Key enabled for the function

UI13 **Enable “ON/OFF” function from key**
To enable or disable the switching on or off of the device from a key [DOWN] (ON/OFF function).
0 = Key not enabled for the function
1 = Key enabled for the function

UI14 **Enable “set” function from key.**
To enable or disable access via the “set” key to machine state menu and relative subfolders.
0 = Key not enabled for the function
1 = Key enabled for the function

Parameter	Key [Press and hold]	*Default* icon on front panel
UI10	[UP]	
UI11	[esc]	**mode**
UI12	[set]	**disp**
UI13	[DOWN]	
Parameter	**Key (press and release)**	***Default* icon on front panel**
UI14	set	**None (set key)**

UI17 **Installation password**
Installation password
UI18 **Manufacturer password**
Manufacturer password

22.1.3 Temperature control parameters (tr) – temperature controller

tr00 **Type of temperature controller**
To set the type of temperature controller.
0 = Proportional
1 = Differential
2 = Digital
tr01 **Enable heat pump**
To enable or disable the heat pump.
0 = Heat pump absent
1 = Heat pump present
tr02 **Select temperature control probe in Cool**
tr03 **Select temperature control probe in Heat**
To select the temperature control probe in Cool/Heat modes.
0 = NTC input for internal exchanger inlet water/air temperature
1 = NTC input for internal exchanger water outlet temperature
2 = NTC input for external exchanger water inlet temperature
3 = NTC input for external exchanger water outlet temperature
4 = High pressure input
5 = Low pressure input
tr04 **Temperature control setpoint in Cool**
tr05 **Temperature control setpoint in Heat**
To modify temperature control setpoint in Cool/Heat modes.
tr06 **Minimum temperature control setpoint in Cool**
To modify the minimum temperature control setpoint in Cool mode.
tr07 **Maximum temperature control setpoint in Cool**
To modify the maximum temperature control setpoint in Cool mode.
tr08 **Minimum temperature control setpoint in Heat.**
To modify the minimum temperature control setpoint in Heat mode.
tr09 **Maximum temperature control setpoint in Heat.**
To modify the maximum temperature control setpoint in Heat mode.
tr10 **Temperature control hysteresis in Cool**
tr11 **Temperature control hysteresis in Heat**
To modify temperature control hysteresis in Cool/Heat modes.
tr12 **Steps/compressors insertion differential in Cool**
tr13 **Steps/compressors insertion differential in Heat**
To modify the steps/compressors insertion differential in Cool/Heat modes
tr14 **Select probe for *temperature control differential* in Cool**
tr15 **Select probe for *temperature control differential* in Heat**
To select the probe for the *temperature control differential* in Cool/Heat modes

Value	Probe 1	Probe 2
0	NTC input for internal exchanger water/air inlet temperature (***CF12*...*CF15*=1**)	External temperature NTC input (***CF12*...*CF15*=6**)
1	NTC input for internal exchanger water/air outlet temperature (***CF12*...*CF15*=2**)	
2	NTC input for external exchanger water/air inlet temperature (***CF12*...*CF15*=3**)	
3	NTC input for external exchanger water/air outlet temperature (***CF12*...*CF15*=4**)	

tr16 **Enable *block heat pump* function**
To enable or disable the heat pump block
0 = Heat pump block disabled
1 = Heat pump block enabled

tr17 ***Block heat pump* set point**
To set the heat pump block setpoint

tr18 **Heat pump block hysteresis**
To modify the heat pump block hysteresis

tr19 **Setpoint differential in Cool from start of Economy**
To modify the setpoint differential in Cool mode from Economy input

tr20 **Setpoint differential in Heat from start of Economy**
To modify the setpoint differential in Heat mode from Economy input

22.1.4 Function mode selection parameters (St)

St00 **Select function modes**
To select the function mode.
0 = cool only
1 = heat only
2 = heat and cool

St01 **Enable changeover from analogue input.**
To enable operating mode changeover from analogue input.
0 = not enabled
1 = enabled

St02 **Select probe for *automatic changeover* of operating mode.**
To select the probe for *automatic changeover* of the operating mode.
- 0 = external temperature

1 = inlet water temperature
2 = outlet water temperature

St03 **Differential for automatic mode change in Heat**
To modify the differential for the automatic mode change in Heat mode.

St04 **Differential for automatic mode change in Cool**
To modify the differential for the automatic mode change in Cool mode.

22.1.5 Compressor Parameters (CP)

CP00 **Compressor type**
To select the type of compressor
0 = simple (1 step)
1 = 2 step partialized

CP01 **Number of compressors per circuit**
To select the number of compressors per circuit.
1 = 1 compressor
2 = 2 compressors

CP02 **Select compressor on/off sequence**
To select the compressor on/off sequence.

0	Balancing durations		
1	1/2 on ; off 2/1 sequence	4	Limited sequence 2 (only compressor 2 available)
2	On 2/1; off 1/2 sequence	5	Run time 1 sequence
3	Limited sequence 1 (only compressor 1 available)	6	Run time 2 sequence

CP03 ***Minimum time* between the switching off and on of the same compressor**
To modify the *minimum time* between the switching off and on of the same compressor.

CP04 ***Minimum time* between the switching on of the same compressor**
To modify the *minimum time* between the switching on of the same compressor.

CP05 ***Minimum time* between the switching on of more than one compressor**
To modify the *minimum time* between the switching on of more than one compressor.

CP06 ***Minimum time* between the switching off of more than one compressor**
To modify the *minimum time* between the switching off of more than one compressor.

CP07 ***Minimum compressor on time***
To modify the minimum compressor switch on time.

CP08 **Minimum compressor switch on time for increase in partializations**
To modify the minimum compressor switch on time for an increase in partializations.

CP09 **Minimum compressor switch on time for decrease in partializations**
To modify the minimum compressor switch on time for a decrease in partializations.

CP10 **Compressor running time for switch on sequence**
To modify the compressor running time for the switch on sequence.

22.1.6 Internal circuit pump parameters (PI)

PI00 **Enable internal circuit water pump**
To enable or disable the internal circuit water pump.
- 0 = Pump disabled
- 1 = Pump enabled

PI01 **Select internal circuit water pump operating mode**
To select operating mode of the internal circuit water pump.

	Digital		Modulating
0	Continuous digital	2	Continuous modulating
1	Digital on request	3	Modulating on request

PI02 **Delay internal circuit water pump on and compressor on**
To modify the delay between switching on the internal circuit water pump and switching on the compressor.

PI03 **Delay compressor off - internal circuit water pump off.**
To modify the delay between switching off the compressor and switching off the internal circuit water pump.

PI04 **Minimum internal circuit water pump speed in Cool**
To modify the minimum internal circuit water pump speed in Cool mode.

PI05 **Maximum internal circuit water pump speed in Cool**
To modify the maximum internal circuit water pump speed in Cool mode.

PI06 **Minimum internal circuit water pump speed setpoint in Cool**
To modify the minimum internal circuit water pump speed setpoint in Cool mode.

PI07 **Internal circuit water pump proportional band in Cool**
To modify the internal circuit water pump proportional band in Cool mode.

PI08 **Fan speed setpoint to modulate internal circuit water pump in Cool**
To modify the fan speed setpoint to modulate the internal circuit water pump in Cool mode.

PI09 **Internal circuit water pump *pick-up* time in Cool**
To modify the internal circuit water pump *pick-up* time in Cool mode.

PI10 **Minimum internal circuit water pump speed in Heat**
To modify the minimum internal circuit water pump speed in Heat mode.

PI11 **Maximum internal circuit water pump speed in Heat**
To modify the maximum internal circuit water pump speed in Heat mode.

PI12 **Minimum internal circuit water pump speed setpoint in Heat**
To modify the minimum internal circuit water pump speed setpoint in Heat mode.

PI13 **Internal circuit water pump proportional band in Heat**
To modify the internal circuit water pump proportional band in Heat mode.

PI14 **Fan speed setpoint to modulate internal circuit water pump in Heat**
To modify the fan speed setpoint to modulate the internal circuit water pump in Heat mode.

PI15 **Internal circuit water pump *pick-up* time in Heat**
To modify the internal circuit water pump *pick-up* time in Heat mode.

***PI16* - *PI17* - *PI18* ANTILOCK**

PI16 **Enable internal circuit water pump antilock function**
To enable the internal circuit water pump antilock function.
- 0 = Function disabled
- 1 = Function enabled

PI17 **Internal circuit water pump idle time due to antilock**
To modify the internal circuit water pump idle time due to antilock.

PI18 **Internal circuit water pump on time for antilock**
To modify the internal circuit water pump on time for antilock.

***PI19* – *PI20* – *PI21* ANTIFREEZE with PUMP**

PI19 **Enable antifreeze function with internal circuit water pump**
To enable or disable the antifreeze function with internal circuit water pump.
- 0 = Function disabled
- 1 = Function enabled

PI20 **Internal circuit water pump regulator setpoint for antifreeze**
To modify the internal circuit water pump regulator setpoint for antifreeze.

PI21 **Internal circuit water pump regulator hysteresis for antifreeze**
To modify the internal circuit water pump regulator hysteresis for antifreeze.

PI22 **Enable internal circuit water pump on when antifreeze heaters active**
Enables the switching on of the internal circuit water pump when the antifreeze heaters are active.
- 0 = Pump disabled
- 1 = Pump enabled

PI23 **Fan speed hysteresis to modulate internal circuit water pump in Heat**
To modify fan speed hysteresis for modulation of the internal circuit water pump in Heat mode.

PI24 **Fan speed hysteresis to modulate internal circuit water pump in Cool**
To modify fan speed hysteresis for modulation of the internal circuit water pump in Cool mode.

22.1.7 Recirculation fan parameters (FI)

FI00 **Enable recirculation fan**
Enables or disables the recirculation fan.
- 0 = fan disabled
- 1 = fan enabled

FI01 **Select recirculation fan operation**
To select the operating mode of the recirculation fan.
- 0 = Always on
- 1 = On request

FI02 **Recirculation fan regulator hysteresis in Cool mode**
To modify the recirculation fan regulator hysteresis in Cool mode.

FI03 **Recirculation fan regulator hysteresis in Heat mode**
To modify the recirculation fan regulator hysteresis in Heat mode.

FI04 **Enable *Hot Start function***
Enables or disables the *Hot Start function*
- 0 = Hot start disabled
- 1 = Hot start enabled

FI05 **Hot Start regulator setpoint**
To modify the regulator setpoint of the *Hot Start function*.

FI06 **Hot Start regulator hysteresis**
To modify the *Hot Start function* regulator hysteresis.

FI07 **Postventilation time in Heat mode**
To modify postventilation time in Heat mode.

FI08 **Time between compressor on and recirculation fan on**
To modify the delay between switching on the compressor and switching on the recirculation fan.

22.1.8 Secondary (external) exchanger fan parameters (FE)

FE00 **Enable external exchanger fan**
To enable or disable the external exchanger.
- 0 = fan disabled
- 1 = fan enabled

FE01 **Select external exchanger fan operating mode**
To select the operating mode of the external exchanger fan.
- 0 = ON/OFF
- 1 = Proportional

If *FE01*= 1 see parameters *CF27*-30 / *CF33*...*CF44*

FE02 **External exchanger fan *pick-up* time**
To vary the pick up time of the external exchanger fan.

FE03 **Enable external exchanger fan on with compressor off**
To enable or disable the switching on of the external exchanger fan when the compressor is off.
- 0 = Fan off with compressor OFF
- 1 = Fan on with compressor OFF

FE04 **Bypass time for external exchanger fan cut-off**
To modify the bypass time of the external exchanger fan cut-off.

FE05 **External exchanger fan preventilation time in Cool**
To modify the external exchanger fan preventilation time in Cool mode.

FE06 **External exchanger fan preventilation time in Heat**
To modify the external exchanger fan preventilation time in Heat mode.

FAN CONTROL IN COOLING

FE07 **Minimum speed external exchanger fan in Cool**
To modify the minimum speed of the external exchanger fan in Cool mode.

FE08 **Average speed external exchanger fan in Cool**
To modify the average speed of the external exchanger fan in Cool mode.

FE09 **Maximum speed external exchanger fan in Cool**
To modify the maximum speed of the external exchanger fan in Cool mode.

FE10 **Select probe for external exchanger fan regulation in Cool**
To select the probe to control the external exchanger fan in Cool mode.
0 = External exchanger temperature
- 1 = High pressure input
- 2 = Low pressure input
- 3 = External exchanger pressure input
- 4 = Internal exchanger pressure input

FE11 **External exchanger fan minimum speed setpoint in Cool**
To modify the minimum speed setpoint of the external exchanger fan in Cool mode.

FE12 **External exchanger maximum speed differential in Cool**
To modify the maximum speed differential of the external exchanger fan in Cool mode.

FE13 **External exchanger fan speed proportional band in Cool**
To modify the proportional band of the external exchanger fan speed in Cool mode.

FE14 **Maximum external exchanger fan hysteresis in Cool mode**
To modify the maximum hysteresis of the external exchanger fan speed in Cool mode.

FE15 **External exchanger fan cut-off hysteresis in Cool**
To modify the cut-off hysteresis of the external exchanger fan in Cool mode.

FE16 **External exchanger fan cut-off differential in Cool**
To modify the cut-off differential for the external exchanger fan in Cool mode.

FAN CONTROL IN HEATING

FE17 **Minimum speed external exchanger fan in Heat**
To modify the minimum speed of the external exchanger fan in Heat mode.

FE18 **Average speed external exchanger fan in Heat**
To modify the average speed of the external exchanger fan in Heat mode.

FE19 **Maximum speed external exchanger fan in Heat**
To modify the maximum speed of the external exchanger fan in Heat mode.

FE20 **Select probe for external exchanger fan regulation in Heat**
To select the probe to control the external exchanger fan in Heat mode.
0 = External exchanger temperature
- 1 = High pressure input
- 2 = Low pressure input
- 3 = External exchanger pressure input
- 4 = Internal exchanger pressure input

FE21 **Minimum external exchanger fan speed setpoint in Heat**
To modify the minimum speed setpoint of the external exchanger fan in Heat mode.

FE22 **Maximum external exchanger speed differential in Heat**
To modify the maximum speed differential of the external exchanger fan in Heat mode.

FE23 **External exchanger fan speed proportional band in Heat**
To modify the proportional band of the external exchanger fan speed in Heat mode.

FE24 **Maximum external exchanger fan hysteresis in Heat**
To modify the maximum hysteresis of the external exchanger fan speed in Heat mode.

FE25 **External exchanger fan cut-off hysteresis in Heat**
To modify the cut-off hysteresis of the external exchanger fan in Heat mode.

FE26 **External exchanger fan cut-off differential in Heat**
To modify the cut-off differential for the external exchanger fan in Heat mode.

FAN CONTROL IN DEFROST

FE27 **Enable external exchanger fan on in defrost**
To enable or disable the switching on of the external exchanger fan in defrost.
0 = Fan disabled
- 1 = Fan enabled

FE28 **External exchanger fan on setpoint in defrost**
To modify the external exchanger fan on setpoint in defrost

FE29 **External exchanger fan on hysteresis in defrost**
To modify the external exchanger fan on hysteresis in defrost

FE30 **Select probe for external exchanger fan regulation in defrost.**
To select the probe to control the external exchanger fan in defrost.
- 0 = Probe absent
- 1 = External exchanger temperature probe
- 2 = High pressure probe
- 3 = External exchanger pressure probe

22.1.9 Electric heater parameters (HI)

HI00 **Enable *internal exchanger heaters for antifreeze***
To enable or disable *internal exchanger heaters for antifreeze*.
0 = Heaters disabled
- 1 = Heaters enabled

HI01 **Enable internal exchanger heater regulator in standby for antifreeze**
To enable or disable internal exchanger heaters in standby for antifreeze.
- 0 = Heaters disabled
- 1 = Heaters enabled

HI02 **Enable integrated use of internal exchanger heaters**
To enable or disable integrated use of internal exchanger heaters.
- 0 = Heaters disabled
- 1 = Heaters enabled

HI03 **Enable force heaters on during defrost.**
To enable or disable force heaters on during defrost.
- 0 = Heaters enabled (ON) when requested by temperature controller (antifreeze or integrated use)
- 1 = Heaters always enabled ON during defrost

See defrost parameters – *folder* dF

HI04 **Number of internal exchanger heaters**
To modify the number of internal exchanger heaters.
- 1 = 1 heater enabled
- 2 = 2 heaters enabled

HI05 **Select probe to regulate internal exchanger heaters during antifreeze**
To select the probe for regulation of internal exchanger heaters during antifreeze.
- 0 = Internal exchanger water/air inlet temperature
- 1 = Internal exchanger water/air outlet temperature

HI06 **Internal exchanger heater regulator setpoint for antifreeze**
To modify the internal exchanger heater regulator setpoint for antifreeze

HI07 **Maximum internal exchanger heater regulator setpoint for antifreeze**
To modify the maximum setpoint of the internal exchanger heater regulator for antifreeze.

HI08 **Minimum internal exchanger heater regulator setpoint for antifreeze**
To modify the minimum setpoint of the internal exchanger heater regulator for antifreeze.

HI09 **Internal exchanger heater regulator hysteresis for antifreeze**
To modify the hysteresis of the internal exchanger heater regulator for antifreeze.

HI10 **Internal exchanger heater dynamic differential setpoint in integrated use**
To modify the dynamic differential setpoint of the *internal exchanger heaters in integrated use*.

HI11 **Maximum dynamic differential *internal exchanger heaters in integrated use***
To modify the maximum dynamic differential of the *internal exchanger heaters in integrated use*.

HI12 **Internal exchanger heater dynamic differential proportional band in integrated use**
To modify the proportional band of the dynamic differential of the *internal exchanger heaters in integrated use*.

HI13 **Internal exchanger heater regulator hysteresis in integrated use**
To modify the hysteresis of the *internal exchanger heaters in integrated use*.

HI14 **Enable digital dynamic differential of *internal exchanger heaters in integrated use***
To enable the digital dynamic differential of the *internal exchanger heaters in integrated use*
- 0 = Proportional differential
- 1 = Fixed differential

HI15 **Differential setpoint internal exchanger heater 2 on in integrated use**
To modify the differential setpoint to switch on internal exchanger heater 2 in integrated use

22.1.10 External exchanger electric heater parameters (HE)

HE00 **Enable *external exchanger heaters* for antifreeze**
To enable or disable *external exchanger heaters* for antifreeze
- 0 = Heaters disabled
- 1 = Heaters enabled

HE01 **Enable external exchanger heater regulator in standby for antifreeze**
To enable or disable *external exchanger heaters* in standby for antifreeze.
- 0 = Heaters disabled
- 1 = Heaters enabled

HE02 **Select probe to regulate *external exchanger heaters* during antifreeze**
To select the probe to control the *external exchanger heaters* during antifreeze.
0 = External exchanger water inlet temperature
- 1 = External exchanger outlet water temperature

HE03 **External exchanger heater switch on setpoint for antifreeze**
To modify the external exchanger switch on setpoint for antifreeze

HE04 **Maximum external exchanger heater regulator setpoint for antifreeze**
To modify the maximum setpoint of the external exchanger heater regulator for antifreeze.

HE05 **Minimum external exchanger heater regulator setpoint for antifreeze**
To modify the minimum setpoint of the external exchanger heater regulator for antifreeze.

HE06 **External exchanger heater regulator hysteresis for antifreeze**
To modify the regulator hysteresis of *external exchanger heaters* for antifreeze.

22.1.11 Auxiliary electric heater parameters (HA)

HA00 **Enable auxiliary heater**
To enable or disable auxiliary heater.
- 0 = Heaters disabled
- 1 = Heaters enabled

HA01 **Auxiliary heater regulator setpoint**
To set the auxiliary heater regulator setpoint.

HA02 **Auxiliary heater regulator hysteresis**
To set the auxiliary heater regulator hysteresis.

22.1.12 External circuit pump parameters (PE)

PE00 **Enable external circuit water pump.**
To enable or disable the external circuit water pump.
- 0 = Pump disabled
- 1 = Pump enabled

22.1.13 Boiler parameters (br) -boiler

br00 **Enable boiler**
To enable or disable the boiler.
- 0 = Boiler disabled
- 1 = Boiler enabled

br01 **Enable *boiler in heating* only**
To enable or disable the *boiler in heating* only.
- 0 = Boiler in integrated use
- 1 = *Boiler in heating*

br02 **Enable boiler digital dynamic differential**
To enable the digital dynamic differential of the boiler.
- 0 = Proportional
- 1 = Fixed

br03 **Boiler dynamic differential setpoint**
To modify the setpoint of the boiler dynamic differential.

br04 **Boiler dynamic differential proportional band**
To modify the proportional band of the dynamic differential of the boiler.

br05 **Maximum boiler dynamic differential**
To modify the maximum dynamic differential of the boiler.

br06 **Boiler regulator hysteresis**
To modify the hysteresis of the boiler regulator (

22.1.14 Defrost parameters (dF)

dF00 **Enable defrost function**
To enable or disable the defrost function.
- 0 = Defrost disabled
- 1 = Defrost enabled

dF01 **Enable interval count between defrosts setpoint**
To modify the setpoint enabling the interval count between defrosts.

dF02 **Defrost deactivation setpoint**
To modify the defrost deactivation setpoint.

dF03 **Cumulative interval between defrosts**
To modify the overall time between defrosts.

dF04 **Compressor-valve-compressor delay before *start defrost***
To modify the time between the compressor-valve-compressor delay and start of defrost.

dF05 **Compressor-valve-compressor delay at end of defrost.**
To modify the time between the compressor-valve-compressor delay and end of defrost.

dF06 **Dripping time**
To modify dripping time.

dF07 **Maximum defrost time.**
To modify maximum defrost time.

dF08 **Enable dynamic defrost differential**
To enable or disable the dynamic defrost differential.
- 0 = Offset disabled
- 1 = Offset enabled

dF09 **Maximum dynamic defrost differential**
To modify the maximum defrost dynamic differential.

dF10 **Defrost dynamic differential setpoint**
To modify the the dynamic differential setpoint for defrost.

dF11 **Dynamic defrost differential proportional band**
To modify the proportional band of the dynamic defrost differential.

dF12 **Select probe to enable interval count between defrosts**
To select the probe to enable the interval count between defrosts.
- 0 = External exchanger temperature
- 1 = High pressure input
- 2 = Low pressure input
- 3 = Internal exchanger pressure
- 4 = External exchanger pressure

dF13 **Select probe to *end defrost***
To select the probe to *end defrost*.
- 0 = External exchanger temperature
- 1 = High pressure input
- 2 = Low pressure input
- 3 = Internal exchanger pressure
- 4 = External exchanger pressure

dF14 **Setpoint to clear cumulative time between defrosts**
To modify the setpoint clearing the cumulative time between defrosts.

22.1.15 Dynamic setpoint parameters (dS)

dS00 **Enable dynamic temperature controller differential**
To enable or disable the dynamic temperature controller differential.
- 0 = Dynamic setpoint disabled
- 1 = Dynamic setpoint enabled

dS01 **Temperature controller dynamic differential proportional band in Cool**
dS02 **Temperature controller dynamic differential proportional band in Heat**
To modify the proportional band of the temperature controller dynamic differential in Cool/Heat mode.

dS03 **Maximum temperature controller dynamic differential in Cool**
dS04 **Maximum temperature controller dynamic differential in Heat**
To modify the maximum dynamic differential of the temperature controller in Cool/Heat mode.

dS05 **Temperature controller dynamic differential setpoint in Cool**
dS06 **Temperature controller dynamic differential setpoint in Heat**
To modify the dynamic differential setpoint of the temperature controller in Cool/Heat mode.

dS07 **Enable temperature controller digital dynamic differential.**
To enable the digital dynamic differential of the temperature controller.
0 = Proportional
- 1 = Fixed

22.1.16 Adaptive parameters (Ad)

Ad00 **Enable machine function without accumulation**
To enable or disable machine function without accumulation.
- 0 = Accumulation disabled
- 1 = Accumulation enabled

Ad01 **Accumulation offset type**
To select the type of accumulation offset.
- 0 = Setpoint
- 1 = Hysteresis
- 2 = Setpoint and hysteresis

Ad02 **Accumulation offset constant**
To modify the accumulation offset constant.

Ad03 **Accumulation offset differential**
To modify the accumulation differential offset.

Ad04 **Block accumulation offset setpoint in cooling mode**
To modify the block accumulation offset setpoint in Cool mode.

Ad05 **Block accumulation offset setpoint in heating mode**
To modify the block accumulation offset setpoint in Heat mode.

Ad06 **Compressor on time for accumulation offset/regression**
To modify the compressor on time for accumulation offset and regression.

Ad07 **Reference compressor on time for accumulation offset**
To modify the reference compressor on time for accumulation offset.

22.1.17 Antifreeze parameters with heat pump (AF)

AF00 **Enable heat pump operation in antifreeze**
To enable or disable heat pump operation during antifreeze.
- 0 = Heat pump disabled
- 1 = Heat pump enabled

AF01 **Water pump regulator setpoint for heat pump operation during antifreeze**
To modify water pump regulator setpoint for heat pump operation during antifreeze.

AF02 **Heat pump regulator setpoint for antifreeze**
To modify heat pump regulator setpoint for antifreeze.

AF03 ***Block heat pump*** **setpoint in antifreeze**
To modify the setpoint to *block heat pump* during antifreeze.

22.1.18 Power limitation parameters (PL)

PL00 **Enable power limitation function**
To enable or disable power limitation function
- 0 = Power limitation disabled
- 1 = Power limitation enabled

PL01 **Select probe for power limitation**
To select the probe for power limitation.
- 0 = Internal exchanger water/air outlet temperature
- 1 = High pressure
- 2 = Low pressure
- 3 = External temperature

PL02 **High pressure setpoint for power limitation**
To modify the high pressure setpoint for power limitation.

PL03 **Low pressure setpoint for power limitation**
To modify the low pressure setpoint for power limitation.

PL04 **High water temperature setpoint for power limitation**
To modify the high water temperature setpoint for power limitation.

PL05 **Low water temperature setpoint for power limitation.**
To modify the low water temperature setpoint for power limitation.

PL06 **External temperature setpoint for power limitation in Cool**
To modify the external temperature setpoint for power limitation in Cool mode.

PL07 **External temperature setpoint for power limitation in Heat**
To modify the external temperature setpoint for power limitation in Heat mode.

PL08 **Power limitation proportional band**
To modify the proportional band for power limitation.

22.1.19 Alarm parameters (AL)

AL00 **Time interval for alarm event count**
To modify the interval in which alarm events are counted.

AL01 **Number of low pressure *alarms*.**
To modify the number of low pressure *alarms*.

AL02 **Low pressure alarm bypass time**
To modify the low pressure alarm bypass time.

AL03 **Number of high pressure *alarms*.**
To modify the number of high pressure *alarms*.

AL04 **Flow switch activation time for internal circuit manual alarm**
To modify the activation time of the flow switch for internal circuit manual *alarms*.

AL05 **Bypass flow switch time from activation of the internal circuit water pump**
To modify the bypass flow switch time from activation of the internal circuit water pump.

AL06 **Flow switch activation time for internal circuit automatic *alarms*.**
To modify the activation time of the flow switch for internal circuit automatic *alarms*.

AL07 **Flow switch deactivation time for internal circuit automatic *alarms*.**
To modify the flow switch deactivation time for internal circuit automatic *alarms*.

AL08 **Number of compressor thermoswitch *alarms*.**
To modify the number of compressor thermoswitch *alarms*.

AL09 **Compressor thermoswitch alarm bypass time**
To modify the bypass time of the compressor thermoswitch alarm.

AL10 **Number of external exchanger fan thermoswitch *alarms***
To modify the number of external exchanger fan thermoswitch *alarms*.

AL11 **Number of internal circuit antifreeze *alarms*.**
To modify the number of internal circuit antifreeze *alarms*.

AL12 **Internal circuit antifreeze alarm regulator setpoint**
To modify the internal circuit antifreeze alarm regulator setpoint.

AL13 **Internal circuit antifreeze alarm regulator hysteresis**
To modify the internal circuit antifreeze alarm regulator hysteresis.

AL14 **Enable force recirculation fan on during internal circuit antifreeze alarm**
To enable or disable the force recirculation fan on during internal circuit antifreeze alarm.
- 0 = fan disabled
- 1 = fan enabled

AL15 **Internal circuit antifreeze alarm bypass time**
To modify the internal circuit antifreeze alarm bypass time.

AL16 **Enable low refrigerant alarm.**
To enable or disable the low refrigerant alarm.
- 0 = Low refrigerant alarm disabled
- 1 = Low refrigerant alarm enabled

AL17 **Low refrigerant alarm bypass time.**
To modify the low refrigerant alarm bypass time.

AL18 **Low refrigerant alarm differential**
To modify the low refrigerant alarm differential.

AL19 **Time low refrigerant before alarm**
To modify the time refrigerant is low before alarm generated.

AL20 **Enable low pressure alarm during defrost**
To enable or disable the low pressure alarm during defrost.
- 0 = Alarm disabled
- 1 = Alarm enabled

AL21 **High temperature alarm regulator setpoint from analogue input**
To modify the setpoint of the high temperature alarm regulator from analogue input.

AL22 **High temperature alarm regulator hysteresis from analogue input**
To modify the hysteresis of the high temperature alarm regulator from analogue input.

AL23 **Time high temperature before alarm**
To modify the time temperature is high before alarm generated.

AL24 **Low pressure alarm regulator setpoint from analogue input**
To modify the setpoint of the low pressure alarm regulator from analogue input.

AL25 **High pressure alarm regulator setpoint from analogue input**
To modify the setpoint of the high pressure alarm regulator from analogue input.

AL26 **Low pressure alarm regulator hysteresis from analogue input**
To modify the setpoint of the low pressure alarm regulator hysteresis from analogue input.

AL27 **High pressure alarm regulator hysteresis from analogue input**
To modify the hysteresis of the high pressure alarm regulator from analogue input.

AL28 **Low pressure alarm bypass time from analogue input**
To modify the low pressure alarm bypass time from analogue input.

AL29 **Number of low pressure *alarms* from analogue input**
To modify the number of low pressure *alarms* from analogue input.

AL30 **Compressor 1 on time for service message**
To modify the on time of compressor 1 for the service message.

AL31 **Compressor 2 on time for service message**
To modify the on time of compressor 2 for the service message.

AL32 **Pump 1 on time for service message**
To modify the on time of pump 1 for the service message.

AL33 **Pump 2 on time for service message**
To modify the on time of pump 2 for the service message.

AL34 **Maximum number of events in alarm log**
To modify the maximum number of events stored in the alarm log.

AL35 **Number of internal exchanger fan thermoswitch *alarms***
To modify the number of internal exchanger fan thermoswitch *alarms*.

AL36 **Flow switch activation time for external circuit manual alarm**
To modify the activation time of the flow switch for external circuit manual *alarms*.

AL37 **Bypass flow switch time from activation of the external circuit water pump**
To modify the bypass flow switch time from activation of the external circuit water pump.

AL38 **Flow switch activation time for external circuit automatic *alarms*.**
To modify the activation time of the flow switch for external circuit automatic *alarms*.

AL39 **Flow switch deactivation time for external circuit automatic *alarms*.**
To modify the deactivation time of the flow switch for external circuit automatic *alarms*.

AL40 **Number of internal circuit pump thermoswitch *alarms*.**
To modify the number of internal circuit pump thermoswitch *alarms*.

AL41 **Number of external circuit pump thermoswitch *alarms*.**
To modify the number of external circuit pump thermoswitch *alarms*.

AL42 **Number of compressor oil pressure switch *alarms***
To modify the number of compressor oil pressure switch *alarms*.

AL43 **Number of high pressure *alarms* from analogue input**
To modify the number of high pressure *alarms* from analogue input.

AL44 **Number of external circuit antifreeze *alarms*.**
To modify the number of external circuit antifreeze *alarms*.

AL45 **External circuit antifreeze alarm regulator setpoint**
To modify the external circuit antifreeze alarm regulator setpoint.

AL46 **External circuit antifreeze alarm regulator hysteresis**
To modify the external circuit antifreeze alarm regulator hysteresis.

AL47 **External circuit antifreeze alarm bypass time**
To modify the external circuit antifreeze alarm bypass time.

AL48 **Compressor oil pressure switch alarm bypass time**
To modify the compressor oil pressure switch alarm bypass time.

22.2 Parameters / visibility table, folder visibility table and client table

The **tables below** list all information required to read, write and decode all accessible resources in the device.
There are three tables:

The **parameters** table contains all device configuration parameters stored in the instrument's non-volatile memory.
The **folders** table lists the visibility of all parameter folders.
The ***client*** *table* includes all I/O and alarm state resources available in the instrument's volatile memory.

Description of columns:

FOLDER LABEL

This indicates the *label* of the *folder* containing the parameter in question

This indicates the *label* used to *display* the **parameters** in the instrument's menu.

VALUE PAR AdDRESS

The whole part represents the address of the MODBUS register containing the value of the resource to be read or written to the instrument. The value after the point indicates the position of the most significant data bit in the register; if not indicated it is taken to be zero. This information is always provided when the register contains more than one information item, and it is necessary to distinguish which bits actually represent the data (the working size of the data indicated in the *DATA SIZE* colum is also taken into consideration). Given that the modbus registers are the size of one WORD (16 bit), the index number after the point can vary from 0 (least significant bit –LSb–) to 15 (most significant bit –MSb–).

Examples (in binary form the least significant bit is the first on the right):

VAL PAR AdDRESS	*DATA SIZE*	Value	Content of register	
8806	WORD	1350	1350	(0000010101000110)
8806	Byte	70	1350	(00000101**01000110**)
8806.8	Byte	5	1350	(**00000101**01000110)
8806.14	1 bit	0	1350	(0**0**000010101000110)
8806,7	4 bits	10	1350	(00000**1010**1000110)

Important: when the register contains more than one data item, during the write operation proceed as follows:

- read current register value
- modify the bits that represent the resource concerned
- write the register

VIS PAR ADDRESS

Same as above. In this case, the parameter visibility value is in the MODBUS register address. By *default*, all parameters have:

Data size 2 bits
Range 0...3
**Visibility 3
UM number

****Value Meaning**

- Value 3 = parameter or *folder* always visible
- Value 2 = **manufacturer level;** these parameters can only be seen by entering the manufacturer's password (see parameter *UI18*) (all parameters specified as always visible, parameters that are visible at the installation level, and manufacturer level parameters will be visible).
- Value 1 = **installation level**; these parameters can only be viewed by entering the installation password (see parameter *UI17*) (all parameters specified as always visible and parameters that are visible at the installation level will be visible)
- Value 0 = parameter or *folder* NOT visible

3. Parameters and/or folders with visibility level <>3 (i.e. password protected) will only be visible if the correct password is entered (installation or manufacturer) following the procedure outlined below:
4. Parameters and/or folders with visibility level =3 are always visible and no password is required; in this case, the procedure below is not required.

Examples (in binary form the least significant bit is the first on the right):
Default **visibility:**

VAL PAR ADDRESS	*DATA SIZE*	Value	Content of register	
49481.6	2 bits	3	65535	----------(**11**1111111111111)
49482	2 bits	3	65535	(111111**11**11111111)
49482.2	2 bits	3	65535	(1111**11**1111111111)
49482.4	2 bits	3	65535	(11**11**1111111111111)
49482.6	2 bits	3	65535	(**11**1111111111111)

To modify the visibility value of parameter *CF04* (address 49482.6) from 3 to 0:
Visibility modified

VAL PAR ADDRESS	*DATA SIZE*	Value	Content of register	
49481.6	2 bits	0	16383	(**00**1111111111111)

RESET (Y/N)

Indicates if the device **MUST** be switched off then back on again to modify the parameter.
Y=YES the device **MUST** be switched off then back on again to modify the parameter:
N=NO the device DOESN'T need to be switched off then back on again to modify the parameter.
Example: ALL configuration parameters (*folder* **CF**) equal Y, so the device **MUST ALWAYS BE SWITCHED OFF THEN BACK ON AGAIN TO MODIFY THEM.**

R/W

Indicates if resources are read/write, read-only or write-only:

R	Read-only resource.
W	Write-only resource.
RW	Read / write resource.

DATA SIZE

Indicates the size of the data in bits.

WORD	=	16 bits
Byte	=	8 bits
"n" bit	=	0...15 bits depending on value of "n"

CPL

When the field indicates "Y", the value read by the register must be converted, because the value represents a number with a sign. In the other cases the value is always positive or null.
To carry out conversion, proceed as follows:
if the value in the register is between 0 and 32,767, the result is the value itself (zero and positive values).
if the value in the register is between 32,768 and 65,535, the result is the value of the register - 65,536 (negative values).

RANGE

Describes the interval of values that can be assigned to the parameter. It can be correlated with other parameters in the instrument (indicated with the parameter *label*).

DEFAULT

Indicates the factory setting for the standard model of the instrument. In this table, take hardware to be **ST544/C** with 4 relays + *TRIAC* + 2 *analogue outputs* A01 AO2 PWM + 1 low voltage analogue output A03.

EXP

If = -1 the value read from the register is divided by 10 (value/10) to convert it to the values given in the *RANGE* and *DEFAULT* column and the unit of measure specified in the U.M. column.
Example: parameter *CF04* = 50.0. Column *EXP* = -1:

- The value read by the device/*ParamManager* is 50.0.
- The value read from the register is 500 --> 500/10 = 50.0.

UM

Measurement unit for values converted according to the rules indicated in the *CPL* and *EXP* columns.

22.2.1 Parameters / visibility table

(See next page)

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
CF	CF00	49202	BYTE			49481,6	Y	RW	Type of analogue input AI1	0 ... 2	0	num
CF	CF01	49203	BYTE			49482	Y	RW	Type of analogue input AI2	0 ... 2	0	num
CF	CF02	49204	BYTE			49482,2	Y	RW	Type of analogue input AI3	0 ... 6	0	num
CF	CF03	49205	BYTE			49482,4	Y	RW	Type of analogue input AI4	0 ... 6	0	num
CF	CF04	16442	WORD	Y	-1	49482,6	Y	RW	Last value analogue input AI3 scale {0}	CF05 ... 99.9	50.0	°C/Bar
CF	CF05	16450	WORD	Y	-1	49483	Y	RW	First value analogue input AI3 scale	-50.0 ... CF04	0.0	°C/Bar
CF	CF06	16444	WORD	Y	-1	49483,2	Y	RW	Last value analogue input AI4 scale {0}	CF07 ... 99.9	50.0	°C/Bar
CF	CF07	16452	WORD	Y	-1	49483,4	Y	RW	First value analogue input AI4 scale	-99.9 ... CF06	0.0	°C/Bar
CF	CF08	49222	BYTE	Y	-1	49483,6	Y	RW	Analogue input AI1 differential	-12.0 ... 12.0	0.0	°C
CF	CF09	49223	BYTE	Y	-1	49484	Y	RW	Analogue input AI2 differential	-12.0 ... 12.0	0.0	°C
CF	CF10	49224	BYTE	Y	-1	49484,2	Y	RW	Analogue input AI3 differential	-12.0 ... 12.0	0.0	°C/Bar
CF	CF11	49225	BYTE	Y	-1	49484,4	Y	RW	Analogue input AI4 differential	-12.0 ... 12.0	0.0	°C/Bar
CF	CF12	49296	BYTE			49484,6	Y	RW	Analogue input AI1 configuration	0 ... 6	0	num
CF	CF13	49297	BYTE			49485	Y	RW	Analogue input AI2 configuration	0 ... 6	0	num
CF	CF14	49298	BYTE			49485,2	Y	RW	Analogue input AI3 configuration	0 ... 11	0	num
CF	CF15	49299	BYTE			49485,4	Y	RW	Analogue input AI4 configuration	0 ... 11	0	num
CF	CF16	49300	BYTE	Y		49485,6	Y	RW	Digital input DI1 configuration	-32 ... 32	0	num
CF	CF17	49301	BYTE	Y		49486	Y	RW	Digital input DI2 configuration	-32 ... 32	0	num
CF	CF18	49302	BYTE	Y		49486,2	Y	RW	Digital input DI3 configuration	-32 ... 32	0	num
CF	CF19	49303	BYTE	Y		49486,4	Y	RW	Digital input DI4 configuration	-32 ... 32	0	num
CF	CF20	49304	BYTE	Y		49486,6	Y	RW	Digital input DI5 configuration	-32 ... 32	0	num
CF	CF23	49307	BYTE	Y		49487,4	Y	RW	Analogue input AI1 configuration when configured as digital input	-32 ... 32	0	num
CF	CF24	49308	BYTE	Y		49487,6	Y	RW	Analogue input AI2 configuration when configured as digital input	-32 ... 32	0	num
CF	CF25	49309	BYTE	Y		49488	Y	RW	Analogue input AI3 configuration when configured as digital input	-32 ... 32	0	num
CF	CF26	49310	BYTE	Y		49488,2	Y	RW	Analogue input AI4 configuration when configured as digital input	-32 ... 32	0	num

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
CF	CF27	49228	BYTE			49488,4	Y	RW	Type of analogue output AO3	0 ... 2	0	num
CF	CF30	49312	BYTE			49489,2	Y	RW	Analogue output AO3 configuration	-13 ... 16	16	num
CF	CF33	49232	BYTE			49490	Y	RW	Enable analogue output TC1	0 ... 1	1	num
CF	CF34	49233	BYTE			49490,2	Y	RW	Enable analogue output AO1	0 ... 1	0	num
CF	CF35	49234	BYTE			49490,4	Y	RW	Enable analogue output AO2	0 ... 1	0	num
CF	CF36	49235	BYTE			49490,6	Y	RW	Analogue output TC1 phase displacement	0 ... 90	27	num
CF	CF37	49236	BYTE			49491	Y	RW	Analogue output AO1 phase displacement	0 ... 90	27	num
CF	CF38	49237	BYTE			49491,2	Y	RW	Analogue output AO2 phase displacement	0 ... 90	27	num
CF	CF39	49238	BYTE			49491,4	Y	RW	Analogue output TC1 pulse time	5 ... 40	10	num
CF	CF40	49239	BYTE			49491,6	Y	RW	Analogue output AO1 pulse time	5 ... 40	10	num
CF	CF41	49240	BYTE			49492	Y	RW	Analogue output AO2 pulse time	5 ... 40	10	num
CF	CF42	49316	BYTE			49492,2	Y	RW	Analogue output TC1 configuration	-13 ... 16	14	num
CF	CF43	49317	BYTE			49492,4	Y	RW	Analogue output AO1 configuration	-13 ... 16	0	num
CF	CF44	49318	BYTE			49492,6	Y	RW	Analogue output AO2 configuration	-13 ... 16	0	num
CF	CF45	49324	BYTE			49493	Y	RW	Digital output DO1 configuration	-13 ... 13	1	num
CF	CF46	49325	BYTE			49493,2	Y	RW	Digital output DO2 configuration	-13 ... 13	3	num
CF	CF47	49326	BYTE			49493,4	Y	RW	Digital output DO3 configuration	-13 ... 13	5	num
CF	CF48	49327	BYTE			49493,6	Y	RW	Digital output DO4 configuration	-13 ... 13	7	num
CF	CF49	49328	BYTE			49494	Y	RW	Digital output DO5 configuration	-13 ... 13	2	num
CF	CF50	49329	BYTE			49494,2	Y	RW	Digital output DO6 configuration	-13 ... 13	0	num
CF	CF51	49330	BYTE			49494,4	Y	RW	Digital output AO1 configuration	-13 ... 13	6	num
CF	CF52	49331	BYTE			49494,6	Y	RW	Digital output AO2 configuration	-13 ... 13	13	num
CF	CF54	49169	BYTE			49495,2	Y	RW	Select COM1 protocol	0 ... 1	0	num
CF	CF55	49176	BYTE			49495,4	Y	RW	Eliwell protocol controller address	0 ... 14	0	num
CF	CF56	49177	BYTE			49495,6	Y	RW	Eliwell protocol controller family	0 ... 14	0	num
CF	CF63	49178	BYTE			49497,4	Y	RW	Modbus protocol controller address	1 ... 255	1	num
CF	CF64	49179	BYTE			49497,6	Y	RW	Modbus baud rate protocol	0 ... 7	3	num
CF	CF65	49180	BYTE			49498	Y	RW	Modbus parity protocol	1 ... 3	1	num
CF	CF66	49182	BYTE			49498,2	Y	RW	Client Code 1	0 ... 255	0	num

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
CF	*CF67*	49183	BYTE			49498,4	Y	RW	Client Code 2	0 ... 255	0	num
CF	*CF68*	49184	BYTE			49498,6	Y	R	Firmware mask revision	0 ... 255	xxxx	num
CF	*CF72*	49359	BYTE			49499,6	Y	RW	RTC present	0 ... 1	1	num
CF	*CF73*	49360	BYTE			49500	Y	RW	Analogue input 5 present	0 ... 2	0	num
CF	*CF76*	49366	BYTE	Y	-1	49500,6	Y	RW	Analogue input AI5 differential	-12.0 ... 12.0	0.0	°C/Bar
CF	*CF77*	49367	BYTE			49501	Y	RW	Analogue input AI5 configuration	0 ... 6	0	num
UI	*UI00*	49440	BYTE			49501,4	Y	RW	LED1 configuration	0 ... 13	1	num
UI	*UI01*	49441	BYTE			49501,6	Y	RW	LED2 configuration	0 ... 13	2	num
UI	*UI02*	49442	BYTE			49502	Y	RW	LED3 configuration	0 ... 13	7	num
UI	*UI03*	49443	BYTE			49502,2	Y	RW	LED4 configuration	0 ... 13	8	num
UI	*UI04*	49444	BYTE			49502,4	Y	RW	LED5 configuration	0 ... 13	6	num
UI	*UI05*	49445	BYTE			49502,6	Y	RW	LED6 configuration	0 ... 13	11	num
UI	*UI06*	49446	BYTE			49503	Y	RW	LED7 configuration	0 ... 13	3	num
UI	*UI07*	49447	BYTE			49503,2	Y	RW	Standby LED configuration	0 ... 1	1	num
UI	*UI09*	49409	BYTE			49503,6	Y	RW	Fundamental state *display* selection	0 ... 7	1	num
UI	*UI10*	49429	BYTE			49504	Y	RW	Enable defrost function from key	0 ... 1	1	num
UI	*UI11*	49430	BYTE			49504,2	Y	RW	Enable MODE function from key	0 ... 1	1	num
UI	*UI12*	49431	BYTE			49504,4	Y	RW	Enable DISP function from key	0 ... 1	1	num
UI	*UI13*	49432	BYTE			49504,6	Y	RW	Enable ON/OFF function from key	0 ... 1	1	num
UI	*UI14*	49433	BYTE			49505	Y	RW	Enable SET function from key	0 ... 1	1	num
UI	*UI17*	16688	WORD			49505,6	Y	RW	Installation engineer password	0 ... 255	1	num
UI	*UI18*	16690	WORD			49506	Y	RW	Manufacturer password	0 ... 255	2	num
tr	*tr00*	49664	BYTE			49506,2	Y	RW	Temperature control type	0 ... 2	0	num
tr	*tr01*	49665	BYTE			49506,4	Y	RW	Enable heating pump	0 ... 1	1	num
tr	*tr02*	49666	BYTE			49506,6	Y	RW	Select temperature control probe in Cool	0 ... 5	0	num
tr	*tr03*	49667	BYTE			49507	Y	RW	Select temperature control probe in Heat	0 ... 5	1	num
tr	*tr04*	16900	WORD	Y	-1	49507,2	N	RW	Temperature control setpoint in Cool	*tr06* ... *tr07*	12.0	°C/Bar
tr	*tr05*	16902	WORD	Y	-1	49507,4	N	RW	Temperature control setpoint in Heat	*tr08* ... *tr09*	40.0	°C/Bar
tr	*tr06*	16904	WORD	Y	-1	49507,6	Y	RW	Minimum temperature control setpoint in Cool	-50.0 ... *tr07*	11.0	°C/Bar

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
tr	*tr07*	16906	WORD	Y	-1	49508	Y	RW	Maximum temperature control setpoint in Cool	*tr06* ... 99.9	20.0	°C/Bar
tr	*tr08*	16908	WORD	Y	-1	49508,2	Y	RW	Minimum temperature control setpoint in Heat	-50.0 ... *tr09*	30.0	°C/Bar
tr	*tr09*	16910	WORD	Y	-1	49508,4	Y	RW	Maximum temperature control setpoint in Heat	*tr08* ... 99.9	45.0	°C/Bar
tr	*tr10*	16912	WORD	Y	-1	49508,6	N	RW	Temperature control hysteresis in Cool	0 ... 25.5	3.0	°C/Bar
tr	*tr11*	16914	WORD	Y	-1	49509	N	RW	Temperature control hysteresis in Heat	0 ... 25.5	3.0	°C/Bar
tr	*tr12*	16916	WORD	Y	-1	49509,2	N	RW	Insert steps/compressors differential in Cool	0 ... 25.5	3.0	°C/Bar
tr	*tr13*	16918	WORD	Y	-1	49509,4	N	RW	Insert steps/compressors differential in Heat	0 ... 25.5	3.0	°C/Bar
tr	*tr14*	49688	BYTE			49509,6	Y	RW	Select probes for *temperature control differential* in Cool	0 ... 3	0	num
tr	*tr15*	49689	BYTE			49510	Y	RW	Select probes for *temperature control differential* in Heat	0 ... 3	0	num
tr	*tr16*	49696	BYTE			49510,2	Y	RW	Enable stop heat pump function	0 ... 1	0	num
tr	*tr17*	16930	WORD	Y	-1	49510,4	N	RW	Stop heat pump function setpoint	-50.0 ... 99.9	10.0	°C
tr	*tr18*	16932	WORD	Y	-1	49510,6	N	RW	Stop heat pump hysteresis	0 ... 25.5	2.0	°C
tr	*tr19*	16934	WORD	Y	-1	49511	N	RW	Setpoint differential in Cool from Economy input	-25.5 ... 25.5	5.0	°C/Bar
tr	*tr20*	16936	WORD	Y	-1	49511,2	N	RW	Setpoint differential in Heat from Economy Input	-25.5 ... 25.5	5.0	°C/Bar
St	*St00*	49712	BYTE			49511,4	Y	RW	Select operating mode	0 ... 2	2	num
St	*St01*	49713	BYTE			49511,6	Y	RW	Enable change mode from analogue input	0 ... 1	0	num
St	*St02*	49714	BYTE			49512	Y	RW	Select probe to change automatic mode	0 ... 2	0	num
St	*St03*	16948	WORD	Y	-1	49512,2	N	RW	Differential for change automatic mode in Heat	-25.5 ... 25.5	-10.0	°C
St	*St04*	16950	WORD	Y	-1	49512,4	N	RW	Differential for change automatic mode in Cool	-25.5 ... 25.5	10.0	°C
CP	*CP00*	49728	BYTE			49512,6	Y	RW	Type of compressor	0 ... 1	0	num
CP	*CP01*	49729	BYTE			49513	Y	RW	Number of compressors per circuit	1 ... 2	2	num
CP	*CP02*	49730	BYTE			49513,2	Y	RW	Select compressor on sequence	0 ... 6	1	num

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
CP	*CP03*	49731	BYTE			49513,4	Y	RW	Minimum off/on for same compressor	0 ... 255	18	sec*10
CP	*CP04*	49732	BYTE			49513,6	Y	RW	Minimum on/on time for same compressor	0 ... 255	30	sec*10
CP	*CP05*	49733	BYTE			49514	Y	RW	Minimum on/on time for different compressors	0 ... 255	10	sec
CP	*CP06*	49734	BYTE			49514,2	Y	RW	Minimum off/off time for different compressors	0 ... 255	10	sec
CP	*CP07*	49735	BYTE			49514,4	Y	RW	*Minimum compressor on time*	0 ... 255	2	sec*10
CP	*CP08*	49736	BYTE			49514,6	Y	RW	*Minimum compressor on time* per splitting increment	0 ... 255	10	sec
CP	*CP09*	49737	BYTE			49515	Y	RW	*Minimum compressor on time* per splitting decrease	0 ... 255	5	sec
CP	*CP10*	49738	BYTE			49515,2	Y	RW	Compressor operating time for each on sequence	0 ... 255	18	sec*10
PI	*PI00*	49744	BYTE			49515,4	Y	RW	Enable primary circuit water pump	0 ... 1	1	num
PI	*PI01*	49745	BYTE			49515,6	Y	RW	Select primary circuit water pump function	0 ... 3	1	num
PI	*PI02*	49746	BYTE			49516	Y	RW	Delay primary circuit water pump on - compressor on	0 ... 255	60	sec
PI	*PI03*	49747	BYTE			49516,2	Y	RW	Delay compressor off - primary circuit water pump off	0 ... 255	60	sec
PI	*PI04*	49748	BYTE			49516,4	Y	RW	Minimum primary circuit water pump speed in Cool	0 ... 100	30	%
PI	*PI05*	49749	BYTE			49516,6	Y	RW	Maximum primary circuit water pump speed in Cool	0 ... 100	100	%
PI	*PI06*	16982	WORD	Y	-1	49517	N	RW	Minimum primary circuit water pump setpoint speed in Cool	-50.0 ... 99.9	20.0	°C
PI	*PI07*	16984	WORD	Y	-1	49517,2	N	RW	Proportional band primary circuit water pump in Cool	-25.5 ... 25.5	8.0	°C
PI	*PI08*	49754	BYTE			49517,4	N	RW	Fan speed setpoint for primary circuit water pump modulation in cool	0 ... 100	80	%

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
PI	*PI09*	49755	BYTE			49517,6	Y	RW	Surge current time primary circuit water pump in Cool	0 ... 255	2	sec
PI	*PI10*	49756	BYTE			49518	Y	RW	Minimum primary circuit water pump speed in Heat	0 ... 100	30	%
PI	*PI11*	49757	BYTE			49518,2	Y	RW	Maximum primary circuit water pump speed in Heat	0 ... 100	100	%
PI	*PI12*	16990	WORD	Y	-1	49518,4	N	RW	Minimum primary circuit water pump setpoint speed in Heat	-50.0 ... 99.9	20.0	°C
PI	*PI13*	16992	WORD	Y	-1	49518,6	N	RW	Proportional band primary circuit water pump in Heat	-25.5 ... 25.5	18.0	°C
PI	*PI14*	49762	BYTE			49519	N	RW	Fan speed setpoint for primary circuit water pump modulation in Heat	0 ... 100	80	%
PI	*PI15*	49763	BYTE			49519,2	Y	RW	Surge current time primary circuit water pump in Heat	0 ... 255	2	sec
PI	*PI16*	49764	BYTE			49519,4	Y	RW	Enable primary circuit water pump anti-lock function	0 ... 1	0	num
PI	*PI17*	49765	BYTE			49519,6	Y	RW	Time primary circuit water pump not active for anti-lock	0 ... 255	50	ore
PI	*PI18*	49766	BYTE			49520	Y	RW	Time primary circuit water pump on for anti-lock	1 ... 255	10	sec
PI	*PI19*	49767	BYTE			49520,2	Y	RW	Enable primary circuit water pump anti-freeze function	0 ... 1	0	num
PI	*PI20*	17000	WORD	Y	-1	49520,4	N	RW	Primary circuit water pump regulator setpoint for anti-freeze	-50.0 ... 99.9	8.0	°C
PI	*PI21*	17002	WORD	Y	-1	49520,6	N	RW	Primary circuit water pump regulator hysteresis for anti-freeze	0.0 ... 25.5	2.0	°C
PI	*PI22*	49772	BYTE			49521	Y	RW	Enable primary circuit water pump on when anti-freeze heaters on	0 ... 1	0	num
PI	*PI23*	49773	BYTE			49521,2	N	RW	Fan speed hysteresis for primary circuit water pump modulation in Heat	0 ... 100	10	%
PI	*PI24*	49774	BYTE			49521,4	N	RW	Fan speed hysteresis for primary circuit water pump modulation in Cool	0 ... 100	10	%

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
FI	*FI00*	49792	BYTE			49521,6	Y	RW	Enable recirculating fan	0 ... 1	0	num
FI	*FI01*	49793	BYTE			49522	Y	RW	Select recirculating fan function	0 ... 1	1	num
FI	*FI02*	17026	WORD	Y	-1	49522,2	N	RW	Recirculating fan regulator hysteresis in Cool	0.0 ... 25.5	2.0	°C
FI	*FI03*	17028	WORD	Y	-1	49522,4	N	RW	Recirculating fan regulator hysteresis in Heat	0.0 ... 25.5	2.0	°C
FI	*FI04*	49798	BYTE			49522,6	Y	RW	Enable *Hot Start function*	0 ... 1	1	num
FI	*FI05*	17032	WORD	Y	-1	49523	N	RW	Hot Start regulator set point	0.0 ... 99.9	38.0	°C
FI	*FI06*	17034	WORD	Y	-1	49523,2	N	RW	Hot Start regulator hysteresis	0.0 ... 15.0	2.0	°C
FI	*FI07*	49805	BYTE			49523,4	Y	RW	Post-ventilation time in Heat	0 ... 255	10	sec
FI	*FI08*	49806	BYTE			49523,6	Y	RW	Delay compressor on - recirculating fan on	0 ... 255	10	sec
FE	*FE00*	49808	BYTE			49524	Y	RW	Enable open system intercooler fan	0 ... 1	1	num
FE	*FE01*	49809	BYTE			49524,2	Y	RW	Select open system intercooler fan function mode	0 ... 1	1	num
FE	*FE02*	49810	BYTE			49524,4	Y	RW	Surge current time open system intercooler fan	0 ... 60	2	sec
FE	*FE03*	49811	BYTE			49524,6	Y	RW	Enable open system intercooler fan on with compressor off	0 ... 1	0	num
FE	*FE04*	49812	BYTE			49525	Y	RW	Cut-off open system intercooler fan bypass time	0 ... 255	2	sec
FE	*FE05*	49813	BYTE			49525,2	Y	RW	Open system intercooler fan pre-ventilation time in Cool	0 ... 255	15	sec
FE	*FE06*	49814	BYTE			49525,4	Y	RW	Open system intercooler fan pre-ventilation time in Heat	0 ... 255	15	sec
FE	*FE07*	49816	BYTE			49525,6	Y	RW	Open system intercooler fan minimum speed in Cool	0 ... 100	50	%
FE	*FE08*	49817	BYTE			49526	Y	RW	Open system intercooler fan average speed in Cool	0 ... 100	95	%
FE	*FE09*	49818	BYTE			49526,2	Y	RW	Open system intercooler fan maximum speed in Cool	0 ... 100	100	%
FE	*FE10*	49819	BYTE			49526,4	Y	RW	Select probe to regulate open system intercooler fan in Cool	0 ... 4	0	num

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
FE	FE11	17052	WORD	Y	-1	49526,6	N	RW	Open system intercooler fan minimum setpoint speed in Cool	-50.0 ... 99.9	14.0	°C/Bar
FE	FE12	17054	WORD	Y	-1	49527	N	RW	Open system intercooler fan maximum speed differential in Cool	-50.0 ... 99.9	5.5	°C/Bar
FE	FE13	17056	WORD	Y	-1	49527,2	N	RW	Open system intercooler fan proportional band speed in Cool	0.0 ... 25.5	3.5	°C/Bar
FE	FE14	17058	WORD	Y	-1	49527,4	N	RW	Open system intercooler fan maximum speed hysteresis in Cool	0.0 ... 25.5	1.0	°C/Bar
FE	FE15	17060	WORD	Y	-1	49527,6	N	RW	Open system intercooler fan hysteresis cut-off in Cool	0.0 ... 25.5	1.0	°C/Bar
FE	FE16	17062	WORD	Y	-1	49528	N	RW	Open system intercooler fan differential cut-off in Cool	0.0 ... 25.5	2.0	°C/Bar
FE	FE17	49832	BYTE			49528,2	Y	RW	Open system intercooler fan minimum speed in Heat	0 ... 100	50	%
FE	FE18	49833	BYTE			49528,4	Y	RW	Open system intercooler fan average speed in Heat	0 ... 100	95	%
FE	FE19	49834	BYTE			49528,6	Y	RW	Open system intercooler fan maximum speed in Heat	0 ... 100	100	%
FE	FE20	49835	BYTE			49529	Y	RW	Select probe to regulate open system intercooler fan in Heat	0 ... 4	0	num
FE	FE21	17068	WORD	Y	-1	49529,2	N	RW	Open system intercooler fan minimum setpoint speed in Heat	-50.0 ... 99.9	5.5	°C/Bar
FE	FE22	17070	WORD	Y	-1	49529,4	N	RW	Open system intercooler fan maximum speed differential in Heat	-50.0 ... 99.9	1.7	°C/Bar
FE	FE23	17072	WORD	Y	-1	49529,6	N	RW	Open system intercooler fan proportional band speed in Heat	0.0 ... 25.5	1.0	°C/Bar
FE	FE24	17074	WORD	Y	-1	49530	N	RW	Open system intercooler fan maximum speed hysteresis in Heat	0.0 ... 25.5	0.5	°C/Bar
FE	FE25	17076	WORD	Y	-1	49530,2	N	RW	Open system intercooler fan hysteresis cut-off in Heat	0.0 ... 25.5	0.5	°C/Bar
FE	FE26	17078	WORD	Y	-1	49530,4	N	RW	Open system intercooler fan differential cut-off in Heat	0.0 ... 25.5	1.0	°C/Bar

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
FE	*FE27*	49848	BYTE			49530,6	N	RW	Enable open system intercooler fan on during defrost	0 ... 1	0	num
FE	*FE28*	17082	WORD	Y	-1	49531	N	RW	Open system intercooler fan switch on setpoint during defrost	-50.0 ... 99.9	19.0	°C/Bar
FE	*FE29*	17084	WORD	Y	-1	49531,2	N	RW	Open system intercooler fan switch-on hysteresis during defrost	0.0 ... 25.5	1.0	°C/Bar
FE	*FE30*	49854	BYTE			49531,4	Y	RW	Select probe to regulate open system intercooler fan during defrost	0 ... 3	1	num
PE	*PE00*	49776	BYTE			49531,6	Y	RW	Enable open system water pump circuit	0 ... 1	0	num
HI	*HI00*	49856	BYTE			49532	Y	RW	Enable primary intercooler heaters for anti-freeze	0 ... 1	1	num
HI	*HI01*	49857	BYTE			49532,2	Y	RW	Enable primary intercooler heaters regulator on stand-by for anti-freeze	0 ... 1	0	num
HI	*HI02*	49858	BYTE			49532,4	Y	RW	Enable primary intercooler heaters for integration	0 ... 1	0	num
HI	*HI03*	49859	BYTE			49532,6	Y	RW	Enable force heaters on during defrost	0 ... 1	0	num
HI	*HI04*	49860	BYTE			49533	Y	RW	Number of primary intercooler heaters	1 ... 2	1	num
HI	*HI05*	49861	BYTE			49533,2	Y	RW	Select probe to regulate primary intercooler heaters for anti-freeze	0 ... 1	1	num
HI	*HI06*	17094	WORD	Y	-1	49533,4	N	RW	Primary intercooler heaters regulator setpoint for anti-freeze	*HI08* ... *HI07*	4.0	°C
HI	*HI07*	17096	WORD	Y	-1	49533,6	Y	RW	Primary intercooler heaters regulator maximum setpoint for anti-freeze	*HI08* ... 99.9	7.0	°C
HI	*HI08*	17098	WORD	Y	-1	49534	Y	RW	Primary intercooler heaters regulator minimum setpoint for anti-freeze	-50.0 ... *HI07*	-10.0	°C
HI	*HI09*	17100	WORD	Y	-1	49534,2	N	RW	Primary intercooler heaters regulator hysteresis for anti-freeze	0.0 ... 25.5	0.5	°C
HI	*HI10*	17102	WORD	Y	-1	49534,4	N	RW	Primary intercooler heaters dynamic differential setpoint in integration	-50.0 ... 99.9	10.0	°C
HI	*HI11*	17104	WORD	Y	-1	49534,6	Y	RW	Primary intercooler heaters maximum dynamic differential in integration	0.0 ... 25.5	25.5	°C/Bar

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
HI	*HI12*	17106	WORD	Y	-1	49535	N	RW	Primary intercooler heaters dynamic differential proportional band in integration	-50.0 ... 99.9	5.0	°C
HI	*HI13*	17108	WORD	Y	-1	49535,2	N	RW	Primary intercooler heaters regulator hysteresis in integration	0.0 ... 25.5	1.0	°C/Bar
HI	*HI14*	49878	BYTE			49535,4	Y	RW	Enable primary intercooler heaters digital dynamic differential in integration	0 ... 1	1	num
HI	*HI15*	17112	WORD	Y	-1	49535,6	N	RW	Primary intercooler heater 2 switch-on setpoint differential in integration	0.0 ... 25.5	3.0	°C/Bar
HE	*HE00*	49888	BYTE			49536	Y	RW	Enable open-system intercooler heaters for anti-freeze	0 ... 1	0	num
HE	*HE01*	49889	BYTE			49536,2	Y	RW	Enable primary open-system intercooler heaters regulator on stand-by for anti-freeze	0 ... 1	0	num
HE	*HE02*	49890	BYTE			49536,4	Y	RW	Select probe to regulate primary open-system intercooler heaters for anti-freeze	0 ... 1	1	num
HE	*HE03*	17124	WORD	Y	-1	49536,6	N	RW	Open-system intercooler heaters switch-on setpoint for anti-freeze	*HE05* ... *HE04*	4.0	°C
HE	*HE04*	17126	WORD	Y	-1	49537	Y	RW	Primary open-system intercooler heaters regulator maximum setpoint for anti-freeze	*HE05* ... 99.9	7.0	°C
HE	*HE05*	17128	WORD	Y	-1	49537,2	Y	RW	Primary open-system intercooler heaters regulator minimum setpoint for anti-freeze	-50.0 ... *HE04*	-10.0	°C
HE	*HE06*	17130	WORD	Y	-1	49537,4	N	RW	Open-system intercooler heaters regulator hysteresis for anti-freeze	0.0 ... 25.5	1.0	°C
HA	*HA00*	49936	BYTE			49537,6	Y	RW	Enable auxiliary heater	0 ... 1	0	num
HA	*HA01*	17170	WORD	Y	-1	49538	N	RW	*Auxiliary heaters* regulator setpoint	-25.5 ... 25.5	2.0	°C
HA	*HA02*	17172	WORD	Y	-1	49538,2	N	RW	*Auxiliary heaters* regulator hysteresis	0.0 ... 25.5	1.0	°C
br	*br00*	49952	BYTE			49538,4	Y	RW	Enable boiler	0 ... 1	0	num
br	*br01*	49953	BYTE			49538,6	Y	RW	Enable boiler during heating only	0 ... 1	0	num
br	*br02*	49954	BYTE			49539	Y	RW	Enable boiler digital dynamic differential	0 ... 1	1	num
br	*br03*	17188	WORD	Y	-1	49539,2	N	RW	Boiler dynamic differential setpoint	-50.0 ... 99.9	10.0	°C
br	*br04*	17190	WORD	Y	-1	49539,4	N	RW	Boiler proportional band dynamic differential	-50.0 ... 99.9	5.0	°C

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
br	*br05*	17192	WORD	Y	-1	49539,6	Y	RW	Maximum boiler dynamic differential	0.0 ... 25.5	25.5	°C/Bar
br	*br06*	17194	WORD	Y	-1	49540	Y	RW	Boiler regulator hysteresis	0.0 ... 25.5	2.0	°C/Bar
dF	*dF00*	49966	BYTE			49540,2	Y	RW	Enable defrost function	0 ... 1	1	num
dF	*dF01*	17202	WORD	Y	-1	49540,4	N	RW	Setpoint for enable interval count between defrost cycles	-500 ... 999	25	°C/Bar
dF	*dF02*	17204	WORD	Y	-1	49540,6	N	RW	Disable defrost setpoint	-500 ... 999	130	°C/Bar
dF	*dF03*	49974	BYTE			49541	Y	RW	Cumulative time between defrost cycles	0 ... 255	20	min
dF	*dF04*	49975	BYTE			49541,2	Y	RW	Delay compressor-valve-compressor *start defrost*	0 ... 255	0	sec
dF	*dF05*	49976	BYTE			49541,4	Y	RW	Delay compressor-valve-compressor *end defrost*	0 ... 255	10	sec
dF	*dF06*	49977	BYTE			49541,6	Y	RW	Drip time	0 ... 255	40	sec
dF	*dF07*	49978	BYTE			49542	Y	RW	Maximum defrost time	0 ... 255	5	min
dF	*dF08*	49979	BYTE			49542,2	Y	RW	Enable dynamic defrost differential	0 ... 1	0	num
dF	*dF09*	17212	WORD	Y	-1	49542,4	Y	RW	Maximum dynamic defrost differential	-255 ... 255	20	°C/Bar
dF	*dF10*	17214	WORD	Y	-1	49542,6	N	RW	Dynamic defrost differential setpoint	-500 ... 999	100	°C
dF	*dF11*	17216	WORD	Y	-1	49543	N	RW	Defrost proportional band dynamic differential	-255 ... 255	-50	°C
dF	*dF12*	49986	BYTE			49543,2	Y	RW	Select probe to enable interval count between defrost cycles	0 ... 4	0	num
dF	*dF13*	49987	BYTE			49543,4	Y	RW	Select probe to disable defrost	0 ... 4	0	num
dF	*dF14*	17220	WORD	Y	-1	49543,6	N	RW	Setpoint to clear cumulative time between defrost cycles	-500 ... 999	130	°C/Bar
dS	*dS00*	50000	BYTE			49544	Y	RW	Enable dynamic *temperature control differential*	0 ... 1	0	num
dS	*dS01*	17234	WORD	Y	-1	49544,2	N	RW	Temperature control proportional band dynamic differential in Cool	-50.0 ... 99.9	5.0	°C
dS	*dS02*	17236	WORD	Y	-1	49544,4	N	RW	Temperature control proportional band dynamic differential in Heat	-50.0 ... 99.9	5.0	°C
dS	*dS03*	17238	WORD	Y	-1	49544,6	Y	RW	Maximum temperature control dynamic differential in Cool	-50.0 ... 99.9	5.0	°C

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
dS	*dS04*	17240	WORD	Y	-1	49545	Y	RW	Maximum temperature control dynamic differential in Heat	-50.0 ... 99.9	5.0	°C
dS	*dS05*	17242	WORD	Y	-1	49545,2	N	RW	Temperature control dynamic setpoint differential in Cool	-50.0 ... 99.9	15.0	°C
dS	*dS06*	17244	WORD	Y	-1	49545,4	N	RW	Temperature control dynamic setpoint differential in Heat	-50.0 ... 99.9	22.0	°C
dS	*dS07*	50014	BYTE			49545,6	Y	RW	Enable temperature control digital dynamic differential	0 ... 1	0	num
Ad	*Ad00*	50016	BYTE			49546	Y	RW	Enable machine function without accumulation	0 ... 1	0	num
Ad	*Ad01*	50017	BYTE			49546,2	Y	RW	Type of accumulation compensation	0 ... 2	0	num
Ad	*Ad02*	50018	BYTE	Y	-1	49546,4	Y	RW	Constant accumulation compensation	0 ... 255	20	num
Ad	*Ad03*	17252	WORD	Y	-1	49546,6	N	RW	Accumulation compensation differential	0.0 ... 25.5	0.5	°C
Ad	*Ad04*	17254	WORD	Y	-1	49547	N	RW	Accumulation compensation block setpoint in Cool	-50.0 ... 99.9	4.0	°C
Ad	*Ad05*	17256	WORD	Y	-1	49547,2	N	RW	Accumulation compensation block setpoint in Heat	-50.0 ... 99.9	50.0	°C
Ad	*Ad06*	50026	BYTE			49547,4	Y	RW	Time compressor on for accumulation compensation regression	0 ... 255	24	sec*10
Ad	*Ad07*	50027	BYTE			49547,6	Y	RW	Compressor on reference time for accumulation compensation	0 ... 255	18	sec*10
AF	*AF00*	50032	BYTE			49548	Y	RW	Enable heat pump function in anti-freeze	0 ... 1	0	num
AF	*AF01*	17266	WORD	Y	-1	49548,2	N	RW	Water pump regulator setpoint for heat pump function in anti-freeze	-50.0 ... 99.9	8.0	°C/Bar
AF	*AF02*	17268	WORD	Y	-1	49548,4	N	RW	Heat pump regulator setpoint in anti-freeze	-50. ... 99.9	5.0	°C/Bar
AF	*AF03*	17270	WORD	Y	-1	49548,6	N	RW	Heat pump block setpoint in anti-freeze	-50. ... 99.9	12.0	°C/Bar
PL	*PL00*	50048	BYTE			49549	Y	RW	Enable power limitation function	0 ... 1	0	num
PL	*PL01*	50049	BYTE			49549,2	Y	RW	Select probe for power limitation	0 ... 3	1	num
PL	*PL02*	17282	WORD	Y	-1	49549,4	N	RW	High pressure setpoint for power limitation	-50.0 ... 99.9	40.0	Bar
PL	*PL03*	17284	WORD	Y	-1	49549,6	N	RW	Low pressure setpoint for power limitation	-50.0 ... 99.9	3.0	Bar

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
PL	*PL04*	17286	WORD	Y	-1	49550	N	RW	High water temperature setpoint for power limitation	-50.0 ... 99.9	50.0	°C
PL	*PL05*	17288	WORD	Y	-1	49550,2	N	RW	Low water temperature setpoint for power limitation	-50.0 ... 99.9	5.0	°C
PL	*PL06*	17290	WORD	Y	-1	49550,4	N	RW	External temperature setpoint for power limitation in Cool	-50.0 ... 99.9	10.0	°C
PL	*PL07*	17292	WORD	Y	-1	49550,6	N	RW	External temperature setpoint for power limitation in Heat	-50.0 ... 99.9	3.0	°C
PL	*PL08*	17294	WORD	Y	-1	49551	N	RW	Power limitation proportional band	0.0 ... 25.5	5.0	°C/Bar
AL	*AL00*	50064	BYTE			49551,2	Y	RW	Time interval in which alarm events are counted	1 ... 99	60	min
AL	*AL01*	50065	BYTE			49551,4	Y	RW	Number of low pressure *alarms*	0 ... 255	3	num
AL	*AL02*	50066	BYTE			49551,6	Y	RW	Low pressure alarm bypass time	0 ... 255	120	sec
AL	*AL03*	50067	BYTE			49552	Y	RW	Number of high pressure *alarms*	0 ... 255	0	num
AL	*AL04*	50068	BYTE			49552,2	Y	RW	Enable flow switch time for primary circuit manual alarm	0 ... 255	2	sec*10
AL	*AL05*	50069	BYTE			49552,4	Y	RW	Flow switch bypass time after primary circuit water pump enabled	0 ... 255	15	sec
AL	*AL06*	50070	BYTE			49552,6	Y	RW	Enable flow switch time for primary circuit automatic alarm	0 ... 255	2	sec
AL	*AL07*	50071	BYTE			49553	Y	RW	Disable flow switch time for primary circuit automatic alarm	0 ... 255	15	sec
AL	*AL08*	50072	BYTE			49553,2	Y	RW	Number of compressor thermal switch *alarms*	0 ... 255	1	num
AL	*AL09*	50073	BYTE			49553,4	Y	RW	Bypass compressor thermal switch alarm time	0 ... 255	0	sec
AL	*AL10*	50074	BYTE			49553,6	Y	RW	Number of open-system intercooler fan thermal switch *alarms*	0 ... 255	1	num
AL	*AL11*	50075	BYTE			49554	Y	RW	Number of primary circuit anti-freeze *alarms*	0 ... 255	1	num
AL	*AL12*	17308	WORD	Y	-1	49554,2	N	RW	Primary circuit anti-freeze regulator setpoint alarm	-50.0 ... 99.9	4.0	°C
AL	*AL13*	17310	WORD	Y	-1	49554,4	N	RW	Primary circuit anti-freeze regulator hysteresis alarm	0.0 ... 25.5	2.0	°C

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
AL	*AL14*	50080	BYTE			49554,6	Y	RW	Enable force recirculating fan on during primary circuit anti-freeze alarm	0 ... 1	0	num
AL	*AL15*	50081	BYTE			49555	Y	RW	Primary circuit anti-freeze alarm bypass time	0 ... 255	1	min
AL	*AL16*	50082	BYTE			49555,2	Y	RW	Enable gas low in plant alarm	0 ... 1	0	num
AL	*AL17*	50083	BYTE			49555,4	Y	RW	Gas low in plant alarm bypass time	0 ... 255	5	min
AL	*AL18*	17316	WORD	Y	-1	49555,6	N	RW	Gas low in plant alarm differential	0 ... 255	20	°C
AL	*AL19*	50086	BYTE			49556	Y	RW	Time gas low in plant before alarm	0.0 ... 25.5	2.0	min
AL	*AL20*	50087	BYTE			49556,2	Y	RW	Enable low pressure alarm during defrost	0 ... 1	0	num
AL	*AL21*	17320	WORD	Y	-1	49556,4	N	RW	High temperature alarm regulator setpoint from analogue input	-50.0 ... 99.9	90.0	°C
AL	*AL22*	17322	WORD	Y	-1	49556,6	N	RW	High temperature alarm regulator hysteresis from analogue input	0.0 ... 25.5	2.0	°C
AL	*AL23*	50092	BYTE			49557	Y	RW	High temperature time per alarm	0 ... 255	30	sec*10
AL	*AL24*	17326	WORD	Y	-1	49557,2	N	RW	Low pressure alarm regulator setpoint from analogue input	-50.0 ... 99.9	2.0	Bar
AL	*AL25*	17328	WORD	Y	-1	49557,4	N	RW	High pressure alarm regulator setpoint from analogue input	-50.0 ... 99.9	42.0	Bar
AL	*AL26*	17330	WORD	Y	-1	49557,6	N	RW	Low pressure alarm regulator hysteresis from analogue input	0.0 ... 25.5	20	Bar
AL	*AL27*	17332	WORD	Y	-1	49558	N	RW	High pressure alarm regulator hysteresis from analogue input	0.0 ... 255	2.0	Bar
AL	*AL28*	50102	BYTE			49558,2	Y	RW	Low pressure alarm bypass time from analogue input	0 ... 255	10	sec
AL	*AL29*	50103	BYTE			49558,4	Y	RW	Number of low pressure *alarms* from analogue input	0 ... 255	2	num
AL	*AL30*	50104	BYTE			49558,6	Y	RW	Time compressor 1 on before maintenance warning	0 ... 255	255	ore*100
AL	*AL31*	50105	BYTE			49559	Y	RW	Time compressor 2 on before maintenance warning	0 ... 255	255	ore*100

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
AL	*AL32*	50106	BYTE			49559,2	Y	RW	Time pump 1 on before maintenance warning	0 ... 255	255	ore*100
AL	*AL33*	50107	BYTE			49559,4	Y	RW	Time pump 2 on before maintenance warning	0 ... 255	255	ore*100
AL	*AL34*	50108	BYTE			49559,6	Y	RW	Maximum number of historical events per alarm message	0 ... 99	99	num
AL	*AL35*	50109	BYTE			49560	Y	RW	Number of primary intercooler fan thermal switch *alarms*	0 ... 255	1	num
AL	*AL36*	50110	BYTE			49560,2	Y	RW	Time flow switch on before open-circuit manual alarm	0 ... 255	2	sec*10
AL	*AL37*	50111	BYTE			49560,4	Y	RW	Flow switch bypass time after open-circuit pump activated	0 ... 255	15	sec
AL	*AL38*	50112	BYTE			49560,6	Y	RW	Time flow switch on before open-circuit automatic alarm	0 ... 255	2	sec
AL	*AL39*	50113	BYTE			49561	Y	RW	Time low switch off before open-circuit automatic alarm	0 ... 255	15	sec
AL	*AL40*	50114	BYTE			49561,2	Y	RW	Number of primary circuit pump thermal switch *alarms*	0 ... 255	2	num
AL	*AL41*	50115	BYTE			49561,4	Y	RW	Number of open-system pump thermal switch *alarms*	0 ... 255	2	num
AL	*AL42*	50116	BYTE			49561,6	Y	RW	Number of compressor oil pressure switch *alarms*	0 ... 255	1	num
AL	*AL43*	50117	BYTE			49562	Y	RW	Number of high pressure *alarms* from analogue input	0 ... 255	0	num
AL	*AL44*	50118	BYTE			49562,2	Y	RW	Number of open-system anti-freeze *alarms*	0 ... 255	1	num
AL	*AL45*	17352	WORD	Y	-1	49562,4	N	RW	Open-system circuit anti-freeze regulator setpoint alarm	-50.0 ... 99.9	4.0	°C
AL	*AL46*	17354	WORD	Y	-1	49562,6	N	RW	Open-system circuit anti-freeze regulator hysteresis alarm	0.0 ... 25.5	2.0	°C
AL	*AL47*	50124	BYTE			49563	Y	RW	Open-system circuit anti-freeze alarm bypass time	0 ... 255	1	min

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	M.U.
AL	*AL48*	50125	BYTE			49563,2	Y	RW	Compressor oil pressure switch alarm bypass time	0 ... 255	1	sec

22.2.2 Folder visibility table

LABEL	VIS PAR AdDRESS	CPL	EXP	R/W	DESCRIPTION	DATA SIZE	RANGE	DEFAULT	U.M.
_VisSt0	49472			RW	*Folder* Ai visibility	2 bit	0 ... 3	3	num
_VisSt1	49472,2			RW	*Folder* di visibility	2 bit	0 ... 3	3	num
_VisSt2	49472,4			RW	*Folder* AO visibility	2 bit	0 ... 3	3	num
_VisSt3	49472,6			RW	*Folder* dO visibility	2 bit	0 ... 3	3	num
_VisSt4	49473			RW	*Folder* SP visibility	2 bit	0 ... 3	3	num
_VisSt5	49473,2			RW	*Folder* Sr visibility	2 bit	0 ... 3	3	num
_VisSt6	49473,4			RW	*Folder* Hr visibility	2 bit	0 ... 3	3	num
_VisPa0	49473,6			RW	*Folder* Par visibility	2 bit	0 ... 3	3	num
_VisPa1	49474			RW	*Folder* FnC visibility	2 bit	0 ... 3	3	num
_VisPa2	49474,2			RW	*Folder* PASS visibility	2 bit	0 ... 3	3	num
_VisPa3	49474,4			RW	*Folder* EU visibility	2 bit	0 ... 3	3	num
_VisSSp0	49474,6			RW	*Folder* SP\COOL visibility	2 bit	0 ... 3	3	num
_VisSSp1	49475			RW	*Folder* SP\HEAT visibility	2 bit	0 ... 3	3	num
_VisSSr0	49475,2			RW	*Folder* Sr\COOL visibility	2 bit	0 ... 3	3	num
_VisSSr1	49475,4			RW	*Folder* Sr\HEAT visibility	2 bit	0 ... 3	3	num
_VisPP0	49475,6			RW	*Folder* Par\CF visibility	2 bit	0 ... 3	3	num
_VisPP1	49476			RW	*Folder* Par\Ui visibility	2 bit	0 ... 3	3	num
_VisPP2	49476,2			RW	*Folder* Par\tr visibility	2 bit	0 ... 3	3	num
_VisPP3	49476,4			RW	*Folder* Par\St visibility	2 bit	0 ... 3	3	num
_VisPP4	49476,6			RW	*Folder* Par\CP visibility	2 bit	0 ... 3	3	num
_VisPP5	49477			RW	*Folder* Par\Pi visibility	2 bit	0 ... 3	3	num
_VisPP6	49477,2			RW	*Folder* Par\Fi visibility	2 bit	0 ... 3	3	num
_VisPP7	49477,4			RW	*Folder* Par\FE visibility	2 bit	0 ... 3	3	num

LABEL	VIS PAR AdDRESS	CPL	EXP	R/W	DESCRIPTION	DATA SIZE	RANGE	DEFAULT	U.M.
_VisPP8	49477,6			RW	*Folder* Par\PE visibility	2 bit	0 ... 3	3	num
_VisPP9	49478			RW	*Folder* Par\Hi visibility	2 bit	0 ... 3	3	num
_VisPP10	49478,2			RW	*Folder* Par\HE visibility	2 bit	0 ... 3	3	num
_VisPP11	49478,4			RW	*Folder* Par\HA visibility	2 bit	0 ... 3	3	num
_VisPP12	49478,6			RW	*Folder* Par\br visibility	2 bit	0 ... 3	3	num
_VisPP13	49479			RW	*Folder* Par\dF visibility	2 bit	0 ... 3	3	num
_VisPP14	49479,2			RW	*Folder* Par\dS visibility	2 bit	0 ... 3	3	num
_VisPP15	49479,4			RW	*Folder* Par\Ad visibility	2 bit	0 ... 3	3	num
_VisPP16	49479,6			RW	*Folder* Par\AF visibility	2 bit	0 ... 3	3	num
_VisPP17	49480			RW	*Folder* Par\PL visibility	2 bit	0 ... 3	3	num
_VisPP18	49480,2			RW	*Folder* Par\AL visibility	2 bit	0 ... 3	3	num
_VisPF0	49480,4			RW	*Folder* FnC\dEF visibility	2 bit	0 ... 3	3	num
_VisPF1	49480,6	Y	Y	RW	*Folder* FnC\tA visibility	2 bit	0 ... 3	3	num
_VisPF2	49481	Y	Y	RW	*Folder* FnC\St visibility	2 bit	0 ... 3	3	num
_VisPF3	49481,2	Y	Y	RW	*Folder* FnC\CC visibility	2 bit	0 ... 3	3	num
_VisPF4	49481,4			RW	*Folder* FnC\Eur visibility	2 bit	0 ... 3	3	num
_VisPFCC0	49563,4			RW	*Folder* FnC\CC\UL visibility	2 bit	0 ... 3	3	num
_VisPFCC1	49563,6			RW	*Folder* FnC\CC\dL visibility	2 bit	0 ... 3	3	num
_VisPFCC2	49564			RW	*Folder* FnC\CC\Fr visibility	2 bit	0 ... 3	3	num

22.2.3 Client Table

LABEL	ADDRESS	CPL	EXP	R/W	DESCRIPTION	DATA SIZE	RANGE	DEFAULT	M.U.
ValSondeVis[0]	344	Y	-1	R	Analogue input AI1	WORD	-500 ... 999	0	°C
ValSondeVis[1]	346	Y	-1	R	Analogue input AI2	WORD	-500 ... 999	0	°C
ValSondeVis[2]	348	Y	-1	R	Analogue input AI3	WORD	-500 ... 999	0	°C/Bar
ValSondeVis[3]	350	Y	-1	R	Analogue input AI4	WORD	-500 ... 999	0	°C/Bar
Dig.Input DI1	33094			R	Digital input DI1	1 bit	0 ... 1	0	num
Dig.Input DI2	33094,1			R	Digital input DI2	1 bit	0 ... 1	0	num
Dig.Input DI3	33094,2			R	Digital input DI3	1 bit	0 ... 1	0	num
Dig.Input DI4	33094,3			R	Digital input DI4	1 bit	0 ... 1	0	num
Dig.Input DI5	33094,4			R	Digital input DI5	1 bit	0 ... 1	0	num
Dig.Output DO1	33095,2			R	Digital output DO1	1 bit	0 ... 1	0	num
Dig.Output DO2	33095,3			R	Digital output DO2	1 bit	0 ... 1	0	num
Dig.Output DO3	33095,4			R	Digital output DO3	1 bit	0 ... 1	0	num
Dig.Output DO4	33095			R	Digital output DO4	1 bit	0 ... 1	0	num
Dig.Output DO5	33095,1			R	Digital output DO5	1 bit	0 ... 1	0	num
Dig.Output DO6	33095,5			R	Digital output DO6	1 bit	0 ... 1	0	num
Dig.Output AO1	33095,6			R	Digital output AO1	1 bit	0 ... 1	0	num
Dig.Output AO2	33095,7			R	Digital output AO2	1 bit	0 ... 1	0	num
Analog.Out TC1	33145	Y		R	Analogue output TC1	BYTE	0 ... 100	0	num
Analog.Out AO1	33146	Y		R	Analogue output AO1	BYTE	0 ... 100	0	num
Analog.Out AO2	33147	Y		R	Analogue output AO2	BYTE	0 ... 100	0	num
Analog.Out AO3	387	Y	-1	R	Analogue output AO3	WORD	0 ... 999	0	num
Setpoint Cool reale	740	Y	-1	R	Cooling mode set point	WORD	-500 ... 999	0	°C
Setpoint Heat reale	742	Y	-1	R	Heating mode set point	WORD	-500 ... 999	0	°C
Isteresi Cool reale	771	Y	-1	R	Cooling mode hysteresis	WORD	-500 ... 999	0	°C
Isteresi Heat reale	773	Y	-1	R	Heating mode hysteresis	WORD	-500 ... 999	0	°C
Ore di Funz. CP1	753			R	Compressor 1 working hour	WORD	0 ... 65535	0	ore
Ore di Funz. CP2	755			R	Compressor 2 working hour	WORD	0 ... 65535	0	ore
Stato Sbrinamento	33513,3			R	Defrosting status	1 bit	0 ... 1	0	num
St.Antig.Pom. prim.	33513,7			R	Status of primary circuit pump for antifreeze	1 bit	0 ... 1	0	num
St.Antig. Res.prim.	33514			R	Status of primary heat exchanger for antifreeze	1 bit	0 ... 1	0	num
St.Antigelo c. perd.	33514,1			R	Status of disposable heat exchanger electric heater for antifreeze	1 bit	0 ... 1	0	num
Macchina Off	33028			R	Device in OFF	1 bit	0 ... 1	0	num
Macchina St.By, 1	33028,2			R	Device in STAND BY	1 bit	0 ... 1	0	num
Macchina St.By, 2	33028,3			R	Device in STAND BY	1 bit	0 ... 1	0	num

LABEL	ADDRESS	CPL	EXP	R/W	DESCRIPTION	DATA SIZE	RANGE	DEFAULT	M.U.
Macchina Cool	33028,4			R	Device in COOL	1 bit	0 ... 1	0	num
Macchina Heat	33028,6			R	Device in HEAT	1 bit	0 ... 1	0	num
Ore di Funz. Pom.1	763			R	Primary circuit pump operating hours	WORD	0 ... 65535	0	ore
Ore di Funz. Pom.2	765			R	Disposable circuit pump operating hours	WORD	0 ... 65535	0	ore
Dif.Set.Res.Integ.	775	Y	-1	R	Integrated electric heater set point dynamic differential	WORD	-999 ... 999	0	°C/Bar
Dif.Set.Boil. da Text	777	Y	-1	R	Boiler set point dynamic differential	WORD	-999 ... 999	0	°C/Bar
Dif.Set.Sbrin.da Te	779	Y	-1	R	Defrost set point dynamic differential	WORD	-999 ... 999	0	°C/Bar
Er00	33037			R	General alarm	1 bit	0 ... 1	0	flag
Er01	33037,1			R	Circuit 1 digital high pressure alarm	1 bit	0 ... 1	0	num
Er03	33037,3			R	Circuit 1 analogue high pressure alarm	1 bit	0 ... 1	0	num
Er05	33037,5			R	Circuit 1 digital low pressure alarm	1 bit	0 ... 1	0	num
Er07	33037,7			R	Circuit 1 analogue low pressure alarm	1 bit	0 ... 1	0	num
Er09	33038,1			R	Machine low charge alarm	1 bit	0 ... 1	0	num
Er10	33038,2			R	Compressor 1 thermal switch alarm	1 bit	0 ... 1	0	num
Er11	33038,3			R	Compressor 2 thermal switch alarm	1 bit	0 ... 1	0	num
Er15	33038,7			R	Compressor 1 oil pressure switch alarm	1 bit	0 ... 1	0	flag
Er16	33039			R	Compressor 2 oil pressure switch alarm	1 bit	0 ... 1	0	flag
Er20	33039,4			R	Primary circuit flow switch alarm	1 bit	0 ... 1	0	num
Er21	33039,5			R	Primary circuit pump thermal switch alarm	1 bit	0 ... 1	0	num
Er25	33040,1			R	Disposable circuit flow switch alarm	1 bit	0 ... 1	0	num
Er26	33040,2			R	Disposable circuit pump thermal switch alarm	1 bit	0 ... 1	0	num
Er30	33040,6			R	Primary circuit antifreeze alarm	1 bit	0 ... 1	0	num
Er31	33040,7			R	Disposable circuit antifreeze alarm	1 bit	0 ... 1	0	num
Er35	33041,3			R	High temperature alarm	1 bit	0 ... 1	0	num
Er40	33042			R	Primary exchanger fan thermal switch alarm	1 bit	0 ... 1	0	flag
Er41	33042,1			R	Disposable exchanger fan thermal switch alarm	1 bit	0 ... 1	0	flag
Er45	33042,5			R	Faulty clock alarm	1 bit	0 ... 1	0	flag
Er46	33042,6			R	Time lost alarm	1 bit	0 ... 1	0	flag
Er47	33042,7			R	No communication with keyboard alarm	1 bit	0 ... 1	0	flag
Er50	33043,2			R	Primary exchanger electric heater 1 thermal switch alarm	1 bit	0 ... 1	0	flag
Er51	33043,3			R	Primary exchanger electric heater 2 thermal switch alarm	1 bit	0 ... 1	0	flag
Er52	33043,4			R	Disposable exchanger electric heater 1 thermal switch alarm	1 bit	0 ... 1	0	flag
Er53	33043,5			R	Disposable exchanger electric heater 2 thermal switch alarm	1 bit	0 ... 1	0	flag
Er56	33044			R	Auxiliary electric heater thermal switch alarm	1 bit	0 ... 1	0	flag
Er60	33044,4			R	Primary exchanger water or air intput temperature probe faulty alarm	1 bit	0 ... 1	0	flag
Er61	33044,5			R	Primary exchanger water or air output temperature probe faulty alarm	1 bit	0 ... 1	0	flag
Er62	33044,6			R	Faulty disposable exchanger 1 temperature probe alarm	1 bit	0 ... 1	0	flag

LABEL	ADDRESS	CPL	EXP	R/W	DESCRIPTION	DATA SIZE	RANGE	DEFAULT	M.U.
Er63	33044,7			R	Faulty disposable exchanger 1 water or air input temperature probe alarm	1 bit	0 ... 1	0	flag
Er64	33045			R	Faulty disposable exchanger 1 water or air output temperature probe alarm	1 bit	0 ... 1	0	flag
Er68	33045,4			R	Faulty external temperature probe alarm	1 bit	0 ... 1	0	flag
Er69	33045,5			R	Faulty circuit 1 high pressure transducer alarm	1 bit	0 ... 1	0	flag
Er70	33045,6			R	Faulty circuit 1 low pressure transducer alarm	1 bit	0 ... 1	0	flag
Er73	33046,1			R	Faulty dynamic set point input alarm	1 bit	0 ... 1	0	flag
Er74	33046,2			R	Faulty primary heat exchanger transducer alarm	1 bit	0 ... 1	0	flag
Er75	33046,3			R	Faulty disposable exchanger transducer 1 alarm	1 bit	0 ... 1	0	flag
Er80	33047			R	Configuration error alarm	1 bit	0 ... 1	0	flag
Er81	33047,1			R	Compressor 1 operating hours exceeded warning	1 bit	0 ... 1	0	flag
Er82	33047,2			R	Compressor 2 operating hours exceeded warning	1 bit	0 ... 1	0	flag
Er85	33047,5			R	Pump 1 operating hours exceeded warning	1 bit	0 ... 1	0	flag
Er86	33047,6			R	Pump 2 operating hours exceeded warning	1 bit	0 ... 1	0	flag
Er90	33048,2			R	Alarm log full warning	1 bit	0 ... 1	0	flag
Reset allarmi	33471,2			W	Alarm manual reset	1 bit	0 ... 1	0	flag
Modo cool	33471,3			W	Select mode COOL	1 bit	0 ... 1	0	flag
Modo heat	33471,4			W	Select mode HEAT	1 bit	0 ... 1	0	flag
Modo stand-by	33471,5			W	Select mode STAND BY	1 bit	0 ... 1	0	flag
Attiva Sbrinamento	33471,6			W	*Manual defrost* activation	1 bit	0 ... 1	0	flag
Toggle stato on/off	33471,7			W	Select mode ON/OFF	1 bit	0 ... 1	0	flag
Reset allarmi	33471,2			W	Alarm manual reset	1 bit	0 ... 1	0	flag

23 FUNCTIONS (FOLDER FNC)

The Functions menu is used to perform a number of manual functions such as switching on/off the device, acknowledging *alarms*, deleting the alarm log, running a *manual defrost* and using the *Multi Function key*.
A number of these operations can be done from the keyboard and main *display* using the *keys* - see User Interface chapter.
Functions associated to *keys* can be disabled and password-only access allowed to these functions at a "Service" level only via parameter.
For more details, see the table below:

	Label	**Operation**	**Function activated by [key] if configured**	**N.B.:**
FnC	dEF	*Manual defrost*	YES [UP]	
	tA	Alarm acknowledgment	YES [UP+DOWN]	
	St	Switch device on/off	YES [DOWN]	
	CC	Copy Card Use (multi-function key)	NO	
	EUr	Reset alarm log	NO	

To open the Functions menu (*folder* Fnc) perform steps 1-4 as indicated below:

1		To view *folder* FnC in the main *display*, press the Esc and Set *keys* at the same time. [esc+set]
2		Pressing both *keys* will open the *Programming menu*: --- the first *folder* you will see is the PAr *folder*.
3		Scroll with the "Up" and "DOWN" *keys* until you find the FnC *folder*. --- Press the set key to open the Functions menu.
4		The first *label* you will see is dEF. --- Scroll using the "up" and "down" *keys* to find other labels/folders. In this order: • (dEF) • tA • St • CC • EUr

23.1 Manual defrost activation (folder FnC/dEF)

See 1-4	Press [esc + set] in the main screen. The *label* 'PAr' will appear. Scroll with 'UP' and 'DOWN' to find the 'FnC' *label*. Press 'set'. The *label* 'dEF' will appear. Scroll with 'UP' and 'DOWN' to find the 'dEF' *label*.
	Press the "set" key to activate defrost manually from the keyboard.
	The DEFROST LED will start to blink.

23.2 Alarm acknowledgment (folder FnC/tA)

See 1-4	Press [esc + set] in the main screen. The *label* 'PAr' will appear. Scroll with 'UP' and 'DOWN' to find the 'FnC' *label*. Press 'set'. The *label* 'dEF' will appear. Scroll with 'UP' and 'DOWN' to find the 'TA' *label*.
	Press the "set" key to acknowledgment active *alarms*.

23.3 Change On/OFF state (folder FnC/St)

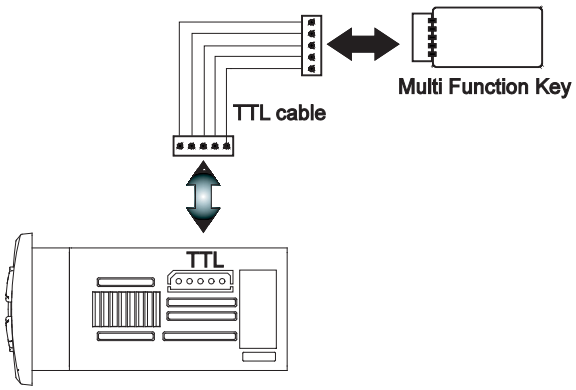
See 1-4	Press [esc + set] in the main screen. The *label* 'PAr' will appear. Scroll with 'UP' and 'DOWN' to find the 'FnC' *label*. Press 'set'. The *label* 'dEF' will appear. Scroll with 'UP' and 'DOWN' to find the 'St' *label*.
	The *label* "OFF" will appear in the "St" *folder* if the device is ON, or "OFF", if the device is switched OFF locally or by remote.
	Press the set key to change state from OFF to On --- or from On to OFF.
	

23.4 Multi Function Key

When the *Multi Function Key* is connected to the TTL type serial port, you can rapidly program device parameters (up/download parameter map to one or more of the same type of devices).

Connecting the Multi Function Key

The connection diagram is shown below:



23.5 Using the Multi Function Key (folder FnC/CC)

Upload (*label* UL), download (*label* dL) and formatting (*label* Fr) operations should be performed as explained below:

UPLOAD (copy from DEVICE to *MULTI FUNCTION KEY*)
By doing this, the programming parameters will be downloaded from Energy ST 500 to the *Multi Function Key*.

DOWNLOAD (copy from *MULTI FUNCTION KEY* to DEVICE)
By doing this, the programming parameters will be uploaded from the *Multi Function Key* to the device.

FORMAT*
Formatting the *Multi Function Key* consists of deleting the contents of the *Multi Function Key* and initializing it.
* This should be done prior to the Upload when used for the first time.

See 1-4	**Upload / Download / Format** **The download procedure is illustrated in the figure.** Press [esc + set] in the main screen. The *label* 'PAr' will appear. Scroll with 'UP' and 'DOWN' to find the 'FnC' *label*. Press 'set'. The *label* 'dEF' will appear. Scroll with 'UP' and 'DOWN' to find the 'CC' *label*.

	The commands you need to use the *Multi Function Key* are in the "CC" *folder*. Press the 'set' key to access the functions.
	Scroll with 'UP' and 'DOWN' to *display* the required function: • UL for upload • dL for download • Fr for format
	Press the 'set' key and the upload (or download) will be performed. (in the example dL- download) The string 'rUn' will appear on the *display*.
	If this completes successfully, 'yes' is displayed; otherwise 'Err' is displayed. Remove the Copy Card on completion.
	

23.5.1 Download from reset

Connect the copy card with the instrument switched off.
On switching on, the programming parameters are loaded in the instrument;

	lamp test completed...
	**Example A** ...dLY... appears on the *display* If the procedure terminates successfully.
	**Example B** ...dLn... appears on the *display*. If the procedure does not complete successfully (°).
	In both cases, the device will be switched OFF locally (OFF appears on the *display*). When you press [DOWN] (°°), the device will operate: • With the new map **Example A** • With the previous map **Example B** Remove the Copy Card on completion.

	(°°) see • User Interface chapter, (*folder* Par/UI) *local ON/OFF* section • Change On/OFF state (*folder* St)) section

N.B.:

- The formatting function is **ONLY REQUIRED FOR UPLOADING (**)**:
  - to use the *Multi Function Key* the first time (*Multi Function Key* that has never been used) and
  - to use the *Multi Function Key* with *models* that are not compatible.
  - (**) a pre-programmed key supplied by Eliwell to DOWNLOAD parameters does not need to be formatted. **N.B. Formatting can NOT be cancelled.**
- After downloading, the instrument will operate with the settings of the new map just loaded.
- Remove the key on completion of the operation.

(°) if the string Err / dLn (*download from reset*) appears:

- Check that the key is connected to the device
- Check the *Multi Function Key* – Energy ST500 connection (check the TTL cable)
- Check that the key is compatible with the device
- Contact Eliwell technical support.

23.6 Reset alarm log (folder EUr)

See 1-4	Press [esc + set] in the main screen. The *label* 'PAr' will appear. Scroll with 'UP' and 'DOWN' to find the 'FnC' *label*. Press 'set'. The *label* 'dEF' will appear. Scroll with 'UP' and 'DOWN' to find the 'EUr' *label*.
	Press the "set" key for 3 seconds [set]
	The 'YES' *label* appears to indicate that the alarm log has been deleted.

24 ELECTRICAL CONNECTIONS

24.1 General warnings

IMPORTANT!
Switch off the device before working on the *electrical connections*. All electrical work must be performed by a qualified electrician. To ensure proper connections, the following warnings must be observed:

- Power supply .
- Use cables of the right size for the terminals used.
- Separate the cables of probes and *digital inputs* from inductive loads and high voltage connections to prevent any electromagnetic interference. Do not place probe cables near any electrically devices (switches, meters, etc.)
- Make connections as short as possible and do not wind them around electrical connected parts.
- Do not touch electronic components on boards to prevent the build up of static electricity.
- Eliwell supplies the high voltage cables to connect the device to loads - see *Accessories* chapter.
- Eliwell supplies the signal cables to connect the power supply, probes, *digital inputs*, etc. See the *Accessories* chapter.
- The device must be connected to a suitable *transformer* that complies with the specifications provided in the Specifications chapter.

24.1.1 Power supply - High voltage inputs (relay)

Do not exceed the maximum permitted current; for higher loads, use a contactor with sufficient power capacity.

Warning!
Make sure that power supply is the correct voltage for the device.

24.1.2 TRIAC

The *TRIAC* (TC1) output, when partialized, suppresses the half-wave at the zero-crossing.

24.1.3 Analogue inputs-Probes

Temperature probes

The *temperature probes* have no characteristic insertion polarity and can be extended using standard bipolar cable (note that extending cables can affect the performance of the device in terms of electromagnetic compatibility: take great care with the wiring).

Warning!

Pressure probes

Pressure probes have a specific insertion polarity which must be observed.
Signal cables (temperature/*pressure probes*, *digital inputs*, TTL serial) must be cabled separately from high voltage cables.
Eliwell supplied cables are recommended. Contact Eliwell sales department for item availability.

24.1.4 Serial connections

24.1.5 TTL connection (COM 1)

TTL (COM 1)

Use a 5-wire TTL cable up to 30cm in length.
An Eliwell-supplied TTL cable is recommended. Contact Eliwell sales department for item availability.

24.2 Circuit diagrams

Circuit diagram key

- 12~ 12Vac power supply
- 5 ⎓ Auxiliary 5Vdc 20mA max supply
- 12 ⎓ Auxiliary 12Vdc supply
- DO1...DO4, DO6 2A - 230Vac high voltage relay outputs
- N Neutral
- TC1 *TRIAC* 2A 230Vac high voltage output
- AO1 PWM low voltage analogue output (SELV (§))
- AO2 PWM low voltage analogue output (SELV (§))
- AO3 Low voltage analogue output (SELV (§)) 0...20mA / 4...20mA / 0...1V / 0...5V / 0...10V
- DO5 Open Collector low voltage output (SELV (§))
- DI1...DI5 No voltage *digital inputs* (°)
- AI1...AI2 NTC* / Digital Input configurable *analogue inputs****
- AI3...AI4 NTC / voltage, current** / Digital Input configurable *analogue inputs****
- GND Ground
- KEYB Remote keyboard (KEYBoard) (100mt max)
- *TTL (COM 1)* TTL serial for connection to *Multi Function Key* / Param Manager

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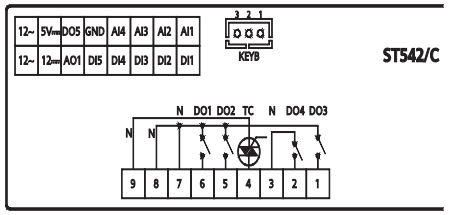
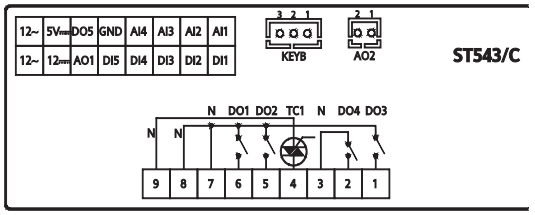
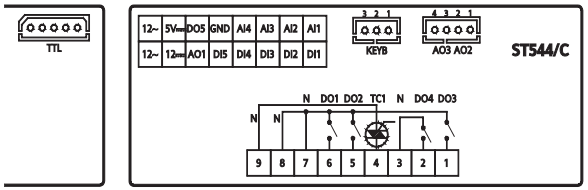
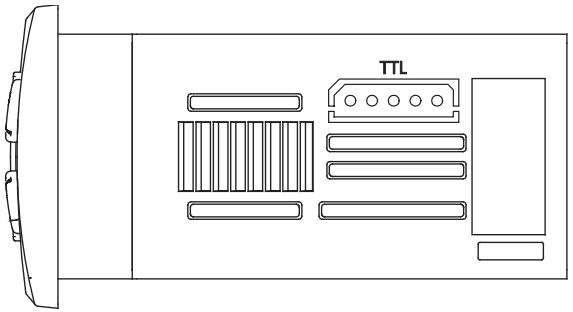
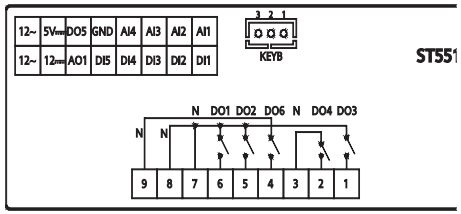
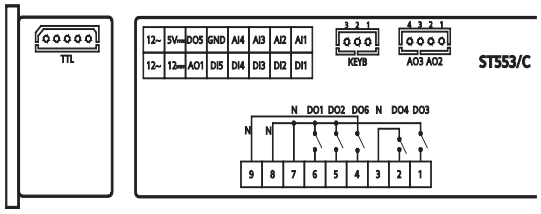
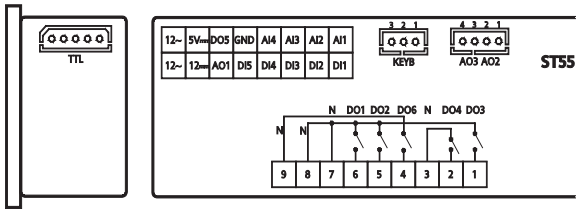
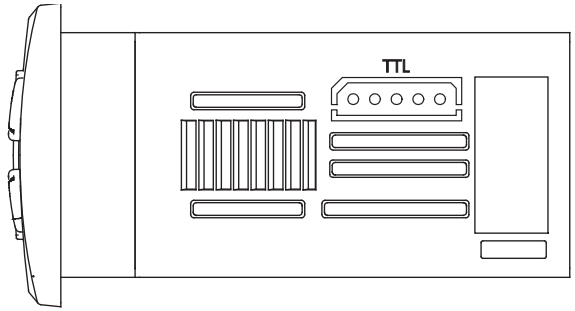
- *SEMITEC 103AT type (10KΩ / 25°C)
- **4...20mA current or 0...5V / 0...10V / 0...1V voltage input or no-voltage digital input
- ***no voltage digital input
- (°) closing current for 0.5mA ground
- (§) **SELV**: (SAFETY EXTRA LOW VOLTAGE)

24.2.1 Circuit diagrams for 4 relay + TRIAC models

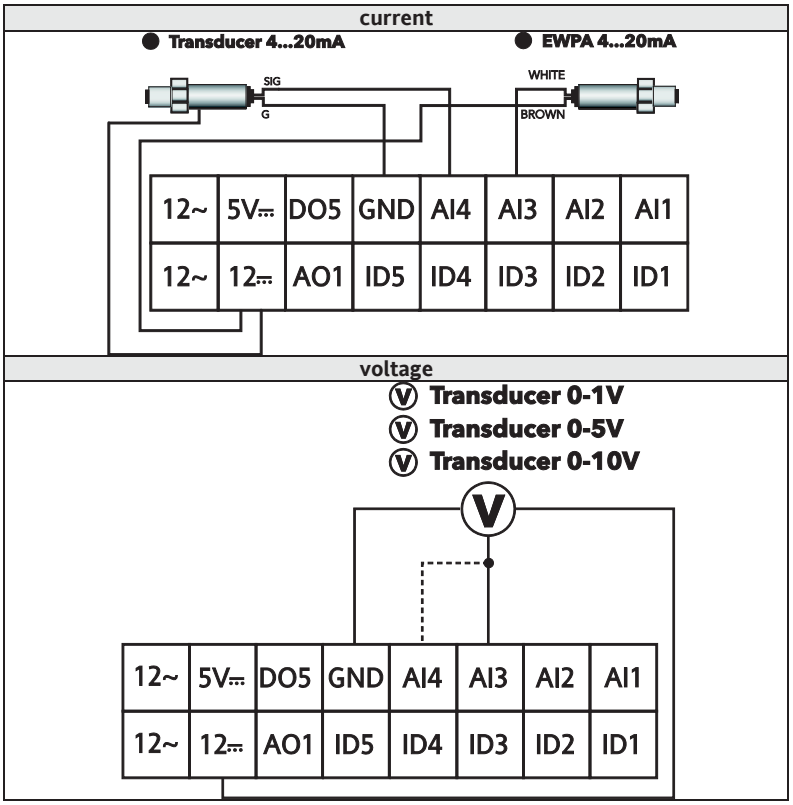
ST542/C	ST543/C	ST544/C
		
• 5 *digital inputs* [DI1...DI5] • DI • 4 high voltage 2A 230Vac *digital outputs* ● DO • 2 *analogue outputs* ● AO: • 1 high voltage [TC1] 2A 230Vac analogue output o 1 PWM analogue output [AO1] • 4 *analogue inputs* [AI1...AI4] • 1 low voltage digital output (SELV (§))[DO5] o Open Collector	• 5 *digital inputs* [DI1...DI5] • DI • 4 high voltage 2A 230Vac *digital outputs* ● DO • 3 *analogue outputs* ● AO: o 1 high voltage [TC1] 2A 230Vac analogue output o 2 analogue PWM outputs [AO1, A02] • 4 *analogue inputs* [AI1...AI4] • 1 low voltage digital output (SELV (§))[DO5] o Open Collector	• 5 *digital inputs* [DI1...DI5] • DI • 4 high voltage 2A 230Vac *digital outputs* ● DO • 4 *analogue outputs* ● AO: o 1 high voltage [TC1] 2A 230Vac analogue output o 2 PWM *analogue outputs* [AO1, AO2] o 1 low voltage 0...10V/4...20mA/0...20mA analogue output (SELV (§)) [AO3] • 4 *analogue inputs* [AI1...AI4] • 1 low voltage digital output (SELV (§))[DO5] o Open Collector
		
• /C RTC • *TTL (COM 1)* supplied as standard • KEYB connection to remote keyboard KEYB (100mt max) (§) SELV: (SAFETY EXTRA LOW VOLTAGE)		

24.2.2 5 relay model circuit diagrams

ST551/C	ST552/C	ST553/C
		
• 5 *digital inputs* [DI1...DI5] • DI • 5 high voltage 2A 230Vac *digital outputs* • DO • 1 analogue output • AO: o 1 PWM analogue output [AO1] • 4 *analogue inputs* [AI1...AI4] • 1 low voltage digital output (SELV (§)) [DO5] o Open Collector	• 5 *digital inputs* [DI1...DI5] • DI • 5 high voltage 2A 230Vac *digital outputs* • DO • 2 *analogue outputs* • AO: o 2 PWM *analogue outputs* [AO1, AO2] • 4 *analogue inputs* [AI1...AI4] • 1 low voltage digital output (SELV (§))[DO5] o Open Collector	• 5 *digital inputs* [DI1...DI5] • DI • 5 high voltage 2A 230Vac *digital outputs* • DO • 3 *analogue outputs* • AO: o 2 PWM *analogue outputs* [AO1, AO2] o 1 low voltage 0...10V/4...20mA/0...20mA analogue output (SELV (§)) [AO3] • 4 *analogue inputs* [AI1...AI4] • 1 low voltage digital output (SELV (§)) [DO5] o Open Collector
		
• /C RTC supplied as standard • *TTL (COM 1)* supplied as standard • KEYB connection to remote keyboard KEYB (100mt max) (§) SELV: (SAFETY EXTRA LOW VOLTAGE)		

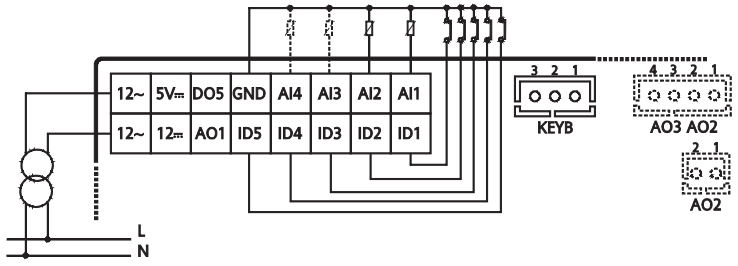
24.2.3 Examples of low voltage input/output connection

24.2.3.1 Example of current/voltage input connection



24.2.3.2 Example of NTC/DI input connection

Example of low voltage input/output connection

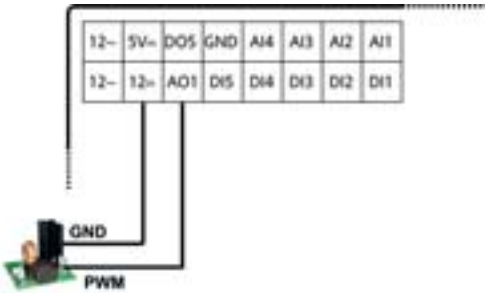
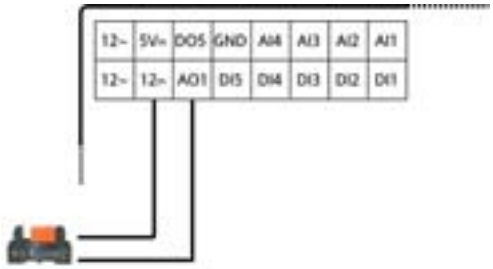


Analogue outputs **AO1 – AO2 – AO3 see Installation configuration (Par/CF *folder*) chapter Analogue output configuration section**

Digital output D05 see Digital Output Configuration

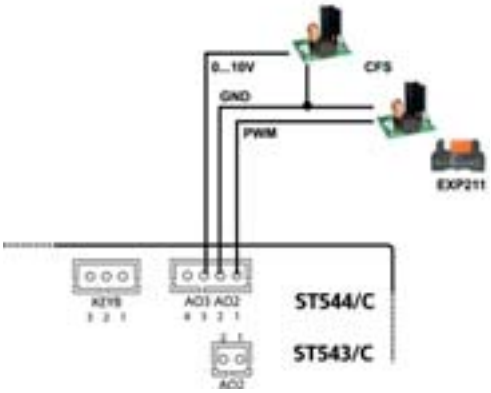
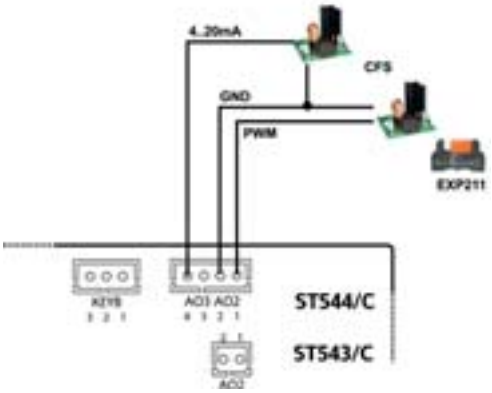
KEYB : see connecting remote keyboard (100mt max)

24.2.3.3 Example of A01 connection

Example of connection with 1 CFS fan module	Example of connection with *EXP* 211
	

ST500 output	CFS	EXP211
AO1	PWM	//
12V	GND	//

24.2.3.4 Example of A02 – AO3 connection

Example of ST544/C connection with 2 CFS / 1 CFS fan modules + *EXP* 211 Example of ST543/C connection with 1 fan module or *EXP* 211	
	
**N.B: 0-10V /4..20mA output are alternatives	

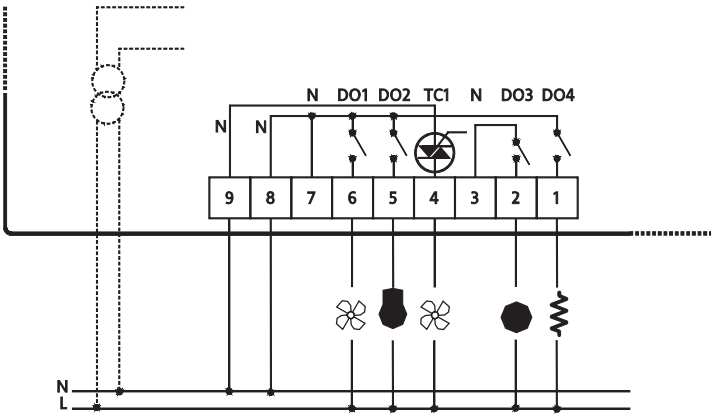
Analogue output	Terminal no.	Description
AO2	1	PWM
AO2	2	GND
AO3	3	0-10V**
AO3	4	4...20mA**

24.2.3.5 Example of DO5 connection

Example of connection with *EXP* 211

24.2.4 Example of connection of high voltage outputs

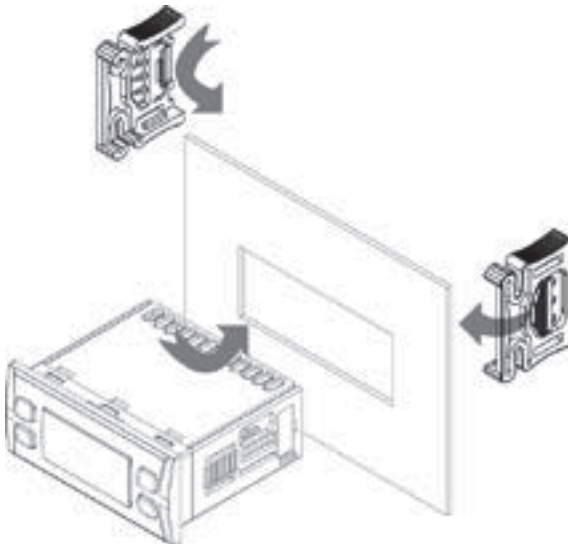
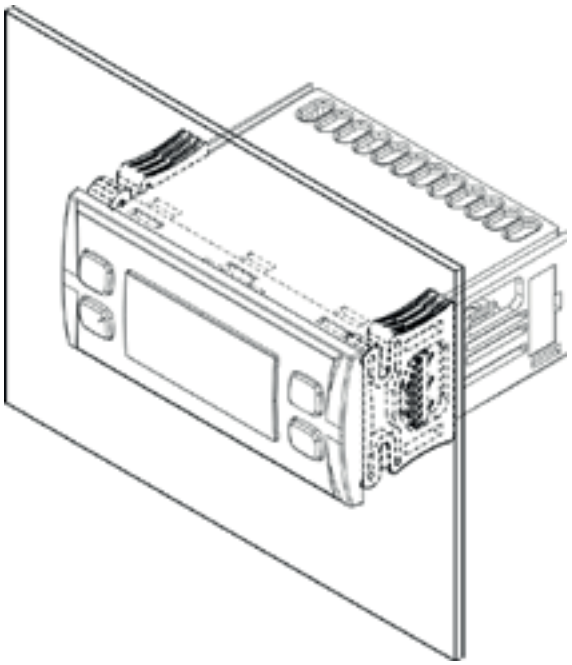
Example of connection of high voltage outputs

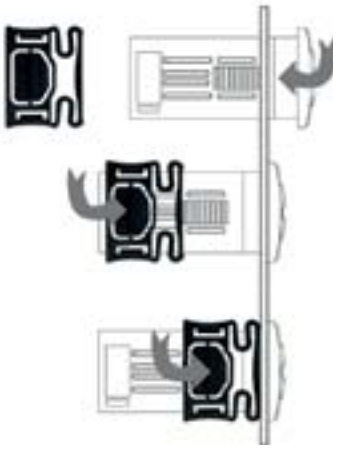
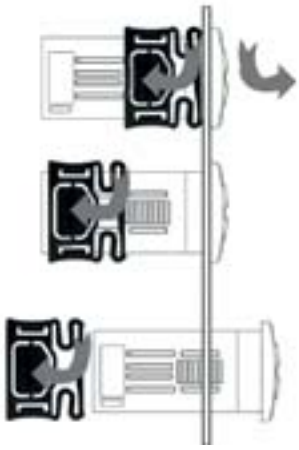


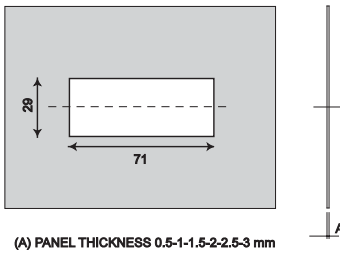
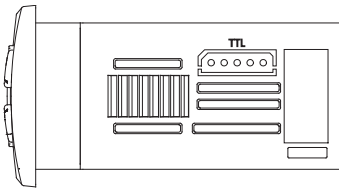
Example of model with *TRIAC*

25 MECHANICAL ASSEMBLY

The keyboard is intended for panel-mounting (see diagram).
Make a 29x71 mm hole and insert the instrument; fix it with the special brackets provided.
Do not mount the device in damp and/or dirt-laden areas; It is suitable for use in places with ordinary or normal levels of pollution. Keep the area around the device cooling slots adequately ventilated
The TTL serial is on the left side of the device.

Example of panel mounting.	Panel-mounted ST500
	

Example of panel mounting - side view	Removing the device from the panel – side view
	

Panel cut-out	TTL (COM1) position
	

26 TECHNICAL DATA

26.1 General specifications

	Standard	Min.	Max.
Power supply voltage	12V~	10.8V~	13.2V~
Power supply frequency	50Hz/60Hz	---	---
Consumption	5VA	---	---
Insulation rating	2	---	---
Ambient operating temperature	25°C	-10°C	60°C
Ambient operating humidity (non-condensing)	30%	10%	90%
Ambient storage temperature	25°C	-20°C	85°C
Ambient storage humidity (non-condensing)	30%	10%	90%

Classification	
The product complies with the following European Community Directives and complies with the following harmonised regulations	EN 60730-2-6 EN 60730-2-9
Use	Operating (not safety) device for incorporation
Assembly	Panel support
Type of action	1.C 1.Y
Pollution class	2
Overvoltage category	To meet system needs
Nominal pulse voltage	2500V
Digital outputs	Refer to the label on the device
Fire resistance category	D
Software class	A

26.2 I/O features

Type	*Label*	Description	*Models*
Digital inputs	**DI1 DI2 DI3 DI4 DI5**	5 no-voltage *digital inputs* Closing current for ground: 0.5mA	**All *models***
High voltage *digital outputs*	**DO1 DO2 DO3 DO4**	4 x 2A 250V~ relays;	**All *models***
	DO6	1 x 2A 250V~ relay;	**ST551/C ST552/C ST553/C**
High voltage analogue output	**TC1**	1 2A *TRIAC*, max 250V~ 1% full scale accuracy Resolution 1% **Remote control switches downstream from the *Triac* are NOT permitted.**	**ST542/C ST543/C ST544/C**
Low voltage (SELV) *analogue outputs*	**AO1**	1 **PWM / Open Collector output** **PWM** resolution: 1% **PWM / Open Collector** Nominal *range* 0...16.9V⎓ (12V~ rectified) Closing at 12V⎓ **Max current**35mA min load** of 600Ohm @12Vcc)	**All *models***
Low voltage (SELV) *analogue outputs*	**AO2**	1 **PWM / Open Collector output** **PWM** Resolution: 1% **PWM / Open Collector** Nominal *range* 0...16.9V⎓ (12V~ rectified) Closing at GND **Max. current **35mA** (min. load of 600Ohm @12Vcc)	**ST543/C ST544/C ST552/C ST553/C**
	AO3	1 x 0-10V / 4..20mA output 1% full scale accuracy Resolution 1% • 0...10Vcc output, max **28mA** @10V (min. heater load 500Ohm). • 4...20mA output, max. load (max. heater load) **360Ohm**	**ST544/C ST553/C**
Analogue inputs	**AI1 AI2 AI3 AI4**	2 NTC 103AT 10kO temperature inputs, measurement *range* -50°C ÷ 110°C; 2 configurable inputs: a) NTC temperature measurement *range* -50°C ÷ 99.9°C; b) 4...20 mA current input/0-10V/0-5V/0-1V voltage input measurement *range* -50.0 ÷ +99.9; Accuracy: 1% full scale (2% full scale for 0-1V voltage input) Resolution: (a) 0.1°C (b) 0.1°C/bar Input impedance (b): • 0-10V and 0-5V: 21KOhm • 0-1V: 10KOhm • 4...20mA: 100Ohm	**All *models***
Analogue inputs	**AI5**	1 x NTC 103AT 10kO temperature input, measurement *range* -50°C ÷ 99.9°C;	**On remote keyboard**
Open Collector low voltage (SELV) digital output	**DO5**	1 Open Collector output **Max. current **35mA** @12Vcc	**All *models***

** Outputs AO1, AO2 and DO5 will not activate at the same time with currents greater than 20mA

26.3 Mechanical specifications

Terminals and connectors	• 1 x 9-way snap-on AWG 16-28 high voltage connector To be used with COLH00000100 • 1 x 16-way snap-on low voltage, 4.2mm pitch AWG 16-28 connector To be used with COLV00000100 • 1 x JST 3-way remote keyboard • To be used with COLV00033200	**All *models***
	• 1 x JST 2-way connector To be used with COLV00022100	**ST543/C** **ST544/C** **ST552/C** **ST553/C**
	• 1 x JST 4 -way connector To be used with COLV00042100	**ST544/C** **ST553/C**
Container	Container: PC+ABS plastic resin with V0 flammability rating	

26.4 Display and LEDS

Display and leds		• 4 or 3 digits + sign; • 18 LEDs	**All *models***
Keys	**UP DOWN set esc**	• 4 *keys*	**All *models***

26.5 Serials

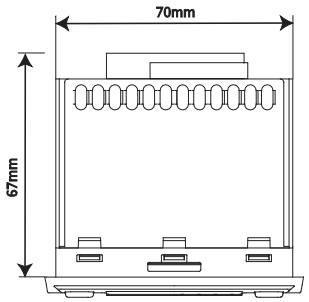
Serials	**TTL (COM1)**	• 1 TTL serial	**All *models***

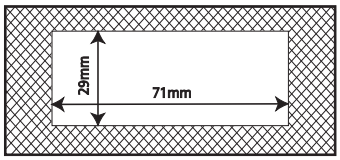
26.6 Transformer

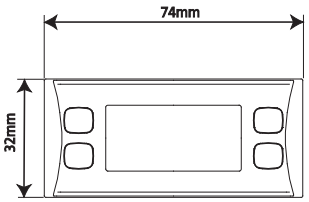
The instrument must be connected to a suitable current *transformer* with the following features:

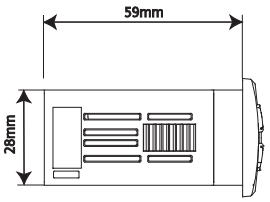
- Primary voltage: depending on requirements of individual device and/or country of installation
- Secondary voltage: 12V~
- Power supply frequency: 50/60Hz
- Power: min. 5VA

26.7 Mechanical dimensions









	Length (L) mm	Depth (d) mm	Height (H) mm	
Front panel	76.4	//	35	(+0.2mm)
Space required	70	67	26	
	//	58 connectors excluded	//	
Hole for panel wall-mounting	71	//	29	(+0.2mm / -0.1mm)

27 DEVICE OPERATION

Permitted use

This product is used to control centralised air-conditioning units

For safety reasons the instrument must be installed and used in accordance with the instructions supplied. Users must not be able to access parts with dangerous voltage levels under normal operating conditions. The device must be suitably protected from water and dust according to the specific application and only be accessible using special tools (except for the front keypad). The device can be fitted to refrigeration equipment for household and/or similar use. It has been tested and in safety terms, conforms to applicable harmonized European standards.

Unintended Use
The use of the unit for applications other than those described above is
forbidden. It should be noted that the relay contacts supplied with the device are functional and therefore may be subject to fault.
Any *protection* devices required to comply with product requirements or dictated by common sense due for obvious safety reasons should be installed externally.

28 RESPONSIBILITY AND RESIDUAL RISKS

Eliwell shall not be held liable for any damage incurred as a result of:

- installation/use other than those intended, and, in particular, failure to comply with the safety instructions specified by applicable *regulations* and/or provided in this document;
- use with equipment which does not provide adequate *protection* against electric shocks, water and dust under the effective conditions of installation;
- use with equipment which permits access to hazardous parts without the use of tools;
- installation/use with equipment which does not comply with current *regulations* and legislation.

29 NON-LIABILITY CLAUSE

30 DISPOSAL

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

31 DEVICEMANAGER

The Device Manager software uses the TTL serial connection of the SB600 to simplify and aid in installing and managing the SB600

Main features

- Device parameters management.
- Real-time monitoring and recording of system variables.
- Device alarms records management.
- Firmware updating.

All basic components required for the use of DeviceManager are described below.

31.1.1 Device Manager software component

The software has a graphic user interface, which is described in the DeviceManager manual.
The Device Manager software supports both Eliwell and Modbus protocols.
The functionalities available to the customer depend on which Device Manager hardware interface he/she has purchased.

31.1.2 Device Manager interface component

The USB/TTL hardware interface, used in association with the software package, enables:

- use of the software itself.
- connection to devices for controlling them.
- connection to the Multi Function Key component.

There are three different types of interface, corresponding to three user levels:

- DMI 100-1 END USER.
- DMI 100-2 SERVICE.
- DMI 100-3 MANUFACTURER.

Depending on the type purchased, the client has access to the functions described above.

31.1.3 Multi Function Key Component

This is a memory device, which enables:

- updating the device's parameter values.
- updating the device's firmware.
- downloading parameter values from the device.
- downloading the alarms records from the device.

For more details
--> See manual
8MAx0219 Device Manager
X = 0 IT; 1 EN; 2 FR; 3 ES; 5 DE; A RU

The TTL serial - referred to also as COM1 – can be used to configure parameters with Device Manager software using the Eliwell protocol.

Study the following tables:

Parameter	Description	Value	
		0	1
CF54	Select COM1 (TTL) protocol	Eliwell	Modbus

Parameter	Description	*Range*
CF55	Eliwell protocol controller address	0...14
CF56	Eliwell protocol controller family	

32 PARAMMANAGER

The TTL serial - referred to also as COM1 – can be used to configure parameters with Param Manager software using the Eliwell protocol.

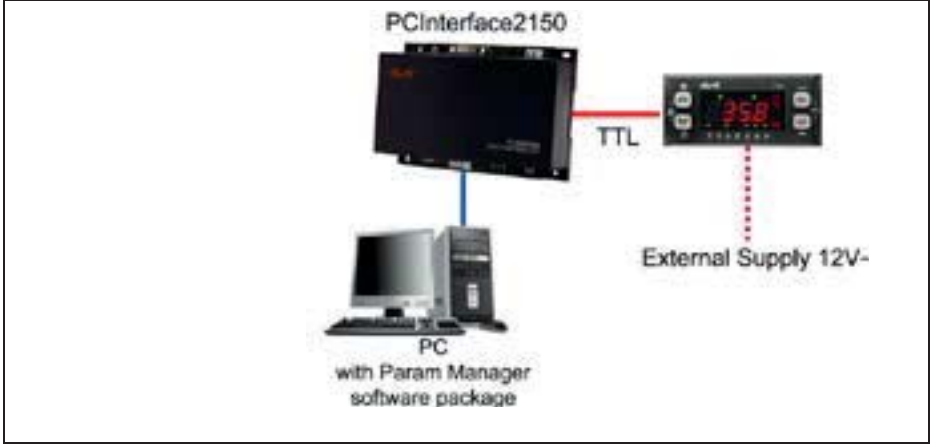
Study the following tables:

Parameter	Description	Value	
		0	1
CF54	Select COM1 (TTL) protocol	Eliwell	Modbus

Parameter	Description	*Range*
CF55	Eliwell protocol controller address	0...14
CF56	Eliwell protocol controller family	

The connection diagram for Param Manager is shown below:***

FIGURE A
Connection to PCInterface / PC to use Param Manager installed in the device Single via TTL

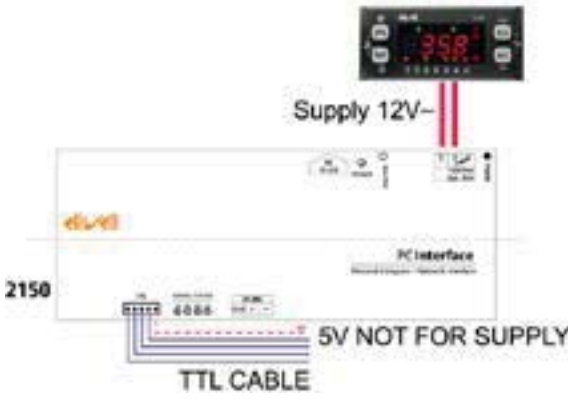


The power supply for Energy ST500 must be:

- from a suitable external power unit (see Figure A).
- via PCInterface (°)

(°) IMPORTANT!
Use a 12V supply only (+12V Out, - terminals) as indicated in Figure B.
Do NOT supply via TTL.

FIGURE B
ST500 power supply via PCInterface2150



(°°) IMPORTANT!

To avoid to supply power through TTL
cut the 5V wire from TTL cable as indicated in Figure C.

FIGURE C TTL cable


Param Manager models

Param Manager models

There are two *Param Manager models*:

- ST54x for all *models* with 4 relays + *triac*;
- ST55x for all 5-relay *models*.

The difference between the two maps is the presence of parameters relating to the *configuration of analogue outputs* / *TRIAC*. Study the table below:

	Parameter visible				
Param manager model	***CF33***	***CF36***	***CF39***	***CF42***	***CF50***
ST54*	•	•	•	•	
ST55*					•

Example *CF54*=0
If the protocol set in parameter ***CF54*** **- "COM1 protocol" = 0 (Eliwell)**, run Param Manager.***
If *CF54*=0, parameters *CF55* and *CF56* have a meaning – see the table at the beginning of the section.

Example *CF54*=1
If on the other hand the protocol set in parameter ***CF54*** **– "COM1 protocol" = 1 (Modbus)** follow the steps outlined below:

- Connect Energy ST 500 to PC Interface / PC as shown in Figure A.
- Run Param Manager.
- The icons at the top right show the situation resulting from the key and device autodetect***: if this fails, these icons will be crossed with a red bar (see Figure).
-

- To start communication with Energy ST500, simply double-click the "Dev" (Device) icon and switch on Energy ST 500 at the same time.

N.B: The device, even when configured for the Modbus protocol, will recognize that it is connected with Param Manager software and will communicate with the Eliwell protocol.

Once parameters have been programmed, switch off the device then switch it back on again to communicate using the Modbus protocol. PS In this case, do NOT modify the value set in parameter *CF54* with Param Manager.

For more details **-->** **See manual**

- **8MA00006 Param manager ITA**
- **8MA10006 Param manager ENG**

33 SUPERVISION

The TTL serial - referred to also as COM1 – can be used to configure the device, parameters, states, and variables using the Modbus protocol.

See the following tables:

Parameter	Description	Value	
		0	1
CF54	Select COM1 (TTL) protocol	Eliwell	Modbus

To configure the device with Modbus, set *CF54*=1 (Modbus protocol)

Parameter	Description	*Range* /values
CF63	Modbus protocol controller address	1...255
CF64	Modbus protocol Baudrate	• 0=1200 baud • 1=2400 baud • 2=4800 baud • 3=9600 baud • 4=19200 baud • 5=38400 baud • 6=58600 baud • 7=115200 baud
CF65	Modbus protocol parity	• 0= STX • 1= EVEN • 2= NONE • 3= ODD

33.1 Configuration with Modbus RTU

Modbus is a client/server protocol for communication between network linked devices.
Modbus devices communicate using a master-slave technique in which a single device (the master) can send messages. All other devices in the network (slaves) respond by returning the data required to the master or executing the action indicated in the message received. A slave is defined as a device connected to a network that processes information and sends the results to a master using the Modbus protocol.
The master can send messages to individual slaves or to the entire network (broadcast) whilst slaves can only reply to messages received individually from the master.
The Modbus standard used by Eliwell uses RTU coding for data transmission.

33.1.1 Data format (RTU)

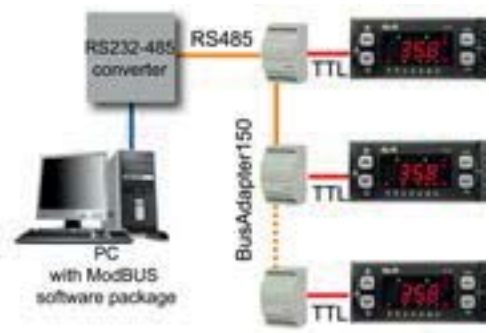
The data coding model used defines the structure of messages sent to the network and the way in which the information is decoded. The type of coding selected is generally based on specific parameters (baud rate, parity, etc)*** and some devices only support specific code *models*. However, the same model must be used for all devices connected to a Modbus network.
The protocol uses the RTU binary method with the following bytes:
8 bits for data, even parity bit (not configurable), 1 stop bit.

***configurable via parameters ***CF63*, *CF64* and *CF65* – see table at beginning of this section.**

N.B.: transmission speed must be set at 9600 baud.
Every aspect of the device can be configured via parameters.
They can be modified by means of:

- Instrument keyboard
- *Multi Function key*
- by sending data via the Modbus protocol straight to individual instruments, or via broadcast, using the address 0 (broadcast).

The connection diagram when using Modbus is shown below.

ModBus - device connection diagram Single via TTL	**ModBus - multiple devices connection diagram via RS485**
	

PC connection / Interface	RS232 cable
Device / Bus Adapter connection	5-wire TTL cable (30cm) in length (other measurements/lengths available).
Bus Adapter	BA150
Bus Adapter / Interface connection	RS485 cable shielded and twisted (example: Belden model 8762)

33.1.2 Modbus commands available and data areas

The commands implemented are:

Modbus command	Description of command
3	Read multiple registers on Client side
16	Write multiple registers on Client side
43	Read device ID
	DESCRIPTION Manufacturer ID Model ID Version ID

Length restrictions

maximum length in bytes of messages sent to device	30 BYTES
maximum length in bytes of messages received by device	30 BYTES

Read example
Multiple read of 2 real setpoints

Field	Decimal	Hex	Dimension
Device address (slave):	1	0x01	bytes
Read command code:	3	0x03	bytes
Start address:	740	0x02E4	Word
Number of registers (words) to read:	3	0x0003	Word

The full command to be sent to the device will therefore be:

TX: 01, 03, 02, E4, 00, 03, 44, 44

Where 44 44 is the packet CRC (check error field)

The reply from the device will be:

RX: 01, 03, 06, 00, 78, 00, 00, 01, 90, 80, 83.

Supposing that the data in registers identified in the device are (in hex):

Address 0x02E4 => data: 0x0078 = 120 = 12.0 °C Real setpoint for Cooling;
Address 0x02E5 => data: 0x0000 address not used;
Address 0x02E6 => data: 0x 0190 = 400 = 40.0 °C Real setpoint for Heating;

Write example, 1
Configuration of COOL operating mode
Write value 8 to word for remote commands at address h2BF

Field	Decimal	Hex	Dimension
Device address (slave):	1	0x01	bytes
Write command code:	10	0x0A	bytes
Write address:	703	0x02BF	Word
Number of words to write:	1	0x0001	Word
Number of bytes (No. words x 2):	2	0x02	bytes
Value (word) to write:	8	0x0008	Word

The full command to be sent to the device will therefore be:

TX: 01, 10, 02, BF, 00, 01, 02, 00, 08, 9E, 99.

The reply from the device will be:

RX: 01, 10, 02, BF, 00, 01, 31, 95.
At the end of this operation, the device will switch to COOL mode (if enabled).

Write example, 2
Configuration of ON/OFF operating mode
Write value 128 to word for remote commands at address h2BF

The full command to be sent to the device will therefore be:

TX: 01, 10, 02, BF, 00, 01, 02, 00, 80, 9E, FF.

The reply from the device will be:

RX: 01, 10, 02, BF, 00, 01, 31, 95.
At the end of this operation, the device will toggle the On/Off state (if enabled).

The Ram variables that can be monitored and commands available are listed below.

Commands available:

- Manual alarm reset
- Change operating mode (Heat, Cool and St-By)
- Switch device on/off
- Enable defrost

Additional operations can be performed by following specific procedures:
- Read alarm log
- Change/set time
- Rest running time of compressor and pump outputs

Details to read alarm log
The alarm log EEPROM is saved in a circular buffer composed of logical 7-byte records in the following formats:

Bytes	Bits	Index	Data	Values
0	0	Bit 0	Alarm record free flag	Must always be 0
	1	Bit 1	Alarm state	0 = alarm reset; 1 = alarm current
	2	Bit 2	Automatic reset alarm	0 = automatic reset; 1 = manual reset
	3	-	Not used	
	4	-		
	5	-		
	6	-		
	7	-		
1	0	Bit 0	Start of alarm minute	0÷59 = minutes >59 = undefined value
	1	Bit 1		
	2	Bit 2		
	3	Bit 3		
	4	Bit 4		
	5	Bit 5		
	6	Bit 0	End of alarm minute	0÷59 = minutes >59 = undefined value
	7	Bit 1		
2	0	Bit 2		
	1	Bit 3		
	2	Bit 4		
	3	Bit 5		
	4	Bit 0	Start of alarm hour	0÷23 = hours >23 = undefined value
	5	Bit 1		
	6	Bit 2		
	7	Bit 3		
3	0	Bit 4		

	1	Bit 0	End of alarm hour	0÷23 = hours >23 = undefined value
	2	Bit 1		
	3	Bit 2		
	4	Bit 3		
	5	Bit 4		
	6	Bit 0	Start of alarm day	1÷31 = day 0 o >31 = undefined value
	7	Bit 1		
4	0	Bit 2		
	1	Bit 3		
	2	Bit 4		
	3	Bit 0	End of alarm day	1÷31 = day 0 o >31 = undefined value
	4	Bit 1		
	5	Bit 2		
	6	Bit 3		
	7	Bit 4		
5	0	Bit 0	Start of alarm month	0÷23 = hours >23 = undefined value
	1	Bit 1		
	2	Bit 2		
	3	Bit 3		
	4	Bit 0	End of alarm month	0÷23 = hours >23 = undefined value
	5	Bit 1		
	6	Bit 2		
	7	Bit 3		
6	0	Bit 0	Alarm code	0÷99 = alarm code >99 Not permitted
	1	Bit 1		
	2	Bit 2		
	3	Bit 3		
	4	Bit 4		
	5	Bit 5		
	6	Bit 6		
	7	Bit 7		

To identify the index of the first record present, read variable ***PntStorAll*** at the address h82C1
To identify the number of records present, read variable ***NumStorAll*** at the address h82C2

TX: 01, 03, 82, C1, 00, 02, BD, 8F.
RX: 01, 03, 04, 00, 27, 00, 27, 0A, 22.

Address 0x82C1 => data: 0x0027 = index of first record (the most recent);
Address 0x82C2 => data: 0x0027 = number of records present (39);

To calculate the address of the most recent record:
Address EU00 = 50432 + (N-1)x7 = 50432 + 38x7 = 50698 (0xC60A)

Read EU00
TX: 01, 03, C6, 0A, 00, 07, 18, 82.
RX: 01, 03, 0E, 00, 02, 00, D6, 00, EF, 00, BE, 00, 00, 00, 04, 00, 3C, C9, F3.

Address 0xC3FD => data: 0x0002 = Byte 0 of alarm log record;
Address 0xC3FE => data: 0x00D6 = Byte 1 of alarm log record;
Address 0xC3FF => data: 0x00EF = Byte 2 of alarm log record;
Address 0xC400 => data: 0x00BE = Byte 3 of alarm log record;
Address 0xC401 => data: 0x0000 = Byte 4 of alarm log record;
Address 0xC402 => data: 0x0004 = Byte 5 of alarm log record;
Address 0xC403 => data: 0x003C = Byte 6 of alarm log record;

Alarm record free flag = b 0 = 0
Alarm state = b 1 = 1
Automatic reset alarm = b 0 = 0
Not used = b 00000 = 0
Start of alarm minute = b 010110 = 22
End of alarm minute= b 111111 = 63 (undefined)
Start of alarm hour = b 01110 = 14
End of alarm hour = b 11111 = 31 (undefined)
Start of alarm day = b 00010 = 2
End of alarm day = b 00000 = 0 (undefined)
Start of alarm month = b 0100 = 4
End of alarm month = b 0000 = 0 (undefined)
Alarm code = b 00111100 = 60

The result shows that on EU00 there is an Er60 that started on 02/04 at 14.22 and it is still active.

To read EU01, the address is determined as follows:
Address EU01 = Address EU00 - 7 = 50698 - 7 = 50691

To read EU02, continue by subtracting 7 from the address EU01 and so on.

N.B.: The minimum limit is the address 50432 after which, any other *alarms* still to be read will start again from 51125 (the buffer is circular and after the 99th record, the oldest ones are rewritten).

Reading time changes/settings

To READ the time, address the structure ***DataVisu*** to address h82AA.

Measurement	**Address**	**Size**
0: seconds	h82AA	bytes
1: minutes	h82AB	bytes
2: hours	h82AC	bytes
3: day of week	h82AD	bytes
4: day of month	h82AE	bytes
5: month	h82AF	bytes
6: year	h82B0	bytes

Details to read/set the time

To write the time, address the ***DataWrite structure*** to h82B8
Write the seconds byte last!

Example: configuring the time **11:33** on **09/01/15**

Field	Address	Decimal	Hex	Dimension
0: seconds	H82B8	0	0x0000	bytes
1: minutes	H82B9	33	0x0021	bytes
2: hours	H82BA	11	0x000B	bytes
3: day week	H82BB	-	-	bytes
4: day month	H82BC	09	0x0009	bytes
5: month	H82BD	1	0x0001	bytes
6: year	H82BE	15	0x000F	bytes

N.B.: Write the seconds byte last!

Write sequence:
Write a word of 33 at the address H82b9
Write a word of 11 at the address H82ba

TX: 01, 10, 82, B9, 00, 02, 04, 00, 21, 00, 0B, 51, DA.
RX: 01, 10, 82, B9, 00, 02, B8, 55.

Write a word of 09 at the address H82bc
Write a word of 1 at the address H82bd
Write a word of 15 at the address H82be

TX: 01, 10, 82, BC, 00, 03, 06, 00, 1C, 00, 03, 00, 07, E3, D2.
RX: 01, 10, 82, BC, 00, 03, 69, 94.

Write a word of 00 at the address H82b8

TX: 01, 10, 82, B8, 00, 01, 02, 00, 00, 1F, 20.
RX: 01, 10, 82, B8, 00, 01, A9, 94.

Details to reset running time
To read and/or clear running time, address the counters in the device's EEPROM and RAM

STCPOreFunz[0] to the address h2F1 Running time CP1 (in Ram)
STCPOreFunz[1] to the address h2F3 Running time CP2 (in Ram)
STPMOreFunz[0] to the address h2FB Running time P1 (in Ram)
STPMOreFunz[1] to the address h2FD Running time P2 (in Ram)

EE_OreFunzCP0 to the address h4461 Running time CP1 (in EEPROM)
EE_OreFunzCP1 to the address h4463 Running time CP2 (in EEPROM)
EE_OreFunzP0 to the address h4471 Running time P1 (in EEPROM)
EE_OreFunzP1 to the address h4473 Running time P2 (in EEPROM)

Multiple reading of running time CP to the RAM address h2F1
The full command to be sent to the device will therefore be:

TX: 01, 03, 02, F1, 00, 03, 55, 80.
RX: 01, 03, 06, 00, 07, 00, 00, 00, 06, 14, B7.

Address 0x02F1 => data: 0x0007 = 7 hours running time CP1;
Address 0x02F2 => data: 0x0000 = not used
Address 0x02F3 => data: 0x0006 = 6 hours running time CP2;

Clear time CP1 (in RAM and EEPROM)
Write 0 for running time CP at RAM address h2F1
TX: 01, 10, 02, F1, 00, 01, 02, 00, 00, 90, B1.

RX: 01, 10 02, F1, 00, 01, 51, 82.

Write 0 for running time CP at RAM address h4461
TX: 01, 10, 44, 61, 00, 01, 02, 00, 00, AA, 25.
RX: 01, 10, 44, 61, 00, 01, 44, E7.

Variables:
See Parameters chapter (PAr), *Client table*

33.2 Configuration of device address

The Device Number in a ModBus message is defined by the parameter ***CF63*** **– see table at beginning of this section.**
The address 0 is used for broadcast messages that all slaves recognize. Slaves do not reply to broadcast messages.

33.2.1 Configuration of parameter addresses

The list of addresses is given in the Parameters chapter under the section headed Parameters Table / ADDRESS column visibility (parameters addresses) and *VIS PAR ADDRESS* (addresses visibility parameters).

33.2.2 Configuration of variable / state addresses

The list of addresses is given in the Parameters chapter, under the section headed *Client Table* ADDRESS column.

34 ANNEXE A – MODELS AND ACCESSORIES

34.1 Models

34.1.1 ST500 Models

Model	Item number	Digital inputs No voltage	Digital outputs High voltage	Analogue output High voltage	Analogue outputs PWM Safe voltage (SELV)	Analogue outputs Safe voltage (SELV)	Analogue inputs Safe voltage (SELV)	Digital output Safe voltage (SELV)
		(DI1...DI5)	(DO1...DO4) (+ DO6)	(TC1)	(A01-AO2)	(AO3)	(AI)	(DO5)
ST542/C*	ST54110411300	5	4	1	1	//	2+2+1***	1
ST543/C	ST54120411300	5	4	1	2	//	2+2+1***	1
ST544/C	ST54121411300	5	4	1	2	1**	2+2+1***	1
ST551/C	ST55010411300	5	5	//	1	//	2+2+1***	1
ST552/C	ST55020411300	5	5	//	2	//	2+2+1***	1
ST553/C	ST55021411300	5	5	//	2	1**	2+2+1***	1

PLEASE NOTE: POWER SUPPLY 12V~

***/C RTC - Real Time Clock**
****0...10V / 4...20mA**
*****4 *analogue inputs* on ST500 32x74 (2 NTC + 2 configurable ones) + 1 on remote LCD keyboard**
SELV: SAFETY EXTRA LOW VOLTAGE

34.1.2 ST700 Models

Model	Item number	Digital inputs No voltage	Digital outputs High voltage	Analogue output High voltage	Analogue outputs PWM Safe voltage (SELV)	Analogue outputs Safe voltage (SELV)	Analogue inputs Safe voltage (SELV)	Digital output Safe voltage (SELV)
		(DI1...DI5)	(DO1...DO4) (+ DO6)	(TC1)	(AO1-AO2)	(AO3)	(AI)	(DO5)
ST744/C	ST74121411400	7	4	1	2	1**	2+2+1***	1
ST753/C	ST75021411400	7	5	//	2	1**	2+2+1***	1

PLEASE NOTE:
- **ST744 POWER SUPPLY 12...24V~**
- **ST753 POWER SUPPLY 12...24V~ / 24V~**

***/C RTC - Real Time Clock**
****0...10V / 4...20mA**
*****4 *analogue inputs* on ST700 32x74 (2 NTC + 2 configurable ones) + 1 on remote LCD keyboard**
SELV: SAFETY EXTRA LOW VOLTAGE

34.2 Accessories

LCD terminal				
	Name	**Part number**	**Description**	**Documentation**
	SKW21	SKW210000000	LCD terminal with integrated room temperature control - - - Compatible with all *ST500 models*	**Instruction sheet** **9IS24081** terminal / terminale LCD GB-I **User manual** • **8MA00210** terminale LCD ITA • **8MA10210** terminal LCD GB
	WIRING	C0LV000033200	3-way wiring for remote LCD terminal (available inside the terminal box)	NA
Transformer				
	*TRANSFORMER*	TF411200	*Transformer* 230V~/12V 5VA	NA
Multi Function key				
	Multi-Function key	CC0S00A00M000	Smart key to up/download parameters	NA

Expansion relay			
	Name	Part number	Description
	EXP211	MW320100	230V 10A expansion module with base fitted to DIN guide

Wirings			
	Name	Part number	Description
	WIRING	COHV000000100	Wiring for utilities (connector + 1m cables).
	WIRING	COLV000000100	Wiring (connector + 1m cables) to connect safe voltage inputs and outputs (SELV).
	WIRING ST500 – AO2	COLV000022100	ST500 - AO2 wiring (connector + 1m cables)
	WIRING ST500 – AO2/AO3	COLV000042100	ST500 - AO2/A03 wiring (connector + 1m cables)
EMC Filter			
	FILTER	FT111201	LC filter, network filter, recommended for applications with fan speed modulation.

Temperature probes				
	Name	**Part number**	**Description**	**Documentation**
	*TEMPERATURE PROBES* (1) (2)	SN691150 Sonda NTC 103AT, 1,5m (plastic cap, 2-wire cable); SN8DED11502C0 NTC103AT 1,5mt IP 68 5x20 -50+110°C SN8DED13002C0 NTC103AT 3,0mt IP 68 5x20 -50+110°C SN8DAE11502C0 NTC103AT 1,5mt IP 68 6x20 -50+110°C SN8DAE13002C0 NTC103AT 3,0mt IP 68 6x20 -50+110°C		Double insulation cable
Pressure transducers				
	RATIOMETRIC TRANSDUCERS	TD420010 EWPA 010 R 0/5V 0/10BAR female TD420030 EWPA 030 R 0/5V 0/30BAR female TD420050EWPA 050 R 0/5V 0/50BAR female		**Packard IP67 2mt cable included**
Pressure transducers				
	PRESSURE TRANSDUCERS	Male TD220050° TD240050* TD220007° TD240007*	Female TD320050° TD340050* TD320007° TD340007*	**EWPA050 4…20mA/0..50bar IP54° / IP67*** **EWPA007 4…20mA/-0.5…7bar** **IP54° / IP67* instructions 9IS64173** EWPA EN-IT-ES-DE-FR-RU

Pressure switches			
	Name	**Part number**	**Description**
	PRESSURE SWITCHES (1)	(3)	HR *range* (automatic reset) - minimum 100,000 ON/OFF cycles available
		(3)	HL *range* (manual reset) - minimum 6,000 ON/OFF cycles
		(3)	HC *range* (automatic reset) - minimum 250,000 ON/OFF cycles

Fan modules				
	Name	**Part number**	**Description**	**Documentation**
	CFS FAN MODULES (1)	For item numbers **--> See instruction sheet**	Single-phase speed regulators for currents from 2A to 9A	**instruction sheet 8FI40014** CFS –Fan Speed Modules GB-I-E-D-F
	CF-REL FAN MODULE	MW991300	6A 230V relay	**instruction sheet 8FI40014** CFS –Fan Speed Modules GB-I-E-D-F
	CFS05 TANDEM FAN MODULE	MW991012	*TRIAC* 5+5A 230V	**instruction sheet 8FI40016** CFS05 - TANDEM - Fan Speed Module GB-I-E-D-F
	THREE-PHASE FAN REGULATOR	Contact Sales Department	Contact Sales Department	Contact Sales Department

Interface modules				
	Name	**Part number**	**Description**	**Documentation**
	PCInterface2150 USB	PCI6A3000000	RS-485 + TTL for *ParamManager*	**instruction sheet 9IS43083** PCInterface 2150 series GB-I-E-D-F
	PC Interface2150	PCI5A3000000	RS-485 + TTL for *ParamManager*	
Connectivity				
	Name	**Part number**	**Description**	**Documentation**
	Bus Adapter 130 TTL RS485	BA11250N3700	TTL/RS-485 communication interface 12V aux. output for power supply to device. TTL cable, L = 1 m (2)	**instruction sheet 9IS43084** BusAdapter 130-150 GB-I-E-D-F
	Bus Adapter 150 TTL RS485	BA10000R3700	TTL/RS-485 communication interface TTL cable, L = 1 m (2)	
	RadioAdapter TTL/WIRELESS 802.15.4	BARF0TS00NH00 (1)		**instruction sheet 8FI40023** RadioAdapter GB-I-E-D-F **User manual 9MAX0010** RadioAdapter GB-I-E-D-F

Software Tools				
	Name	**Part number**	**Description**	**Documentation**
	Firmware Uploader kit	STSWKFWU00000		**User manual** **8MAX0209** Firmware Uploader GB+ITA **8MA00209** Firmware Uploader ITA **8MA10209** Firmware Uploader GB
	Param Manager AC/CR	SLP05XX000100	With a suitable Personal Computer with Windows 95 operating system or later, Param Managersoftware, a PCI 2150 interface module and the right wirings, all Energy ST parameters can be fully controlled via PC.	**User manual** **8MA00006** Param manager ITA **8MA10006** Param manager GB
	Device Manager	Contact Sales Department		**User Manual** **8MAx0219** X = 0 IT; 1 EN; 2 FR; 3 ES; 5 DE; A RU

	Name	Part number	Description	Documentation
	WebAdapter	WA0ET00X700		**Instruction sheet** **9IS44065** WebAdapter GB-I-E-D-F **User manual** • **8MA00202** WebAdapter ITA • **8MA10202** WebAdapter GB • **8MA20202** WebAdapter FRE • **8MA30202** WebAdapter SPA • **8MA50202** WebAdapter GER
	WebAdapter Wi-Fi	WA0WF00X700		

Demo Case ST500			
	Name	**Part number**	**Description**
	Demo Case ST500	VAL00030K	ST500 Demo Case

([1]) various items available. Contact Sales Department
([2]) Various lengths can be requested.

GENERAL NOTES:

- COHV and COLV cabling are not required if they are made by the manufacturer.
- Connection of remote keyboard via 3-way cables with no optional modules.
- Eliwell can also supply a variety of different NTC probes depending on the cable type (PVC or silicon) and length.

35 ANALITIC INDEX

Eliwell Controls S.r.l.
Via dell' Industria, 15 Zona Industriale Paludi
32010 Pieve d' Alpago (BL) Italy
Telephone +39 0437 986 111
Facsimile +39 0437 989 066

Sales:
+39 0437 986 100 (Italy)
+39 0437 986 200 (other countries)
saleseliwell@schneider-electric.com

Technical helpline:
+39 0437 986 300
E-mail Techsuppeliwell@schneider-electric.com

www.eliwell.com

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