Energy SB-SD-SCA600
Compact controller with Hot Water management for domestic heat pumps

Controls

CONTENTS

1 INTRODUCTION

To allow quick and easy reference, this guide has 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.

Highlighting icons:

Some text passages are marked by icons in the references column, which have the following meanings:

Important! : **highlights information of which an incorrect understanding can impact negatively on the system or result in risk to persons, instruments, data, etc.; users *must* read and take note of these sections.**

Note / highlight: indicates further information on the subject that the user should take into account

Tip: a suggestion that could help the user understand and make better use of the information provided.

1.1 General description

Eliwell, the leading manufacturer of controllers for small and medium air conditioning plants, presents SBA600 in the Energy Flex product family, a compact heat pump controller with advanced functions (domestic hot water and anti-legionnaire's disease in a dedicated storage tank) for residential applications.

Control of centralized air-conditioning systems with up to 2 circuits and a maximum of 4 compressors (steps) of the following types:

- Chillers:
  - air-air;
  - air-water;
  - water-water;
- Heat pumps:
  - air-air;
  - air-water;
  - water-water with gas inversion;
  - water-water with water inversion;
- Condenser units
  - Air chillers;
  - Air heat pumps
  - Water chillers;
  - Water heat pumps

1.1.1 Typical applications

- Minimarkets,
- Industrial plants,
- Offices
- Hotels,
- Homes

1.1.2 Specifications:

Energy SBA600 has 2 models providing 6 digital inputs, up to 5 relay outputs, a TRIAC output, 2 PWM analogue outputs, 3 configurable 0...10 V/0...20 mA/4...20 mA analogue outputs and an Open Collector digital output for an external relay.
The standard Eliwell 32x74 mm format ensures versatility and ease of installation.

Energy SDA - SCA - SE 600 features various models which can be used to obtain 6 digital inputs, up to 5 relay outputs, up to 2 TRIAC outputs, up to 2 PWM analogue outputs, up to 3 configurable 0...10 V/0...20 mA/4...20 mA analogue outputs and up to 2 Open Collector digital outputs for external relays.
The 4DIN format guarantees maximum flexibility and easy installation.

- - -

All inputs and outputs are independent and configurable, meaning they can be adapted to fit any system.
It runs on 12-24 V~ or 12-24 V~/24 V⎓ □□□eliwell□ □□□□□□eliwell□□

1.1.3 Main functions:

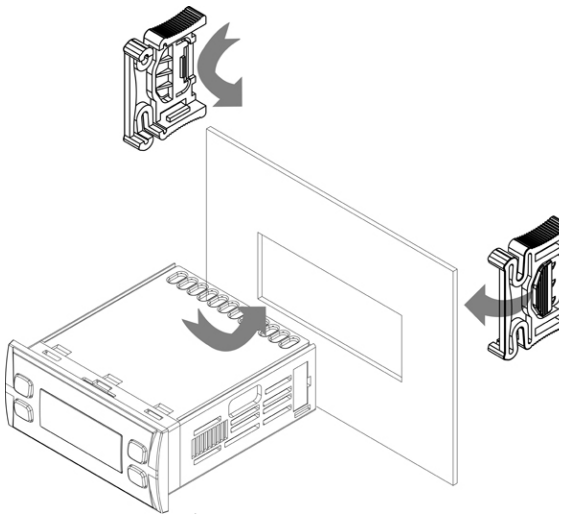
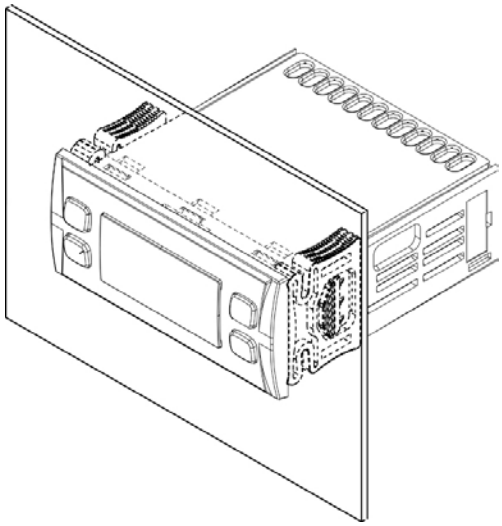
- Domestic hot water with auto-adaptive setpoint
- Domestic hot water and Anti-legionnaire's Disease with weekly programming
- Inverter management for BLDCM compressors
- User interface with configurable keys.
- Menus with configurable displays.
- Parameter settings via keyboard or PC
- Alarms log
- Multi Function Key (MFK) to download or upload parameter maps
- Terminal (up to 100 m) connectible directly with no serial interface
- Configurable NTC inputs, 4...20 mA, 0...1 V, 0...5 V, 0...10 V, or digital inputs configurable from parameters.
- Temperature control via input or output probe depending on configuration and installation
- Automatic change-over
- Dynamic setpoint
- Digital/analogue condensation control without external devices up to 2A
- Water heater or supplementary electrical heater control for heating
- Electrical heater for domestic hot water
- Control of 1 or 2 stepper motor electronic expansion valves via
    - o XVD Open driver (on LAN serial port)
    - o third-party drivers (on suitably configured digital inputs).
- Internal ventilation control
- Control of semi-hermetically sealed, scroll and screw compressors with one or two capacity steps
- Control of a single circuit with up to 4 compressors or 1 compressor with 4 capacity steps
- Control of double circuits up to a maximum of 2 compressors/capacity steps per circuit.
- Management of cycle inversion valve (including valve temporary inversion)
- External circuit pump extended management

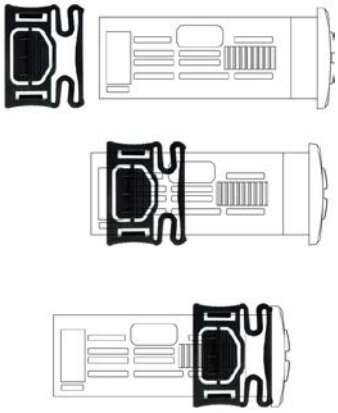
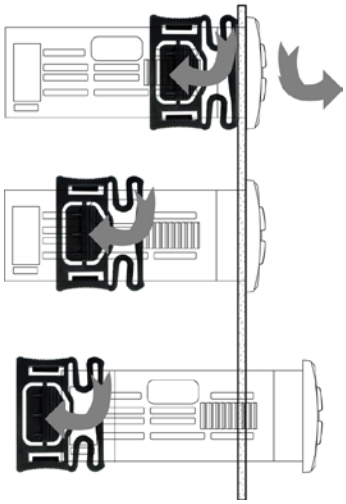
1.2 Models and Features

-->See Appendix A - Models and Accessories, and Technical Data section

2 MECHANICAL ASSEMBLY

SB600 – SKP 10
The instrument is intended for panel mounting (see diagram).
Make a 29x71 mm hole and insert the instrument; secure 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-mounted SB600 – SKP 10	Panel-mounted SB600 – SKP 10
	
The images refer to SB600	

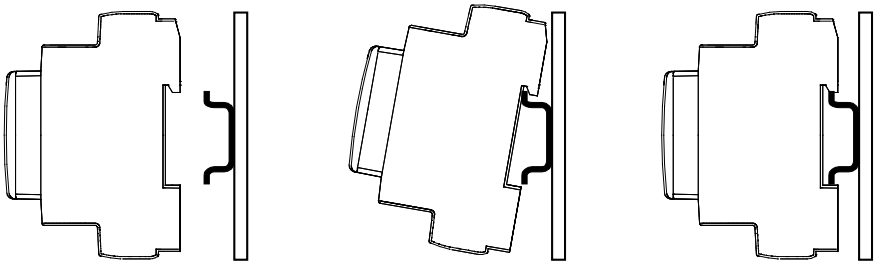
SB600 – SKP 10 Example of panel mounting - side view	SB600 – SKP 10 Removing the device from the panel - side view
	
The images refer to SB600	

SD600 – SC600 – SE600
The instrument is intended for 4DIN rail mounting

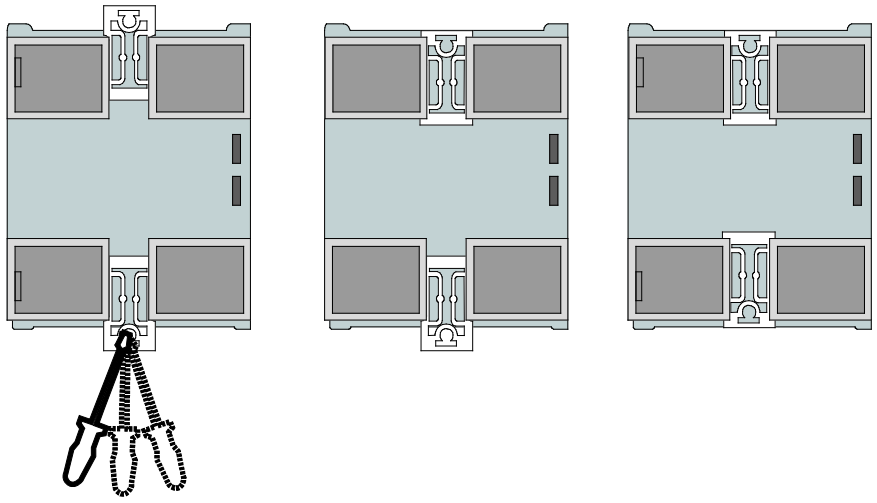
Follow the instructions below to install the BASE on DIN RAIL:

- Move the two spring docking devices to their standby position (use a screwdriver).
- Install the "BASE" on the DIN RAIL, then press the "spring docking devices" which will go to the closing position.

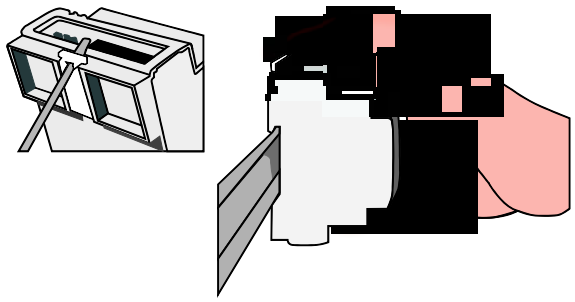
SD – SC – SE Series
DIN guide mounting example – side view



SD – SC – SE Series
DIN guide mounting example – rear view

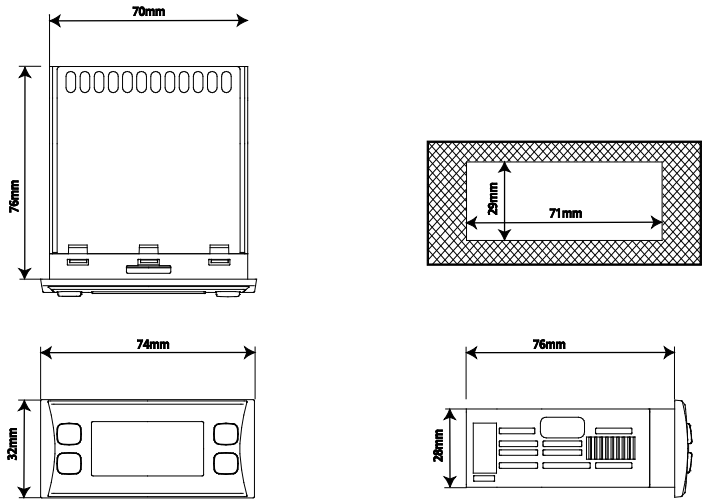


SD – SC – SE Series
DIN guide mounting example - ¾ view

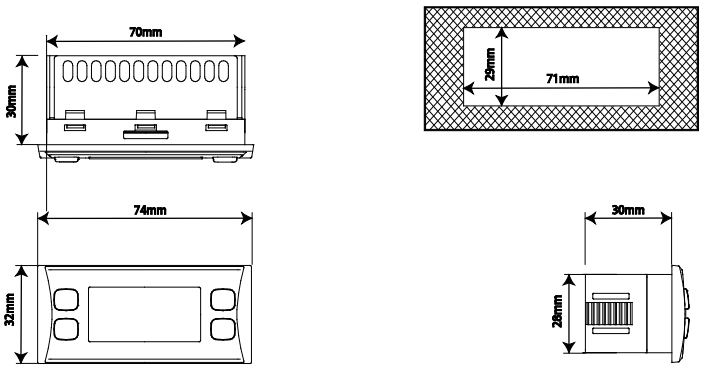


2.1 Mechanical dimensions

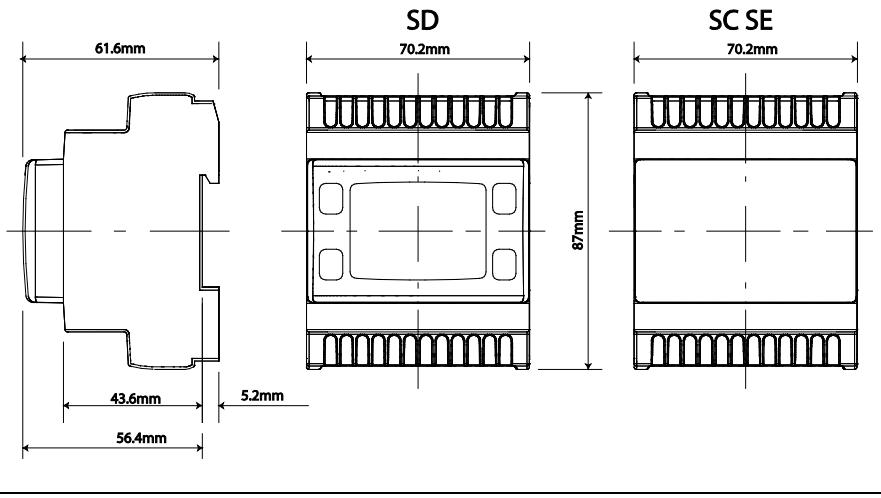
SB



SKP 10



SD/SC – SE6xx



3 ELECTRICAL CONNECTIONS

3.1 General warnings

IMPORTANT!
Make sure the machine is switched off before working on the electrical connections. The work must be done by qualified personnel. To ensure proper connections, comply with the following:
Power supplies other than those specified can seriously damage the system.
Use cables of suitable section 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 the probe cables near other electrical equipment (switches, meters, etc.)
Make connections as short as possible and do not wind them around electrically connected parts.
To avoid causing static discharges, do not touch the electronic components on the boards.
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.

3.1.1 Power supply - High voltage inputs (relay)

Do not exceed the maximum permitted current; for higher loads, use a contactor with sufficient power capacity.

Important!
Make sure that power supply is of the correct voltage for the device.

3.1.2 TRIAC

The TRIAC (TC1, TC2 for 63x models) output, when partialized, suppresses the half-wave at the zero-crossing.

3.1.3 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).

Important!

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 the Eliwell sales department for item availability.

3.1.4 Serial connections TTL connection

TTL (COM 1)

Use a 5-wire TTL cable up to 30cm in length.
An Eliwell-supplied TTL cable is recommended. Contact the Eliwell sales department for item availability.

3.2 Wiring diagrams

Circuit diagram key

- SUPPLY — **SB ● SD ● SC 63x 64x** Power supply 12-24V~;
- SUPPLY — **SB ● SD ● SC 65x** Power supply 12-24V~ / 24V⎓
- 5 ⎓ — Auxiliary 5V ⎓ 20mA max supply
- 12 ⎓ — Auxiliary 12V ⎓ supply
- DO1...DO4, DO6 — 2A - 250Vac high voltage relay outputs
- DO1...DO3 — **SD ● SC 63x** 2A - 250Vac high voltage relay outputs
- N — Neutral
- TC1 — TRIAC 2A 250Vac high voltage output
- TC1, TC2 — **SD ● SC 63x** TRIAC 3A 250Vac high voltage output
- AO1 AO2 — Low voltage (SELV (§)) PWM analogue outputs
- AO3 AO4 — Low voltage (SELV (§)) 0...10V analogue outputs
- AO5 — Low voltage (SELV (§)) 0...20mA / 4...20mA analogue outputs
- DO5 — Open Collector low voltage output (SELV (§))
- DO4, DO5 — **SD ● SC 63x** Open Collector low voltage output (SELV (§))
- DI1...DI6 — No voltage digital inputs (°)
- AI1...AI2, AI5 — NTC* / Digital Input configurable analogue inputs***
- AI3...AI4 — NTC / voltage, current** / Digital Input configurable analogue inputs***
- GND — Ground
- LAN — Serial for terminal / SE600 (max 100m)
- TTL — TTL serial for connection to Multi Function Key / Device Manager
- RS-485 — RS-485 Serial for connection to supervision system

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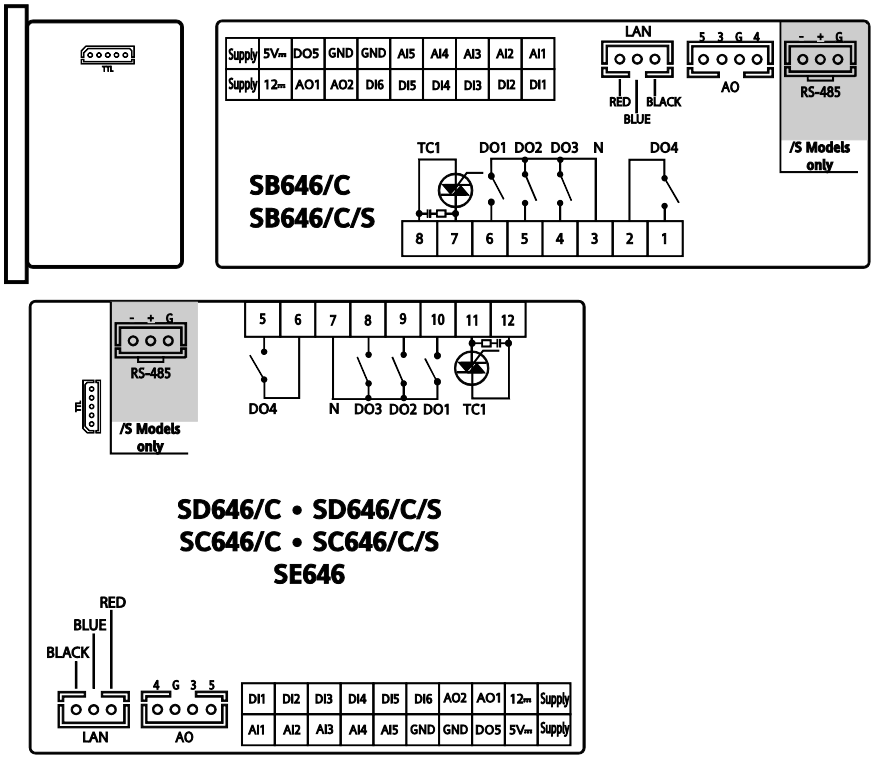
*SEMITEC 103AT type (10KΩ / 25°C)
**4...20mA current or 0...5V / 0...10V / 0...1V voltage input or no-voltage digital input
***no voltage digital input
(°) closing current for 0.5mA ground
(§) **SELV**: (SAFETY EXTRA LOW VOLTAGE)

3.2.1 Wiring Diagrams

646/C/S models

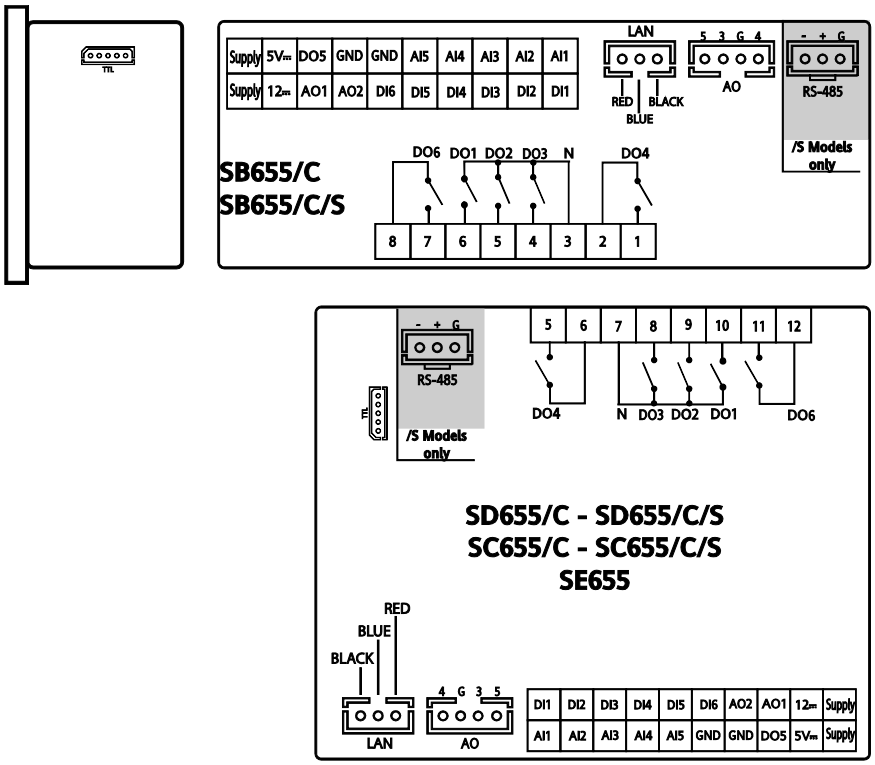


- **6** digital inputs [DI1...DI6] ● DI
- **4** high voltage digital outputs 2A 250Vac ● DO
- **6** analogue outputs ● AO:
  - 1 high voltage [TC1] 2A 250Vac analogue output
  - 2 PWM analogue outputs [AO1, AO2]
  - 3 low voltage (SELV (§)) analogue outputs
    - 2 outputs [AO3-4] 0-10V
    - 1 output [AO5] 4...20mA/0...20mA
- **5** analogue inputs [AI1...AI5]
- 1 low voltage digital output (SELV (§)) [DO5]
  - Open Collector

Model /S RS-485 on board

- /C RTC supplied as standard
- Serial LAN Connection to terminal / SE6xx (max 100m)
- TTL Serial TTL for connection to Multi Function Key
- (§) SELV: (SAFETY EXTRA LOW VOLTAGE)

655/C/S models



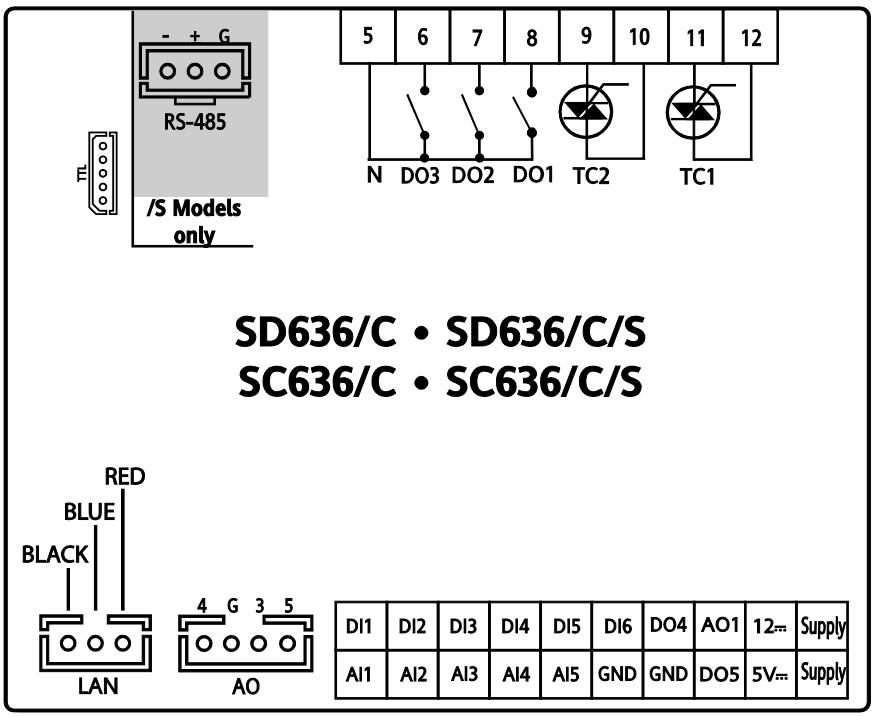
- **6** digital inputs [DI1...DI6] ● DI
- **5** high voltage digital outputs 2A 250Vac ● DO
- **5** analogue outputs ● AO:
  - 2 PWM analogue outputs [AO1, AO2]
  - 3 low voltage (SELV (§)) analogue outputs
    - 2 outputs [AO3-4] 0-10V
    - 1 output [AO5] 4...20mA/0...20mA

- **5** analogue inputs [AI1...AI5]
- 1 low voltage digital output (SELV (§)) [DO5]
  - Open Collector

Model /S RS-485 on board

- /C RTC supplied as standard
- Serial LAN Connection to terminal / SE6xx (max 100m)
- TTL Serial TTL for connection to Multi Function Key
- (§) SELV: (SAFETY EXTRA LOW VOLTAGE)

636/C/S models



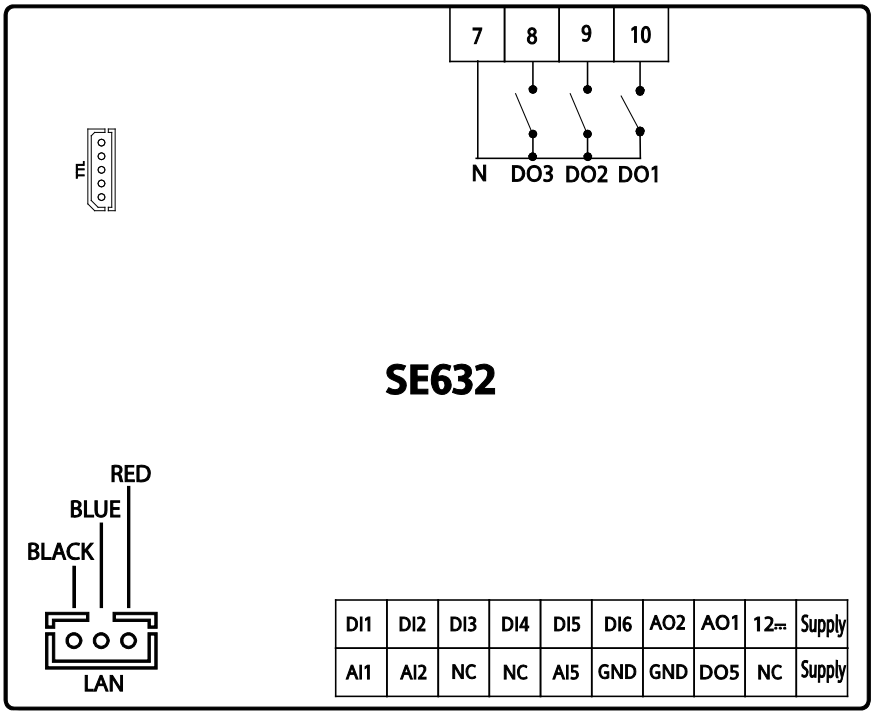
- **6** digital inputs [DI1...DI6] ● DI
- **3** high voltage digital outputs 2A 250Vac ● DO
- **6** analogue outputs ● AO:
  - 2 high voltage [TC1, TC2] 3A 250Vac analogue output
  - 1 PWM analogue outputs [AO1]
  - 3 low voltage (SELV (§)) analogue outputs
    - 2 outputs [AO3-4] 0-10V
    - 1 output [AO5] 4...20mA/0...20mA

- **5** analogue inputs [AI1...AI5]
- 2 low voltage digital output (SELV (§)) [DO4, DO5]
  - Open Collector

Model /S RS-485 on board

- /C RTC supplied as standard
- Serial LAN Connection to terminal / SE6xx (max 100m)
- TTL Serial TTL for connection to Multi Function Key

632 model



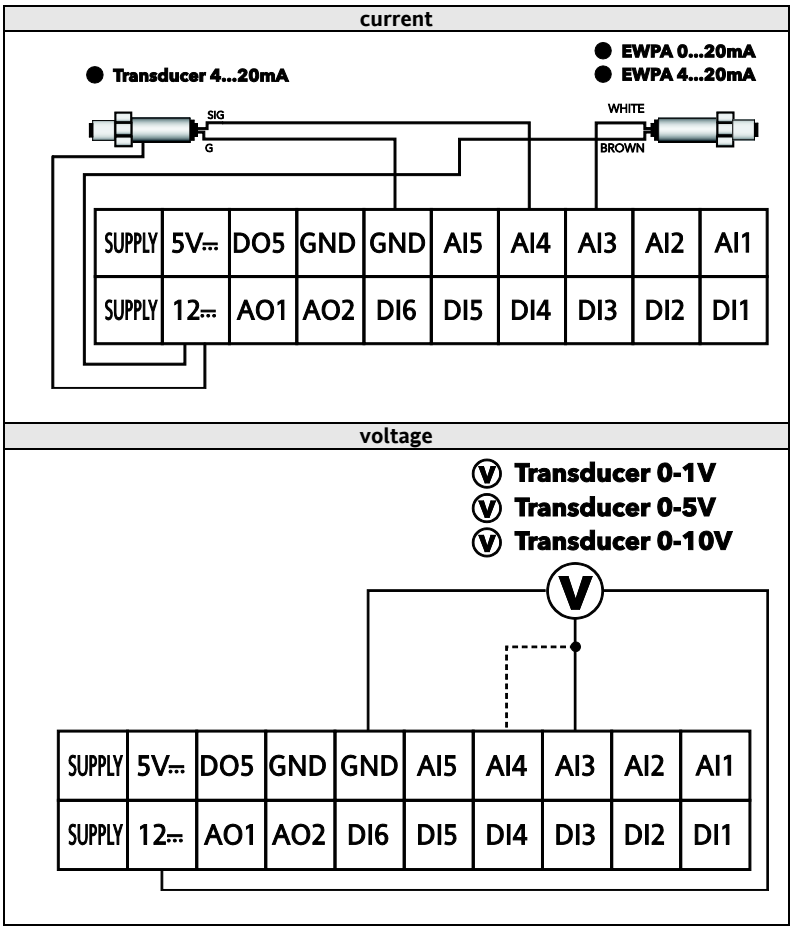
- **6** digital inputs [DI1…DI6] ● DI
- **3** high voltage digital outputs 2A 250Vac ● DO
- **2** analogue outputs ● AO:
  - 2 analogue outputs [AO1, AO2]

- **3** analogue inputs [AI1, Ai2, AI5]
- 1 low voltage digital output (SELV (§)) [DO5]
  - Open Collector

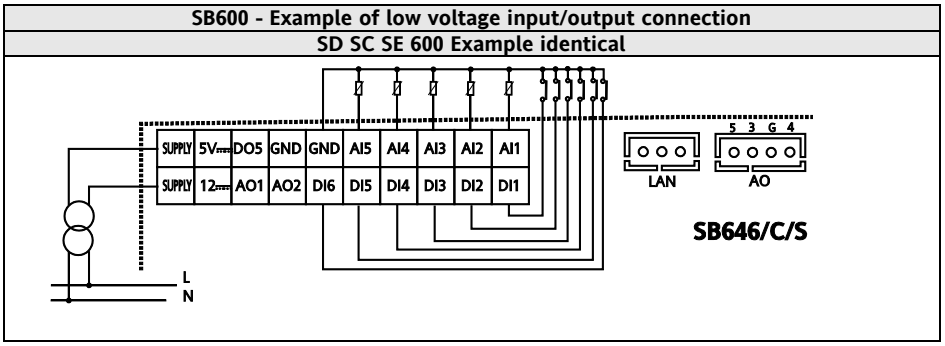
- Serial LAN Connection to terminal / SE6xx (max 100m)
- TTL Serial TTL for connection to Multi Function Key

3.2.2 Example of low voltage input/output connection

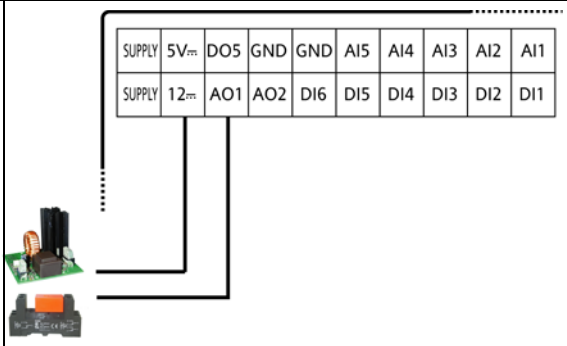
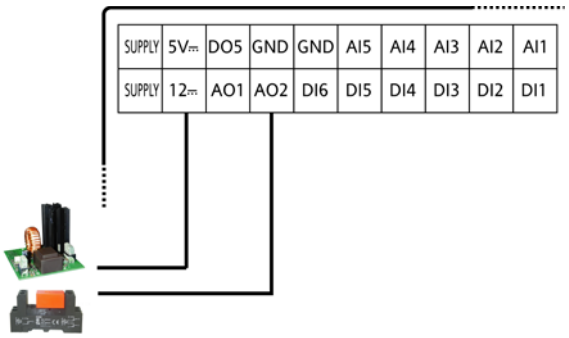
3.2.2.1 Example of current/voltage input connection



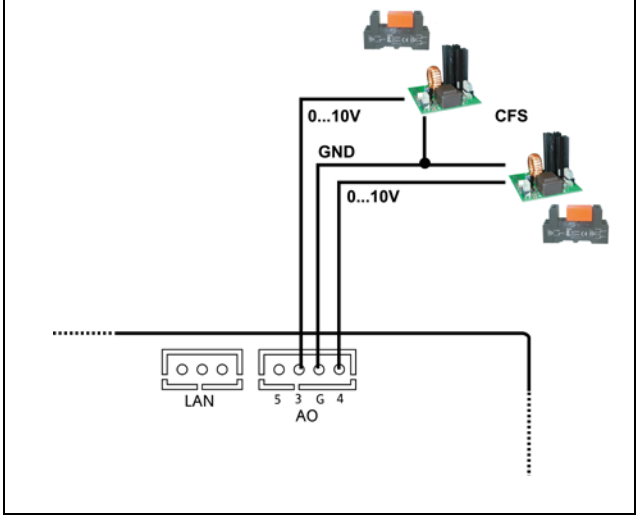
3.2.3 Example of low voltage inputs NTC/DI



3.2.3.2 Example of AO1 / AO2 connection

Example of SB600 (AO1) connection with 1 fan module CFS PWM or EXP211	Example of SB600 (AO2) connection with 1 fan module CFS PWM or EXP211
SD SC SE 600 Example identical	SD SC SE 600 Example identical
	

3.2.3.3 Example of AO3 - AO4 connection

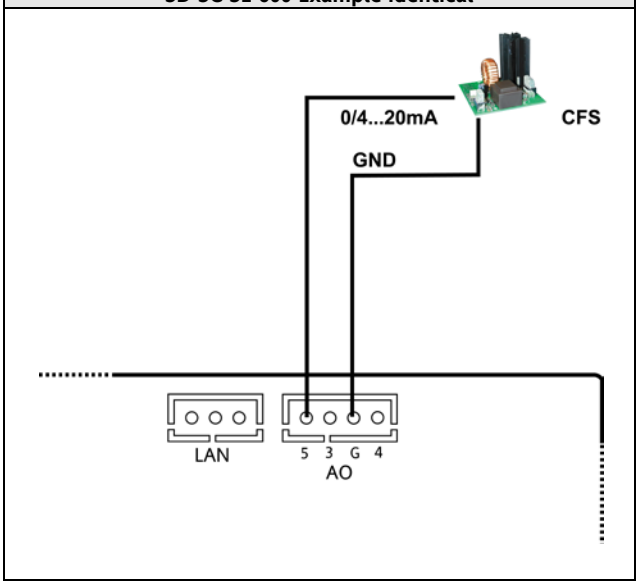
Example of SB600 (AO3-AO4) connection with 1 fan module CFS 0-10V
SD SC SE 600 Example identical


Analogue output	Terminal no.	description
AO3	3	0-10V
AO3	G	GND
AO4	4	0-10V
AO4	G	GND

3.2.3.4 Example of AO5 connection

Example of SB600 (AO5) connection with 1 fan module CFS 0...20mA / 4...20mA

SD SC SE 600 Example identical

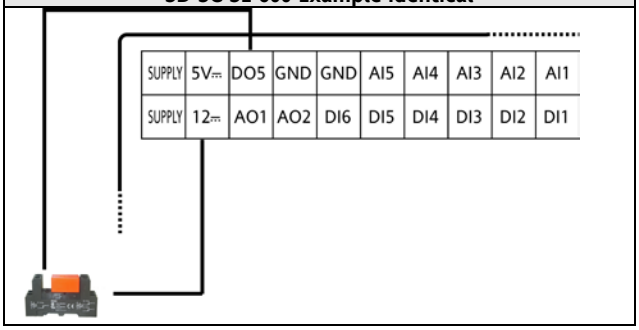


Analogue output	Terminal no.	description
AO5	5	0...20mA / 4...20mA
AO5	G	GND

3.2.3.5 Example of DO5 connection

Example of SB600 connection with EXP 211

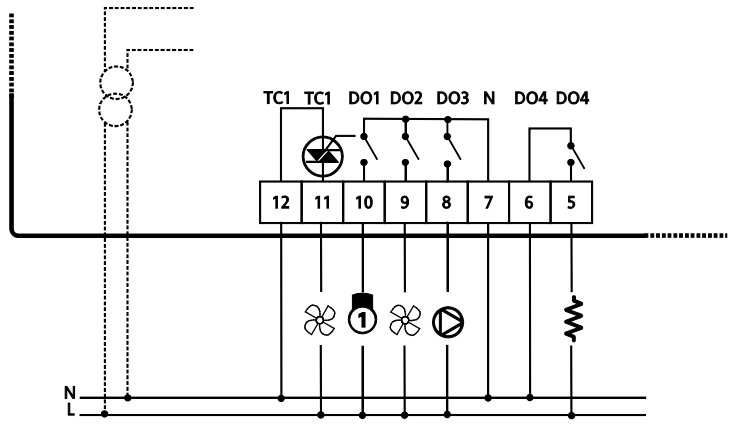
SD SC SE 600 Example identical



3.2.4 Example of connection of high voltage outputs

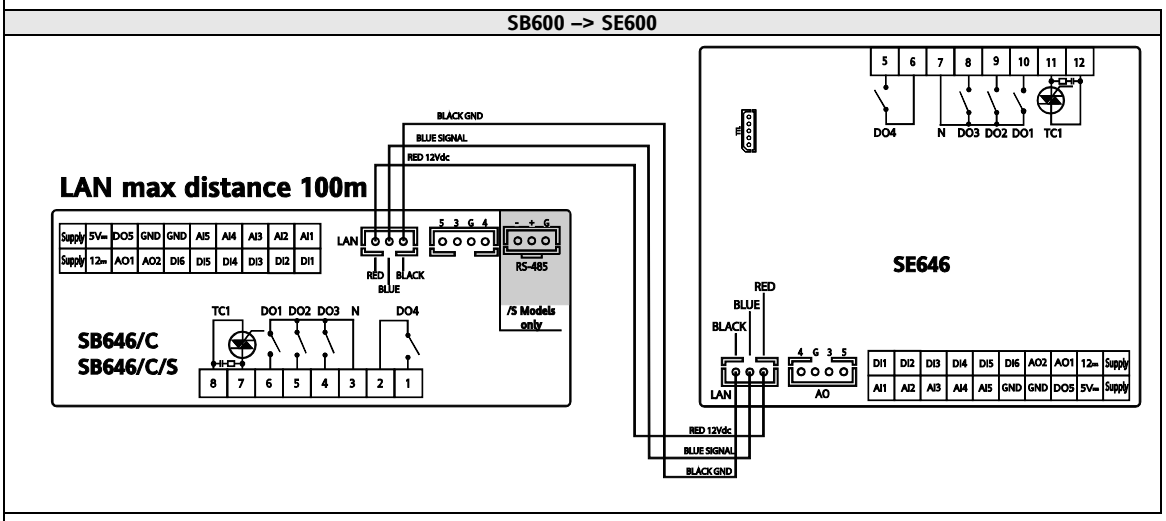
Example of model with TRIAC

646 models - Example of connection of high voltage outputs

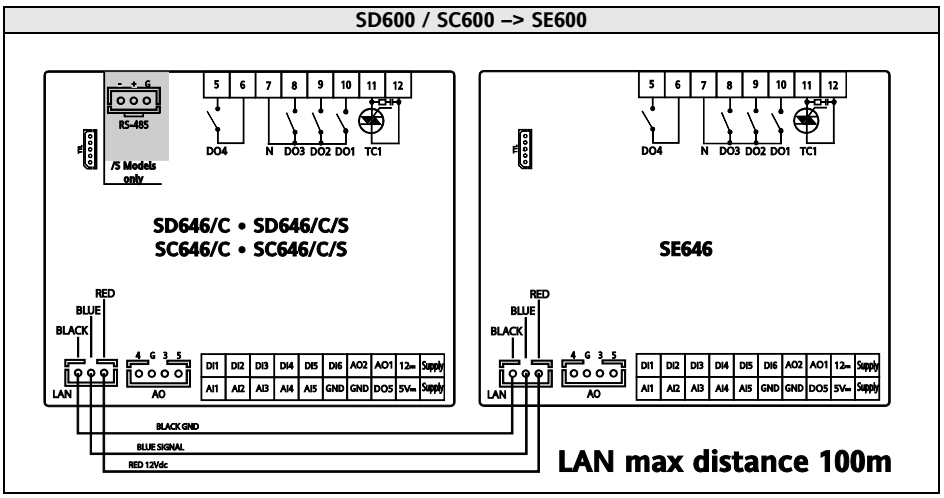


3.3 Examples of network connections

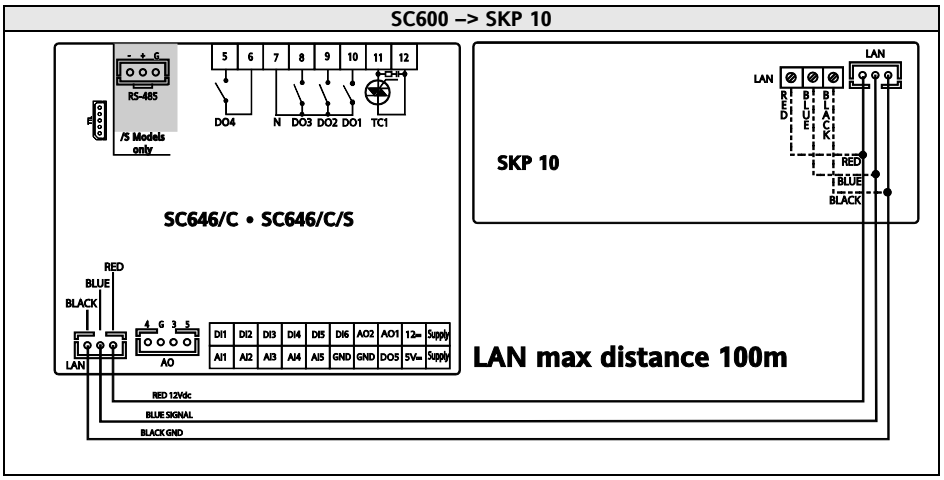
3.3.1 Example of connection SB600 – SE600



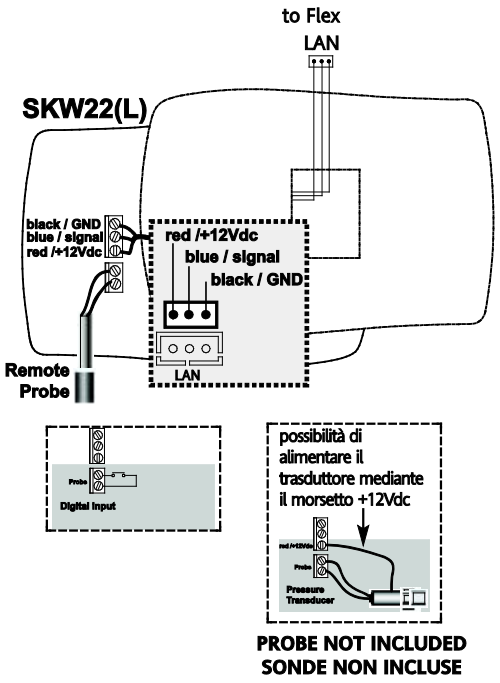
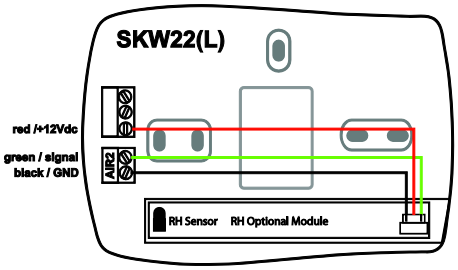
3.3.2 Example of connection SD600/SC600 – SE600



3.3.3 Example of connection SC600 – SKP 10



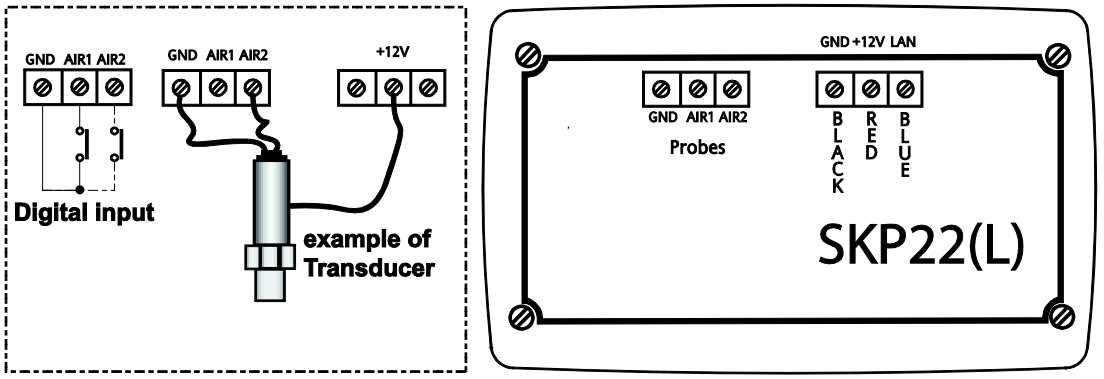
3.4 SKW22 - SKW22L remote LCD terminal

SKW22(L)	Optional RH module Part number KP100000 can be ordered from the Sales Department NOT included
	

Flex	SKW22(L)	description
AIR1		NTC integrated analogue input
	GND / black	GND / black
	Signal / Blue	Signal / blue
	+12Vdc /red**	12Vdc power supply from Flex
AIR2	Remote Probe	Probe AIR2 remote analogue input configurable as NTC*/ 4...20mA / DI

*** SEMITEC 103AT (10Kohm / 25°C) type**
****the transducer can be powered from the +12Vdc terminal**

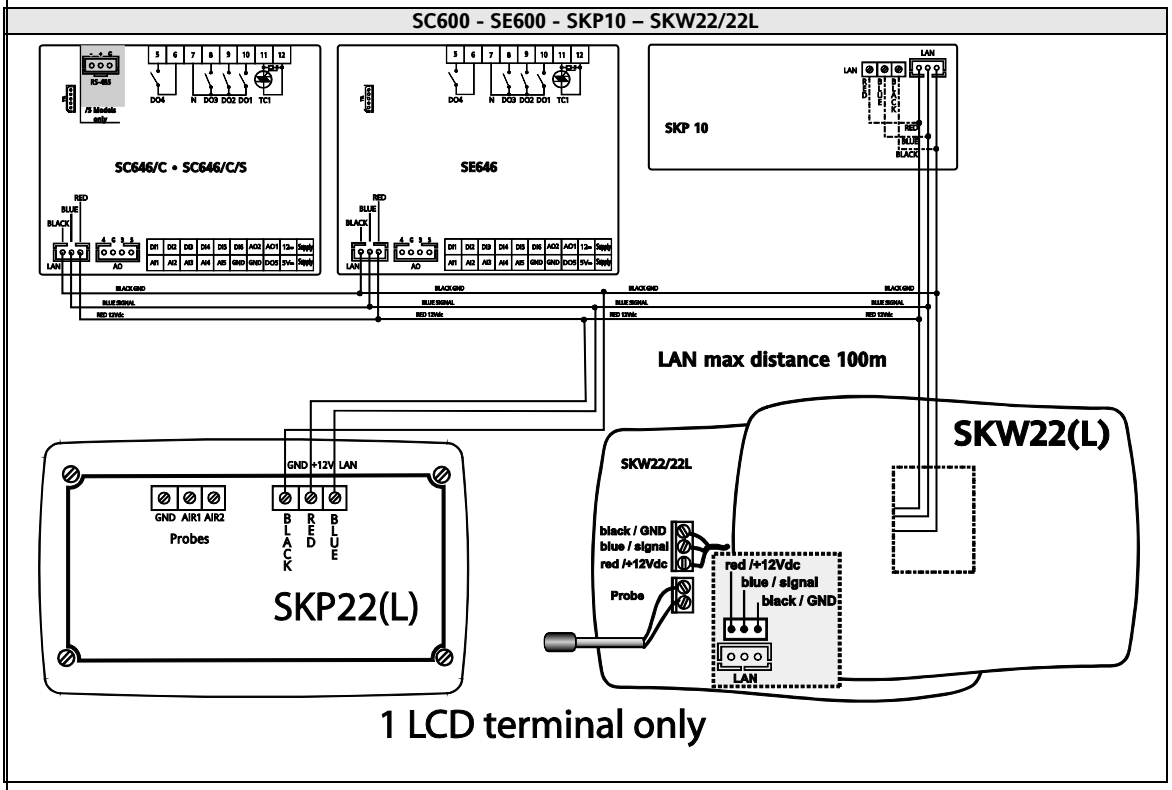
3.5 SKP22 - SKP22L remote LCD terminal



Flex	SKP22(L)	description
AIR1	AIR1	NTC/DI integrated analogue input
AIR2	Remote Probe	Remote analogue input configurable as NTC*/ 4...20mA / DI
	GND	Ground
	GND / black	GND / black
	Signal / Blue	Signal / blue
	+12Vdc /red**	12Vdc power supply from Flex

*** SEMITEC 103AT (10Kohm / 25°C) type**
****the transducer can be powered from the +12Vdc**

3.5.1 Example of connection SC600 – SE600 – SKP10 – SK22/22L



4 TECHNICAL DATA

4.1 General specifications

	Standard	Min.	Max.
Power supply voltage **Models 63x 64x**	12-24V~		
Power supply voltage **Models 65x**	12-24V~ /24V⎓		
Power supply frequency	50Hz/60Hz	---	---
Consumption **SB600 SD600 SC600**	6VA / 4W	---	---
Consumption **SE600**	5VA /3.5W	---	---
Insulation class	2	---	---
Working temperature	25°C	-20°C	55°C
Ambient operating humidity (non-condensing)	30%	10%	90%
Storage temperature	25°C	-40°C	85°C
Ambient storage humidity (non-condensing)	30%	10%	90%

Classification	
The product complies with the following European Community Directives	Directive 2006/95/EC Directive 89/108/EC
..and complies with the following harmonised regulations	EN 60730-2-6 / EN 60730-2-9
Use	Operating (not safety) device for incorporation
Assembly	Panel or on DIN Omega bar 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

4.2 I/O features

		SB SC SD			Expansions SE		
Type & Label	**Description**	**636**	**646**	**655**	**632**	**646**	**655**
Digital inputs **DI1 DI2 DI3 DI4 DI5 DI6**	6 no-voltage digital inputs Closing current for ground: 0.5mA	**x**	**x**	**x**	**x**	**x**	**x**
Digital outputs High voltage **DO1 DO2 DO3 DO4***	4 relays 2A 250V~; *For 636 models D04 is available as Open Collector output **(OC)** Max. current **35mA** @12Vcc **Lifetime of outputs on relays at nominal capacity: 100,000 cycles**	**OC**	**x**	**x**	**DO1 DO2 DO3**	**x**	**x**
DO6	1 x 2A 250V~ relay; **Lifetime of outputs on relays at nominal capacity: 100,000 cycles**			**x**			**x**
Analogue output High voltage **TC1**	1 TRIAC 2A max 250V~ Resolution 1% **Contactors may NOT be installed downstream from the Triac**		**x**			**x**	
TC1 + TC2 (= AO2)	2 TRIAC 3A max 250V~ Resolution 1% **Contactors may NOT be installed downstream from the Triac**	**x**					
Analogue outputs O.C. PWM/PPM low voltage (SELV) **AO1 AO2**	2 outputs **Open Collector PWM/PPM** resolution: 2% Nominal range 0...16.9V⎓ (12V~ rectified) Closing at 12V⎓ ** Max. current **35mA** (min. load 340Ohm @12Vcc	**AO2 = TC2 (TRIAC)**	**x**	**x**	**x**	**x**	**x**
Analogue outputs low voltage (SELV) **AO3 AO4**	2 uscite 0-10V max **28mA*** ** @10V (min. load resistance **360**Ohm) Accuracy 2% f.s. Resolution 1%	**x**	**x**	**x**		**x**	**x**

		SB SC SD			Expansions SE		
Type and Label	**Description**	**636**	**646**	**655**	**632**	**646**	**655**
AO5	1 x 4..20mA / 0...20mA output 2% full scale accuracy Resolution: 1% • output 0/4...20mA max. load (max load resistance **350Ohm**)***	**x**	**x**	**x**		**x**	**x**
Analogue inputs **AI1 AI2** **AI3 AI4** **AI5**	3 configurable inputs: a) NTC 103AT 10kOhm temperature, measurement range -50°C ÷ 99.9°C; b) No voltage digital input 2 configurable inputs: a) NTC 103AT 10kOhm temperature, measurement range -50°C ÷ 99.9°C; b) Current input 4...20 mA /voltage input 0-10V/0-5V/0-1V 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 c) No voltage digital input	**x**	**x**	**x**	**AI1** **AI2** **AI5**	**x**	**x**
Open Collector PWM low voltage (SELV) digital output **DO4*, DO5**	2 **Open Collector outputs** **Max. current **35mA** @12Vcc	**x**					
DO5	1 **Open Collector output** **Max. current **35mA** @12Vcc	**x**	**x**	**x**	**x**	**x**	**x**

* For 636 models, DO4 is an open collector, **TC2 equals AO2 (TC2=AO2) - see chapter Configuration Configuration of physical I/O (folder PAr/CL..Cr).**

** Outputs AO1, AO2 and DO5 (typically connected to the device's auxiliary 12V output) cannot deliver more than 70mA total). Any other loads connected to the same 12V⎓ auxiliary output must also be taken into account

If the Echo **SKP** keypad is connected to the device, the current becomes **55mA**

*** outputs AO3, AO4 and AO5 cannot deliver more than 40mA total.

4.3 Mechanical specifications

Terminals and connectors	1 8-way high voltage male connector For use in combination with the supplied female connector	**All models**
	1 20-way snap-on low voltage connector To be used with COLV0000E0100	**All models**
	1 JST 3-way LAN connector To be used with COLV000033200	**All models**
	1 JST 4 -way connector To be used with COLV000042100	**All models**
	1 JST 3-way connector To be used with COLV000035100	**Models /S**
Housing	Housing: PC+ABS plastic resin with V0 flammability rating	**All models**

4.4 Display and LEDS

Display and LEDS		• 4 digits or 3 digits + sign; • 18 LEDs	**All models except SC600 SE600**
Keys	**UP DOWN set esc**	• 4 keys	**All models except SC600 SE600**

4.5 Serial

TTL	1 TTL serial for connection to CopyCard (MFK) or Personal Computer via interface module	**All models**
RS-485	RS-485 opto-isolated serial	**Models /S**
LAN	Remote terminal / SE600 (max 100m)	**All models**

4.6 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
- Rating: 6VA min. (/S models), 5VA (all other models)

4.7 Mechanical dimensions

	Length (L) mm	Depth (d) mm	Height (H) mm	Notes
Front keypad	76.4	//	35	(+0.2mm)
Front (cover) SD600 SC600 SE600	70	//	45	(+0.2mm)
Dimensions SB600	86	76 connectors excluded	26	
Dimensions SD600 SC600 SE600	70.2	61.6 56.4 from Din bar to cover	87	4DIN
Hole for panel mounting	71	//	29	(+0.2mm/ -0.1mm)

4.8 Permitted use

This device is intended for controlling centralised air conditioning systems.

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

4.9 Improper Use

Any use other than that expressly permitted is prohibited.

The relay contacts supplied, and generally speaking, all outputs are of the functional type and subject to fault (since they are electronically controlled they are prone to short-circuiting or remaining open). Any protection devices specified in product standards or suggested by common sense for obvious safety requirements must be installed externally to the device.

Eliwell is not liable for damage due to:
- Unspecified installation/use and, in particular, in contravention of the safety requirements of established legislation or specified in this document.
- Use on equipment which does not provide adequate protection against electrocution, water and dust in the actual installation conditions.
- Use on equipment which allows toolfree access to dangerous components.
- Installation/use on equipment which does not comply with established legislation and standards.

4.10 Disclaimer

5 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 in this manual/product label must not be applied to outputs.**
- **When connecting loads, follow connection diagrams carefully.**
- **To avoid electric pairings, wire all SELV (°) utilities separately from high voltage ones.**

(°) SELV: SAFETY EXTRA LOW VOLTAGE

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

5.1 Configuration of analogue inputs

SBA600 SDA600 SCA600 analogue inputs

There are a total of 5 analogue inputs referred to below as AiL1...AiL5.
Using the parameters, a physical resource (probe, digital input, voltage/current signal) can be "physically" associated with each type of input

5.1.1 Configuration of SE600 expansion analogue inputs

SE600 analogue inputs

There are a total of 5 analogue inputs referred to below as AiE1...AiE5.
Using the parameters, a physical resource (probe, digital input, voltage/current signal) can be "physically" associated with each type of input

5.1.2 Configuration of Terminals Analogue Inputs SKW22(L)/SKP22(L)

Analogue Inputs SKW22(L)/SKP22(L)

There are a total of 2 analogue inputs referred to below as AIR1...AIR2.
Using the parameters, a physical resource (probe, digital input, voltage/current signal) can be "physically" associated with each type of input

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
CL00	AiL1 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	//	//	//	//
CL01	AiL2 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	//	//	//	//
CL02	AiL3 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	4-20 mA	0-10 V	0-5 V	0-1 V
CL03	AiL4 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	4-20 mA	0-10 V	0-5 V	0-1 V
CL04	AiL5 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	//	//	//	//
CE00	AiE1 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	//	//	//	//
CE01	AiE2 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	//	//	//	//
CE02	AiE3 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	4-20 mA	0-10 V	0-5 V	0-1 V
CE03	AiE4 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	4-20 mA	0-10 V	0-5 V	0-1 V
CE04	AiE5 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	//	//	//	//

Parameter	Description	Value			
		0	1	2	3
Cr00	Air1 analogue input type	Probe not configured	//	NTC probe	//
Cr01	Air2 analogue input type	Probe not configured	Probe configured as voltage-free digital input	NTC probe	4...20mA
			See Configuration of Digital Inputs		

NOTE: // indicates that value is not present.

Analogue input AI	Parameter	Range	Description
AiL3	**CL10**	CL11…99.9	AiL3 analogue input full-scale value
AiL3	**CL11**	-50.0…CL10	AiL3 analogue input start of scale value
AiL4	**CL12**	CL13…99.9	AiL4 analogue input full-scale value
AiL4	**CL13**	-50.0…CL12	AiL4 analogue input start of scale value
AiE3	**CE10**	CE11…99.9	AiE3 analogue input full-scale value
AiE3	**CE11**	-50.0…CE10	AE3 analogue input start of scale value
AiE4	**CE12**	CE13…99.9	AiE4 analogue input full-scale value
AiE4	**CE13**	-50.0…CE12	AiE4 analogue input start of scale value
Air2	**Cr10**	CR11…99.9	Air2 analogue input full-scale value
Air2	**Cr11**	-50.0…Cr10	Air2 analogue input start of scale value

The values read by analogue inputs can be calibrated using parameters CL20…CL24 / Cr20…Cr21

Parameter	Description	Unit of Measure	Range
CL20	AiL1 analogue input differential	°C	-12.0…12.0
CL21	AiL2 analogue input differential	°C	-12.0…12.0
CL22	AiL3 analogue input differential	°C / Bar	-12.0…12.0
CL23	AiL4 analogue input differential	°C / Bar	-12.0…12.0
CL24	AiL5 analogue input differential	°C	-12.0…12.0
CE20	AiE1 analogue input differential	°C	-12.0…12.0
CE21	AiE2 analogue input differential	°C	-12.0…12.0
CE22	AiE3 analogue input differential	°C / Bar	-12.0…12.0
CE23	AiE4 analogue input differential	°C / Bar	-12.0…12.0
CE24	AiE5 analogue input differential	°C	-12.0…12.0
Parameter	**Description**	**Unit of Measure**	**Range**
Cr20	Air1 analogue input differential	°C	-12.0…12.0
Cr21	Air2 analogue input differential	°C / Bar	-12.0…12.0

Study the following tables:

Table A – parameter association - analogue input configuration

Parameter	Description	Value	Description	Notes
CL30	AiL1 analogue input configuration	0…16	See table B	If CL00=1 (AiL1 configured as DI), set CL30=0
CL31	AiL2 analogue input configuration	0…16	See table B	If CL01=1 (AiL2 configured as DI) set CL31=0
CL32	AiL3 analogue input configuration	0…30	See table B	If CL02=1 (AiL3 configured as DI) set CL32=0
CL33	AiL4 analogue input configuration	0…30	See table B	If CL03=1 (AiL4 configured as DI) set CL33=0
CL34	AiL5 analogue input configuration	0…16	See table B	If CL04=1 (AiL5 configured as DI) set CL34=0
CE30	AiE1 analogue input configuration	0…16	See table B	If CE00=1 (AiE1 configured as DI), set CE30=0
CE31	AiE2 analogue input configuration	0…16	See table B	If CE01=1 (AiE2 configured as DI) set CE31=0
CE32	AiE3 analogue input configuration	0…30	See table B	If CE02=1 (AiE3 configured as DI) set CE32=0
CE33	AiE4 analogue input configuration	0…30	See table B	If CE03=1 (AiE4 configured as DI) set CE33=0
CE34	AiE5 analogue input configuration	0…16	See table B	If CE04=1 (AIE5 configured as DI) set CE34=0
Parameter	**Description**	**Value**	**Description**	**Notes**
CR30	Air1 analogue input configuration	0…16	See table B	
CR31	Air2 analogue input configuration	0…30	See table B	If CR01=1 (AIR2 configured as DI), set CR31=0

Table B – analogue input logical meaning & parameter values CL30…CL34 / CR30, CR31

AiL analogue input	AiL analogue input Remote terminal	Value	Description
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	0	Input disabled
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	1	Water/air inlet temperature internal exchanger
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	2	Water/air outlet temperature internal exchanger
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	3	Water outlet temperature internal exchanger circuit 1
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	4	Water outlet temperature internal exchanger circuit 2

AiL analogue input	AiL analogue input Remote terminal	Value	Description
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	5	External exchanger temperature circuit 1
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	6	External exchanger temperature circuit 2
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	7	Water inlet temperature recovery (or external) exchanger
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	8	Water outlet temperature recovery (or external) exchanger
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	9	External temperature
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	10	Internal ambient temperature
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	11	Domestic hot water temperature
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	12	Compressor 1 discharge temperature
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	13	NOT USED
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	14	NOT USED
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	15	NOT USED
AiL1 AiL2 AiL3 AiL4 AiL5 AiE1 AiE2 AiE3 AiE4 AiE5	AIR1 AIR2	16	Temperature display
		17	NOT USED
		18	NOT USED
		19	NOT USED
		20	NOT USED
AiL3 AiL4 AiE3 AiE4	AIR2	21	High pressure input circuit 1
AiL3 AiL4 AiE3 AiE4	AIR2	22	High pressure input circuit 2
AiL3 AiL4 AiE3 AiE4	AIR2	23	Low pressure input circuit 1
AiL3 AiL4 AiE3 AiE4	AIR2	24	Low pressure input circuit 2
AiL3 AiL4 AiE3 AiE4	AIR2	25	Input for dynamic setpoint
AiL3 AiL4 AiE3 AiE4	AIR2	26	Internal exchanger pressure circuit 1
AiL3 AiL4 AiE3 AiE4	AIR2	27	Internal exchanger pressure circuit 2
AiL3 AiL4 AiE3 AiE4	AIR2	28	External exchanger pressure circuit 1
AiL3 AiL4 AiE3 AiE4	AIR2	29	External exchanger pressure circuit 2
AiL3 AiL4 AiE3 AiE4	AIR2	30	Pressure display

5.2 Digital Input Configuration

Low voltage (SELV)

There are a total of 6 voltage free digital inputs referred to below as DIL1…DIL6 and DIE1…DIE6.
These can be integrated with AiL1…AiL5 if the latter are configured as digital inputs (via parameters CL50…CL5L4+Cr50 respectively).

Study the following tables:

Table A – parameter association - configuration of digital inputs

Parameter	Description	Value	Description	Notes
CL40	DIL digital input configuration 1	-58…+58	See table B	
CL41	DIL digital input configuration 2	-58…+58	See table B	
CL42	DIL digital input configuration 3	-58…+58	See table B	
CL43	DIL digital input configuration 4	-58…+58	See table B	
CL44	DIL digital input configuration 5	-58…+58	See table B	
CL45	DIL digital input configuration 6	-58…+58	See table B	
CL50	AiL analogue input configuration 1 when configured as digital input	-58…+58	See table B	Set to 0 if AiL1 is NOT configured as a DI
CL51	AiL analogue input configuration 2 when configured as digital input	-58…+58	See table B	Set to 0 if AiL2 is NOT configured as a DI
CL52	AiL analogue input configuration 3 when configured as digital input	-58…+58	See table B	Set to 0 if AiL3 is NOT configured as a DI
CL53	AiL analogue input configuration 4 when configured as digital input	-58…+58	See table B	Set to 0 if AiL4 is NOT configured as a DI
CL54	AiL analogue input configuration 5 when configured as digital input	-58…+58	See table B	Set to 0 if AiL5 is NOT configured as a DI
CE40	DIE digital input configuration 1	-58…+58	See table B	
CE41	DIE digital input configuration 2	-58…+58	See table B	
CE42	DIE digital input configuration 3	-58…+58	See table B	
CE43	DIE digital input configuration 4	-58…+58	See table B	
CE44	DIE digital input configuration 5	-58…+58	See table B	
CE45	DIE digital input configuration 6	-58…+58	See table B	
CE50	AiE analogue input configuration 1 when configured as digital input	-58…+58	See table B	Set = 0 if AiE1 is NOT configured as DI
CE51	AiE analogue input configuration 2 when configured as digital input	-58…+58	See table B	Set = 0 if AiE2 is NOT configured as DI
CE52	AiE analogue input configuration 3 when configured as digital input	-58…+58	See table B	Set = 0 if AiE3 is NOT configured as DI
CE53	AiE analogue input configuration 4 when configured as digital input	-58…+58	See table B	Set = 0 if AiE4 is NOT configured as DI
CE54	AiE analogue input configuration 5 when configured as digital input	-58…+58	See table B	Set = 0 if AiE5 is NOT configured as DI
Parameter	**Description**	**value**	**Description**	**Notes**
Cr50	AIR analogue input configuration 2 when configured as digital input	-58…+58	See Table B**	Set to 0 if AIR2 is NOT configured as a DI

Digital inputs: configuration table

Table B - Digital inputs: configuration table
Polarity is defined as indicated below:

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

Value	Description	Notes
0	Input disabled	
±1	Remote STD-BY	Remote mode changeover: to obtain the correct sequence STD-BY – DHW, enable 2 D.I. and configure one as STB-BY and the other as DHW (±28) If you enable only 1 D.I. in STD-BY and the machine is in DHW mode, it may occur that the from D.I. the status transitions to HEAT
±2	Remote off	Local ON/OFF ineffective
±3	Remote Summer/Winter	
±4	Capacity step 1 request	
±5	Capacity step 2 request	
±6	Capacity step 3 request	
±7	Capacity step 4 request	
±8	Digital input heat step 1 request	See also digital temperature control
±9	Digital input heat step 2 request	See also digital temperature control
±10	Digital input heat step 3 request	See also digital temperature control
±11	Digital input heat step 4 request	See also digital temperature control
±12	Digital input cool step 1 request	See also digital temperature control
±13	Digital input cool step 2 request	See also digital temperature control

Value	Description	Notes
±14	Digital input cool step 3 request	See also digital temperature control
±15	Digital input cool step 4 request	See also digital temperature control
±16	Block compressor 1	
±17	Block compressor 2	
±18	Block compressor 3	
±19	Block compressor 4	
±20	Heat pump lock	See section Block heat pump (folder PAr/HP)
±21	Capacity control forced to 50%	See section Forced power stage (folder PAr/PL)
±22	Economy input	See section Operating modes - Temperature control (folder PAr/tr)
±23	NOT USED	
±24	General alarm	
±25	End of defrost C1	
±26	End of defrost C2	
±27	NOT USED	
±28	Remote AS	
±29	NOT USED	
±30	High pressure pressure switch C1	
±31	High pressure pressure switch C2	
±32	Low pressure pressure switch C1	
±33	Low pressure pressure switch C2	
±34	Compressor 1 oil pressure switch	
±35	Compressor 2 oil pressure switch	
±36	Compressor 3 oil pressure switch	
±37	Compressor 4 oil pressure switch	
±38	NOT USED	
±39	External exchanger fan thermal switch C1	
±40	External exchanger fan thermal switch C2	
±41	Internal exchanger fan thermal switch	
±42	NOT USED	
±43	Compressor 1 thermoswitch	
±44	Compressor 2 thermoswitch	
±45	Compressor 3 thermoswitch	
±46	Compressor 4 thermoswitch	
±47	Internal circuit pump 1 thermal switch	
±48	Internal circuit pump 2 thermal switch	
±49	External circuit pump thermal protection	
±50	Internal exchanger electric heater 1 thermal switch	
±51	Internal exchanger electric heater 2 thermal switch	
±52	Auxiliary output alarm	
±53	NOT USED	
±54	NOT USED	
±55	Primary circuit flow switch	
±56	External circuit flow switch	
±57	NOT USED	
±58	MAIN	

NOTE: If more than one digital input in the table is configured with the same value, the function is activated when the input with the highest index is piloted.

5.3 Digital output configuration

Digital Outputs

See the section on Electric 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 DO6
- 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 - output configuration

Parameter	Description	Value	Description	Notes
CL90	DOL1 digital output configuration	-53…+53	See table B	Present in all models
CL91	DOL2 digital output configuration	-53…+53	See table B	Present in all models
CL92	DOL3 digital output configuration	-53…+53	See table B	Present in all models
CL93	DOL4 digital output configuration	-53…+53	See table B	Present in all models
CL94	DOL5 digital output configuration	-53…+53	See table B	Present in all models **(Open Collector Output)**
CL95	DOL6 digital output configuration	-53…+53	See table B	Present in models with 5 relays
CL96	AOL1 digital output configuration	-53…+53	See table B	See Table A – Analogue Outputs and Models **(Applies if CL71=0, set CL80 appropriately)**
CL97	AOL2 digital output configuration	-53…+53	See table B	See Table A – Analogue Outputs and Models **(Applies if CL72=0, set CL81 appropriately)**
CE90	DOE1 digital output configuration	-53…+53	See table B	Present in all models
CE91	DOE2 digital output configuration	-53…+53	See table B	Present in all models
CE92	DOE3 digital output configuration	-53…+53	See table B	Present in all models
CE93	DOE4 digital output configuration	-53…+53	See table B	Present in all models
CE94	DOE5 digital output configuration	-53…+53	See table B	Present in all models **(Open Collector Output)**
CE95	DOE5 digital output configuration	-53…+53	See table B	Present in models with 5 relays
CE96	AOE1 digital output configuration	-53…+53	See table B	See Table A – Analogue Outputs and Models **(Applies if CE71=0, set CE80 appropriately)**
CE97	AOE2 digital output configuration	-53…+53	See table B	See Table A – Analogue Outputs and Models **(Applies if CE72=0, set CE81 appropriately)**

Table B - Outputs: configuration table

Polarity is defined as indicated below:

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

Value	Description	Type
0	Output disabled	Digital
±1	Compressor 1	Digital
±2	Compressor 2	Digital
±3	Compressor 3	Digital
±4	Compressor 4	Digital
±5	Reversal valve circuit 1	Digital
±6	Reversal valve circuit 2	Digital
±7	NOT USED	Digital
±8	NOT USED	Digital
±9	Sanitary water valve	Digital
±10	NOT USED	Digital
±11	NOT USED	Digital
±12	NOT USED	Digital
±13	NOT USED	Digital
±14	Water pump 1 internal circuit	Digital
±15	Water pump 2 internal circuit	Digital
±16	Water pump external circuit	Digital
±17	NOT USED	Digital
±18	Recirculation fan	Digital
±19	Fan external exchanger Circuit 1	Digital
±20	Fan external exchanger Circuit 2	Digital

Value	Description	Type
±37	NOT USED	Digital
±38	NOT USED	Digital
±39	NOT USED	Digital
±40	NOT USED	Digital
±41	NOT USED	Digital
±42	NOT USED	Digital
±43	NOT USED	Digital
±44	NOT USED	Digital
±45	NOT USED	Digital
±46	NOT USED	Digital
±47	NOT USED	Digital
±48	NOT USED	Digital
±49	NOT USED	Digital
±50	NOT USED*	Digital
±51	NOT USED*	Digital
±52	NOT USED*	Digital
±53	NOT USED*	Digital
±54	NOT USED	Digital
±55	NOT USED	Digital
±56	Fan external exchanger circuit 1	Analogue
±57	Fan external exchanger circuit 2	Analogue

±21	NOT USED	Digital
±22	Auxiliary output conditional on defrosting	Digital
±23	Electrical heater 1 internal exchanger	Digital
±24	Electrical heater 2 internal exchanger	Digital
±25	Electrical heater external exchanger 1	Digital
±26	Electrical heater external exchanger 2	Digital
±27	Auxiliary output	Digital
±28	Electrical heater Domestic Hot Water	Digital
±29	Running hours exceeded	Digital
±30	Water heater	Digital
±31	Preheat	Digital
±32	EEV 1 ON command	Digital
±33	EEV 2 ON command	Digital
±34	Compressor 1 Inverter (only for single circuit and single compressor units)	Digital
±35	NOT USED	Digital
±36	NOT USED	Digital

±58	Water heater	Analogue
±59	Water pump 1 modulating internal circuit	Analogue
±60	Water pump 2 modulating internal circuit	Analogue
±61	NOT USED	Analogue
±62	Analogue stage 1 for compressor	Analogue
±63	Analogue stage 2 for Compressor	Analogue
±64	NOT USED	Analogue
±65	NOT USED	Analogue
±66	Analogue stage 1 for Compressor Inverter	Analogue
±67	NOT USED	Analogue
±68	NOT USED	Analogue
±69	NOT USED	Analogue
±70	NOT USED*	Digital
±71	NOT USED*	Digital
±72	NOT USED*	Digital
±73	NOT USED*	Digital
±74	NOT USED*	Digital
	*see LED configuration	

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

5.4 Configuration of analogue outputs

Analogue Outputs
See the section on Electric Connections for the number and type of analogue outputs used and for information on the symbols used on labels supplied with the controller.

Table A2 – Analogue Outputs and Models

		Dangerous voltage		**SELV**			**Models bases**			**Models expansions**			
output	**Label on display**	**636 models**	**Models 646**	**PWM O.C**	**0..10V**	**0...20mA 4...20mA**	**636**	**646**	**655**	**632**	**636**	**646**	**655**
TC1	**TCL1**	**3A 230V**	**2A 230V**				●	●					
TC2	**TCL2**	**3A 230V**					●						
AO1	**AOL1**			●			●	●	●				
AO2	**AOL2**			●				●	●				
AO3	**AOL3**						●	●	●				
AO4	**AOL4**						●	●	●				
AO5	**AOL5**					●	●	●	●				
TC1	**TCE1**	**3A 230V**	**2A 230V**								●	●	
TC2	**TCE2**	**3A 230V**									●		
AO1	**AOE1**			●	●					●	●	●	●
AO2	**AOE2**			●	●					●		●	●
AO3	**AOE3**				●						●	●	●
AO4	**AOE4**				●						●	●	●
AO5	**AOE5**					●					●	●	●

TRIAC analogue outputs (TC1, TC2)

TRIACs are high voltage outputs generally used to drive 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 output can be configured as described in the table entitled "Analogue Output TC1 - AO1 AO2: configuration table"

Configuration of safety low voltage (SELV) analogue outputs

AO1 always available. If configured as digital, see parameter CL96/CE96
AO2 always available. If configured as digital, see parameter CL97/CE97
They can be configured as:
PWM (via CFS modules) or
Open Collector (ON/OFF).

AO3 – AO4 - low voltage (SELV) output to drive external modules to control fans / pumps / compressors. Can be used to drive 0-10V fans (via parameters CL61/CL62 – CE61/CE62)
AO5 - safety low voltage (SELV) output to drive external modules to control fans / pumps / compressors.
Can be used to drive 4-20mA loads or 0-20mA loads (via parameter CL60/CE60 / CL63/CE63)

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 for models 63x 64x	**CL73 CE73**	Phase shift TCL analogue output 1 Phase shift TCE analogue output 1	0...90	Phase shift values to pilot TRIAC with cut-off in the event of inductive loads.
	CL76 CE76	TCL analogue output pulse length 1 TCE analogue output pulse length 1	5...40 units (347...2776 µs)	pulse length to drive Triac (1 unit = 69.4 µs).
	CL79 CE79	TCL analogue output configuration 1 TCE analogue output configuration 1	-53...+53 if digital (see polarity) 56...66 if proportional	See **Table B Outputs: configuration table, paragraph on Configuration of Digital Outputs**
TCE1	**CE70**	Enable TCE analogue output 1	0= 65x models	See CE95
			1= 64x models	see CE73 – CE76 – CE79
AO1	**CL71 CE71**	Enable AOL analogue output 1 Enable AOE analogue output 1	0= Output configured as digital	If =0 see parameter **CL96/CE96**
			1= Output configured as TRIAC	(for pulse pilot) If =1 see parameters CL74 – CL77 – CL80 CE74 – CE77 – CE80
	CL74 CE74	Phase shift AOL analogue output 1 Phase shift AOE analogue output 1	0...90	Active if **CL71=1 / CE71=1**
	CL77 CE77	AOL analogue output pulse length 1 AOE analogue output pulse length 1	5...40 units (347...2776 µs)	Active if **CL71=1 / CE71=1** (1 unit = 69.4 µs).
	CL80 CE80	AOL analogue output configuration 1 AOE analogue output configuration 1	-53...+53 if digital (see polarity) 56...66 if proportional	See **Table B Outputs: configuration table**
AO2 *	**CL72 CE72**	Enable AOL analogue output 2 Enable AOE analogue output 2	0= Output configured as digital	If =0 see parameter **CL97/CE97**
			1= Output configured as TRIAC	(for pulse pilot) If =1 see parameters CL75 – CL78 – CL81 CE75 – CE78 – CE81
	CL75 CE75	Phase shift AOL analogue output 2 Phase shift AOE analogue output 2	0...90	Active if **CL72=1 /CE72=1**
	CL78 CE78	AOL analogue output pulse length 2 AOE analogue output pulse length 2	5...40 units (347...2776 µs)	Active if **CL72=1 /CE72=1** (1 unit = 69.4 µs).
	CL81 CE81	AOL analogue output configuration 2 AOE analogue output configuration 2	-53...+53 if digital (see polarity) 56...66 if proportional	See **Table B Outputs: configuration table**

* in 636 models, AO2 can be used as TRIAC (TC2)

Low voltage (SELV) analogue output AO3-4-5: configuration table

Parameter	Description	values	Notes

CL60 **CE60**	AOL analogue output type 5 AOE analogue output type 5	0 = 4-20mA Current analogue output 1 = 0-20mA Current analogue output	See Analogue Output Configuration table
CL61 **CE61**	AOL analogue output configuration 3 AOE analogue output configuration 3	-53...+53 if digital (see polarity) 56...66 if proportional	Modulated piloting or on/off via 10V external relay
CL62 **CE62**	AOL analogue output configuration 4 AOE analogue output configuration 4	-53...+53 if digital (see polarity) 56...66 if proportional	Modulated piloting or on/off via 10V external relay
CL63 **CE63**	AOL analogue output configuration 5 AOE analogue output configuration 5	-53...+53 if digital (see polarity) 56...66 if proportional	Modulated piloting or on/off

The following can be driven:
loads with power modulation (values from 56 to 66) or
loads with on/off type switching using
the Triac as a switch (TC1 AO1 AO2)
the output as a 0-10V switch (AO3-4)
the output as a 0/4...20mA switch (AO5)

6 USER INTERFACE (FOLDER PAR/UI)

The interface, comprising the front cover of the controller, allows you to perform all operations needed to use the device.

SBA600	SDA600	Terminal SKP 10
		

NOTE:

- The SCA600 module has no display. To work on the device use terminal SKP 10 or SKW22(L)/SKP22(L)
- The SE600 expansion module has no display.

6.1 Keys

Refer to models SBA600 SDA600 and SKP 10.
There are 4 keys on the front cover of the controller. Each key has (see the two tables below):

- o A direct action (shown on the key itself).
- o An associated function (indicated on the front cover of the controller, near the key). In the manual, this is shown in square brackets (e.g. [UP])
- o A combined action using 2 keys. In the manual, this is shown in square brackets (e.g. [UP+DOWN])

6.1.1 Description of keys and associated functions

Key	Description key	Single press (press and release)	Key [associated function]	Long press [press and hold for about 3 seconds]	Menu / Comments
	**UP**	• Increase a value. • Go to next label • Modify Set Point (if UI25=1)		[Activate Sanitary Water function)	Sanitary Water / Manual defrost depending on model Functions menu see Functions chapter (folder FnC)
	**DOWN**	• Decrease a value. • Go to previous label • Modify Set Point (if UI25=1)		(Standby)	Standby / Local ON/OFF according to model
esc	**Esc(ape) Escape** (without saving new settings)	• Exit without saving new settings • Go back to previous level.	**mode**	[Mode Change] --- See section on Changing operating mode.	Operating mode menu
set	**Set Confirm** (saving new settings)	• Confirm 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]
	UP+ DOWN	Activate Time Bands			
			By parameter (see parameters chapter, parameters UI20-21-22-23-24) the function [associated] can be enabled or disabled • 0 = Key not enabled for the function • 1 = Key enabled for the function		

The following indications refer to the SBA600 user interface. Navigation is identical for SDA600 and SKP10

6.1.2 Stand-by

Controller “On” --> “Standby”	
	
Press the [DOWN] key for about 3 seconds from the main display.	The Standby icon will appear on the display All other LEDs will be off

Controller “Standby” --> “On”	
	
The Standby icon will appear on the display Press and hold the [DOWN] key for about 3 seconds.	Energy SBA600 will return to the “normal” screen

6.1.3 Description of keys – combined action

Symbol [function associated with combined pressing of the keys]	**Combination Keys**	**Combined pressing of keys Press once (press and release)**	**[associated function]**	**[Menu] / Comments**
	 	**UP + DOWN**	[Activate/Deactivate]	See section on Time Bands Time Bands / Reset depending on model
Prg	esc set	**[Esc + Set]**	[Open programming menu]	[Programming menu]

6.1.3.1 Manual alarm acknowledgement and reset

Alarm signals are displayed as flashing. Below is an explanation of how to acknowledge an alarm.
The various error messages will be shown in folder AL (see States Menu)

		
The error message will be displayed, and will alternate with the error warning signal .... (e.g. driver XVD1 resource alarm)... and the main display. The ALARM LED will be permanently on.		**ALARM/ERROR ACKNOWLEDGMENT** Press any key once to acknowledge an alarm. When any key is pressed, the alarm LED will start to flash.

MANUAL RESET
See Functions section Manual Reset paragraph

6.2 LEDs and Display

The display has 18 icons (LEDs) split into 3 categories:

- Statuses and operating modes
- Values and Units of Measure
- Services

Display
Values of up to 4 digits or 3 digits plus sign can be displayed.
LED: decimal point
Values are always shown in tenths of a degree/bar.

6.2.1 LED: States and Operating Modes

LED states and Operating Modes	Icons:	Description	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)		Preheat	red	Active alarm	Alarm acknowledged
		Heating*	green	Heating mode	Antifreeze with heat pump active Remote heating mode (from digital input)
		Cooling*		Cooling mode	Remote cooling mode (from digital input)
		Standby*		Local standby mode (from keyboard)	Remote standby (from digital input)
		Defrost		Defrost active	Manual defrost activated
		Economy		Configurable ---- See Parameters section. ---- Ui /dS folder Parameters UI07 /dS00	Configurable ---- See Parameters section. ---- Ui /dS folder Parameters UI07 /dS00
* In AS (domestic hot water) mode the Mode LED is off					

6.2.2 LEDs: values and units of measurement

LED Unit of measure	Icons:	Description	Colour	Permanently on	Blinking
		Clock (RTC) --- Time Bands	red	Shows current time (24hr format). --- Time Bands enabled	Set time --- Programming Time Bands
	°C	Degrees centigrade		/	/
	Bar	Pressure (Bar)		/	/
	%R.H.	Relative humidity transducer (% RH)		Not used	Not used
	ABC	Menu (ABC)		Menu navigation	/

6.2.3 LED: services

LED services		Description	Colour	Permanently on	Blinking
		service	Amber	Configurable (°) ---- See Parameters section. ---- Ui folder Parameters UI00..UI06	Configurable (°°) ---- See Parameters section. ---- Ui folder Parameters UI00..UI06

(°) permanently on: Service active
(°°) blinking: UI00..UI06= 50...53 (capacity steps 1...4) indicates safety timing
N.B.: In the case of LED configured as DHW valve, the LED blinks when AS mode is enabled but not active. Permanently on when serving a DHW request.

Default Configuration
LEDs for services are all configurable (see parameters chapter, folder Ui). The factory settings of the controller are listed in the table:

LED symbol on display	SBA600 LEDs	Default SBA600	Default icon on front panel SBA600
	LED 1 (first LED from left)	Capacity step 1	
	LED 2	Capacity step 2	
	LED 3	Internal circuit water pump	
	LED 4	External circuit water pump	
	LED 5	Internal exchanger electric heater 1	
	LED 6	Valve or DHW pump	
	LED 7	Water heater	

6.3 First switch-on

	
When Energy SBA600 is powered on for the first time, a lamp test is carried out to check its state and operation. --------- The Lamp Test lasts for just a few seconds. For this short time, all LEDs and digits will flash at the same time.	After the lamp test, the following are displayed (depending on the default settings): • Time • Real setpoint • Parameter setpoint • Value of the analogue input selected (AIL1…AIL5) --------- In the example, the main display is the real set point

6.4 Access to folders - menu structure

Folders are organized into menus.
Access to said folders is defined by the keys on the front cover (see relative paragraphs).
In the paragraphs that follow (or chapters indicated), we will explain how to enter each individual menu.
There are 4 menus:

- Main Display Menu → see the “Main Display Menu” chapter.
- Operating Mode Menu → see the “Operating Mode Menu” chapter.
- States Menu → see the “States Menu” chapter.
- Programming Menu → see the “Programming Menu” chapter.

There are 4 folders / sub-menus in the Programming Menu:

- Parameters Menu (folder Par) see Parameters chapter.
- Functions Menu (folder Fnc) see Functions chapter.
- Password PASS
- EU alarm codes

6.4.1 Main display Menu

“Main Display” means what the controller on the default display screen, i.e. when no keys have been pressed.

Main Display	Ai	AIL1	AIL2	AIL3	AIL4	AIL5			
		AIE1	AIE2	AIE3	AIE4	AIE5			
		Air1	Air2						
	E1(§)	1rE1	1rE2	-	-	1rE5	1rE6	1rE7	1SP4
		2rE1	2rE2	-	-	2rE5	2rE6	2rE7	2SP4
	rtC	HH:MM							
	SetP	SetP							
	Setr	Setr							

In Energy SBA600, the main display can be customized to suit personal requirements. The various displays can be selected from the “disp” menu, which can be opened by pressing and holding the [set] key for more than three seconds. The main display can be selected from:

- Analogue inputs AiL1, AiL2, AiL3, AiL4, AiL5, AiE1, AiE2, AiE3, AiE4, AiE5, Air1, Air2
- If configured as digital inputs:

- 0 or 0.0 = input not active (i.e. input short circuited to ground)
- 1 or 0.1 = input active (i.e. input open)

- analogue inputs 1AI1..1AI4, 2AI1..2AI4 (one of the probes made available by XVD1 or XVD2 of the relative probe is configured)
- 1rE1..1rE7,1SP4, 2rE1..2rE7,2SP4 (one of the resources made available by XVD1 / XVD2)
- rtC,
- Set-point → SetP= set by parameter, Setr= real with possible decalibrations;

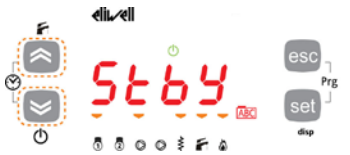
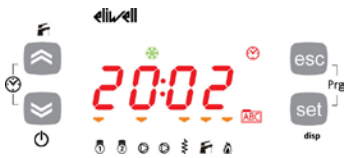
NOTES
E1(§) see parameters UI10/UI11 values 20…35
If **CP01 - Number of circuits = 1** the resources relative to XVD 2 will not be displayed (plant with single circuit)

A step by step account of how to proceed is 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]	This will open the flashing menu on the previous display (in this case rtC, i.e. current time).
	
To modify the display, scroll the menu using the “up” and “down” keys and press the set key to confirm.	When you have decided the type of display, press the set key to confirm. You will be automatically returned to the main display set.

6.4.2 “Operating Mode” Menu

Instructions are provided below on how to change the operating mode. There are three different operating modes:
Stand-by (StbY) mode
HEAT mode
COOL mode
Domestic hot water (AS) mode

	
For example, let's say you want to change from StbY to COOL mode. To change the 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 (heating), COOL (cooling) and AS (domestic hot water).
	
After selecting the preferred operating mode, 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.

6.4.3 "States" Menu

The value of resources can be viewed in the states menu. For some resources, a "dynamic" view is possible:

- For example, when declared as not present / probe not configured (see System Configuration chapter (folder Par/CL), parameter CL01=0), analogue input AIL2 will not be displayed.
- For example the hours of functioning of compressor 2 - CP02 – not available on single compressor machines

Resources can be present / not present depending on the model (e.g. dOL6 is present on SBA655 only).

Label								Visibility	Description	Modification
Ai	AIL1	AiL2	AIL3	AIL4	AIL5			Dynamic	Analogue inputs LOCAL	//
Ai	AIE1	AiE2	AIE3	AIE4	AIE5			Dynamic	Analogue inputs EXTENDED(§)	//
Ai	Air1	Air2						Dynamic	Analogue inputs TERMINAL	//
of	diL1	diL2	diL3	diL4	diL5	diL6	//	Dynamic	Digital inputs LOCAL	//
of	diE1	diLE2	diE3	diE4	diE5	diE6	//	Dynamic	Digital inputs EXTENDED(§)	//
AO	tCL1	AOL1	AOL2	AOL3	AOL4	AOL5	//	Dynamic	Analogue outputs LOCAL	//
AO	tCE1	AOE1	AOE2	AOE3	AOE4	AOE5	//	Dynamic	Analogue outputs EXTENDED(§)	//
dO	dOL1	dOL2	dOL3	dOL4	dOL5	dOL6	//	Dynamic	Digital outputs LOCAL	//
dO	dOE1	dOE2	dOE3	dOE4	DOE5	dOE6	//	Dynamic	Digital outputs EXTENDED*(§)	//
CL	HOUr	dAtE	YEAr						Clock	YES
AL	E000	....	...	...	...	...	E090	Dynamic	Alarms	//
AL	E100 E200	....	...	...	...	...	E115 E215	Dynamic	XVD1 Alarms XVD2 Alarms	//
SP	Value	//	//	//	//	//	//		Setpoint (set)	YES
Sr	Value	//	//	//	//	//	//		Real setpoint	//
Hr	CP01	CP02	CP03	CP04	PU01	PU02	PU03	Dynamic	Tens of hours of operation compressor/pumps	YES

(§) only if SE600 expansion module present

As shown in the table, the setpoint SP and time can be modified as well as displayed.

6.4.3.1 Inputs/Outputs Display (AiL, diL, tCL1/AOL, dOL)

	
Press the set key from the main display.	**Example of analogue input display The procedure is the same for other I/Os***** Label Ai appears on the display. (Use the UP and DOWN keys to scroll the other labels until you find the one you need.)
	
Press the set key to view the label for the first analogue input (AiL1 in this case).	Press the set key again to view the value of AiL1. Note that the °C icon lights up to indicate that the value shown is in degrees centigrade

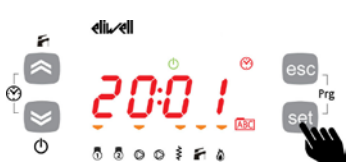
***For digital inputs / analogue inputs configured as digital, the value will be:

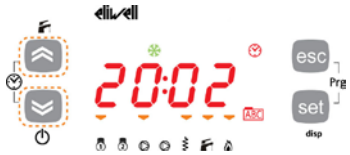
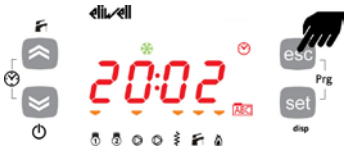
- 0 = input not active (for digital inputs this equals an open input, for analogue inputs configured as digital, this equals an input short circuited to ground)
- 1 = input active (for digital inputs this equals an input short-circuited to ground, for analogue inputs configured as digital, this equals an open input)

Press the esc key to go back to the main display.

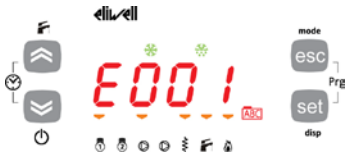
6.4.3.2 Setting the clock (CL)

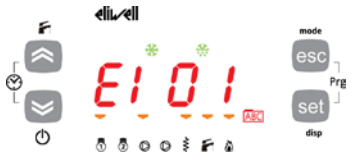
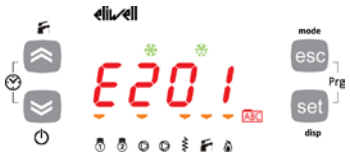
Energy SBA600 is equipped with a clock (RTC) that makes it possible to manage the alarms log, just like a programmable timer thermostat.
We will now show you how to set the time: you will also use the same procedure to set the date and year.

	
To change the time on your machine, starting from the main display, press the set key.	Press the key once to view the various folders. Scroll the menu using the “up” and “down” keys until you locate the CL folder.
	
Press the set key to open the CL menu.	

		
On entering 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 selected variable. 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, then	...press the set key	To exit the set time menu, press the esc key until you are returned to the main display.

6.4.3.3 Alarm Display (AL)

	
Press the set key from the main display.	Label Ai appears on the display. Use the UP and DOWN keys to browse the other labels until you find the AL label.
	
Press the “set” key to display the label of the first active alarm (if present)	In this case, the first alarm is E001. Scroll using the “UP” and “DOWN” keys to find other active alarms. --- N.B.: the menu is not cyclical. For example, if the active alarms are E001 E002 and E003, the display will show: E001 ->E002->E003 <-E002<-E001 Press the esc key to go back to the main display.

XVD1 Alarms	XVD2 Alarms
	
The XVD alarms are managed locally by each driver and they are signalled and recorded by the master SBA controller in the same folder as the E0xx alarms The alarm codes are divided as follows	E1xx for driver XVD1 E1xx for driver XVD2

6.4.3.4 Example of how to set the setpoint (SP)

For example, we will modify the setpoint in COOL mode from 12.0 degrees centigrade to 12.6 degrees centigrade.

	
To change the setpoint on your machine, starting from the main display, press the set key.	Press the key once to view the various folders. Scroll the menu using the “up” and “down” keys until you locate the SP folder.
	
Press the set key to open the SP menu.	The first display will be COOL mode, and then scrolling with the UP and DOWN keys, HEAT mode and DHW (ACS) mode (the various displays are shown at the side).
	
	
Let's say we want to change the COOL mode setpoint. Select COOL from the menu and press the set key.	The device will show the current setpoint of the machine, which is 12.0 degrees centigrade in this case). To increase or decrease this, press the “up” and “down” keys. For example, if you want to change the setpoint to 12.6 degrees, press the “up arrow” key until you reach the required value.
	
On reaching the required value, press the set key. The device will save the value 12.6	To repeat the procedure in reverse until you get back to the main display, press the esc key or wait for the 15-second timeout to elapse.

Setpoint edit function enable from main screen
Parameter Ui25 allows you to enable Set Point modification on the main display with the UP and DOWN keys.
For example, we will modify the setpoint in COOL mode from 12.0 degrees centigrade to 12.6 degrees centigrade.

Parameter **UI25=1 (folder Par/Ui/UI25)** must be set.
See Parameters section (folder PAr)

	
Let's say we want to change the COOL mode setpoint. **The device must be in COOL mode (or in StdBy mode from COOL).** To change the set point of the HEAT mode, proceed in the same way by first changing the device's mode from COOL to HEAT See Operating Mode Menu chapter.	To change the setpoint on your machine, press the UP or DOWN key in the main display The device will show the current setpoint of the machine, which is 12.0 degrees centigrade in this case).
	
To increase or decrease this, press the "up" and "down" keys again. For example, if you want to change the setpoint to 12.6 degrees, press the "up arrow" key until you reach the required value.	On reaching the required value, press the set key. The device will save the value 12.6

6.4.3.5 Display and reset compressor/pump hours

	
Example display and reset (tens of) hours for Pump 2 Press the set key from the main display.	Label Ai appears 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 operating time for compressor 1 (CP01)	Scroll with the UP and DOWN keys to view (if the relative resources are present) the operating time for compressor 2 (CP02) and the pump running time (PU01, PU02, PU03) Press the set key to view the pump operating time PU02
	The number of tens of operating hours is 2. (Hours are expressed in tens: 2 means 20 hours of operation). To reset the operating hours of pump PU02, press and hold [set] N.B.: to clear the operating hours of other resources, repeat the same procedure described above. ---------- Press the esc key to go back to the main display.

6.4.4 Programming menu:

Menu	Label								description	notes
Parameters	PAr	CL	Cr	CF	Ui	St	...	Al	the parameters	
Functions	FnC	dEF	tA	tA	tA	St	CC	EUr	Functions	See the "Functions" chapter (folder FnC).
Password	PASS								Password	
EU	EU	Eu00	...	...	...	...	...	...		

6.4.4.6 Parameters (folder PAr)

Modifying a parameter

Instructions are provided below on how to change a machine parameter. In this case, we will take the parameter configuration folder CL01 and parameter CL01 as an example (folder PAr/CL/CL01).

	
To view the parameter menu, press the Esc and Set keys at the same time. This will open the PAr menu.	The parameters menu PAr contains all controller folders. Press the set key to view folders.
	
The first folder displayed by the controller will be the CL configuration folder. If you want to modify individual CL parameters, just press the set key again.	The controller will show parameter CL00 (default settings). Scroll through the parameters with the "up" and "down" keys To view the parameter value (CL01 in this case), press the set key.
	
For parameter CL01, the value shown will be 2. To change the parameter value, press the up and down keys.	On selecting a value, press the set key. To quit press the esc key. N.B. pressing the set key confirms the modified value; pressing the esc key returns you to the previous level **without saving the new value entered**

6.4.5 Setting a password (Par/PASS folder)

Levels of visibility

There are four levels of visibility that can be set by assigning appropriate values to each parameter and folder, **only via serial communication, software** (DeviceManager or other communication SW) **or programming key**

The levels of visibility are:

- Value 3 = parameter or folder always visible
- Value 2 = **manufacturer level;** these parameters can only be viewed by entering the manufacturer's password (see parameter Ui28) (all parameters declared as always visible, parameters visible at the installation engineer level and manufacturer's level will be visible).
- Value 1 = **installation level;** these parameters can only be viewed by entering the installation password (see parameter Ui27) (all parameters declared as always visible, and parameters visible at the installation engineer level will be visible).
- Value 0 = parameter or folder NOT visible.

1. Parameters and/or folders with a level of visibility <>3 (password-protected) will be visible only if the correct password is entered (installer or manufacturer) by means of the following procedure
2. Parameters and/or folders with a level of visibility = 3 are always visible even without a password: in this case, the following procedure is not necessary.

To view parameters visible for the given password, open folder PASS (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.

	
To view the PASS folder in the main display, press the Esc and Set keys at the same time. [esc+set]	Pressing both keys will open the folder menu. Scroll using the “up” and “down” keys to find the PASS folder.
	Press the set key to open the PASS menu. From here, set the password (installer or manufacturer), press set and exit. Now open and view parameters to change a value (see parameters chapter).

6.4.6 Alarm events (Par/EU folder)

	
To view the PAr folder in the main display, press the Esc and Set keys at the same time. [esc+set]	C Pressing both keys will open the folders menu. 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 event 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 (in this case the first label will appear). (alarm code EU00) Use the UP and DOWN keys to scroll: **Alarm code** (as indicated)

	
Alarm start time	**Alarm start date**
	
Alarm stop time (alarm still active in this case)	**Alarm stop date** (alarm still active in this case)
	
Alarm type (automatic) or in alternative (manual)	

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

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

Energy SBA600 controls the main temperature regulator setpoint by dynamically modifying its value using special algorithms and events to maximise plant efficiency and output.

The action on the setpoint can be:

- Direct: modifies the main setpoints
- Indirect: modifies by using the sum of the values (positive or negative) called the setpoint differentials with the principal setpoints for the Cool and Heat modes.

There are several setpoint differentials:

- Dynamic setpoint differential on dedicated input or external temperature
- Economy function setpoint differential
- Adaptive function setpoint differential (see section in question)

In the same way (by means of the same direct and indirect actions) the temperature regulator hysteresis can be dynamically controlled. This only affects the compressor capacity steps; the other steps, such as water heater and electric heaters, have parameter-set hysteresis.
The main hysteresis differentials for the compressors are:

- Adaptive function hysteresis differential (see section in question)

The results of the direct and indirect actions on the principal setpoints and hysteresis are the **real** setpoint and hysteresis.

In general, we can say that the main temperature control is based on these 4 values:

1. Real Cool setpoint
2. Real Heat setpoint
3. Real Cool hysteresis (compressors only)
4. Real Heat hysteresis (compressors only)

The main temperature regulator calculates the capacity to be delivered, both in Heat and Cool mode.
The capacity is expressed a number of steps (hot or cold) to deliver.

7.1 Temperature regulator setpoint and hysteresis

7.1.1 Setpoint and hysteresis from parameter value

The parameters used to set the **main** working setpoints, one for each operating mode, are shown below:

Parameter		
COOL	**HEAT**	**Description**
tr10	**tr20**	**Temperature regulator setpoint in Cool / Heat**
tr11	**tr21**	**Temperature regulator minimum setpoint in Cool / Heat**
tr12	**tr22**	**Temperature regulator maximum setpoint in Cool / Heat**
tr13	**tr23**	**Temperature regulator hysteresis in Cool / Heat**

For setpoint and hysteresis there exist direct modification actions (direct action on the principal values, such as modification via COM1) or indirect modifications, summing differentials, to obtain the **real** setpoint and hysteresis values.

7.1.2 Real setpoint and hysteresis

The real setpoints and hysteresis are calculated from the parameters described above and summing the total differentials calculated in a specific way from the components described above.

- **Real** setpoint Heat = Main setpoint Heat + **Setpoint differential Heat**
- **Real** setpoint Cool = Main setpoint Cool + S**etpoint differential Cool**

Setpoint differential = Dynamic setpoint differential on dedicated input and/or external temperature
+ Economy function setpoint differential
+/- Adaptive function setpoint differential

- **Real** hysteresis Heat = Main hysteresis Heat + **Hysteresis differential Heat**
- **Real** hysteresis Cool = Main hysteresis Cool + **Hysteresis differential Cool**

Hysteresis differential = Adaptive function Hysteresis Differential

7.1.2.1 Setpoint differential: dynamic differential

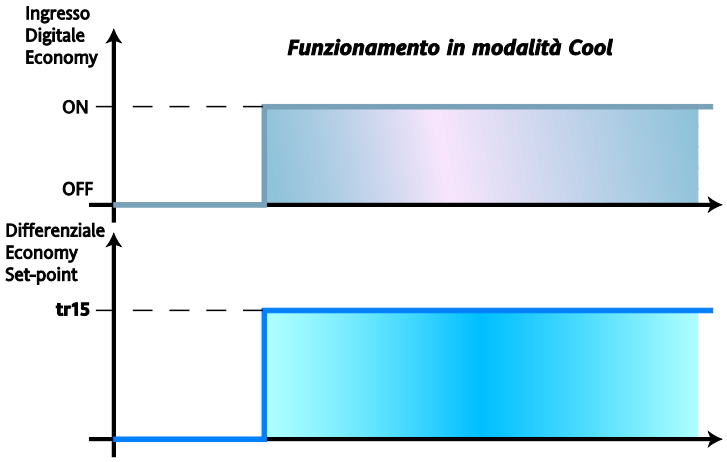
See dynamic setpoint section (folder PAr/dS)

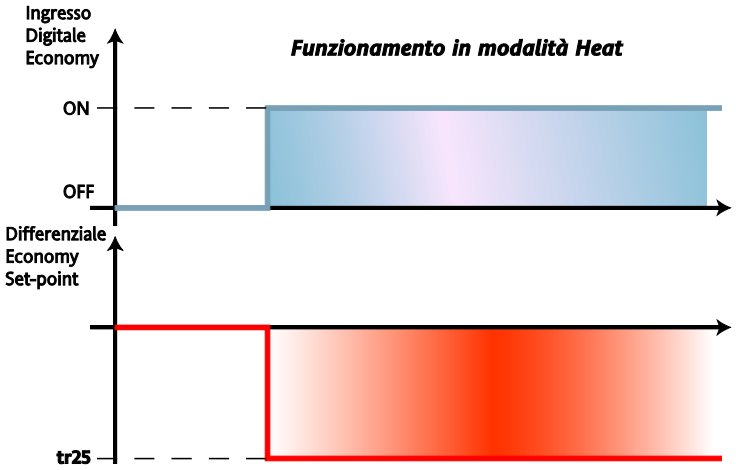
7.1.2.2 Setpoint differential: Economy differential

Enabling
The function is enabled only if a digital input has been configured as Economy input (at least one of CL40...CL45, CL50...CL54=22)

When the digital input is enabled, the setpoint is increased by a differential equal to the value of parameter **tr15** or **tr25** depending on the current operating mode (Cool or Heat):

tr15: *Setpoint differential in Cool from Economy input* (typically positive) if the current operating mode is Cool





tr25: *Setpoint differential in Heat from economy input* (typically negative) if the current operating mode is Heat.

The activation of Economy mode is indicated by the Economy LED (if so configured)

7.1.2.3 Setpoint and hysteresis differentials: Adaptive function

See Adaptive section (folder PAr/Ad)

7.2 Temperature regulator

The SBA600 has five types of temperature control that can be selected with **tr00** *Temperature control type*:

- **Proportional:** Calculates the power the unit must supply in relation to the distance of the air/water temperature from the setpoint
  - o tr00=0 Proportional temperature control **- see diagrams A and B**
- **Differential:** Calculates the power the unit must supply in relation to difference in temperature between two analogue inputs
  - o tr00=1 Differential temperature regulator - **see diagrams C and D**
- **Digital (condenser unit)**
  - o tr00=2 Digital temperature control
- **INVERTER proportional** Calculates the capacity the unit must supply in relation to the distance of the air/water temperature from the setpoint
  - o tr00=3 Proportional INVERTER control thermoregulation **- see diagrams A' and B'**
- **INVERTER differential** Calculates the capacity the unit must supply in relation to the temperature difference between two analogue inputs
  - o tr00=4 INVERTER control differential thermoregulation

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

7.2.1 Temperature control probes

Table A Control probe selection

Temperature control	COOL	HEAT	Description	Probe 1	Probe 2
Control	**tr02**	**tr03**	**Probe selection for temperature control in Cool/Heat modes**	**See table B**	N.O.
Differential	**tr04**	**tr05**	**Select probe for differential temperature control in Cool/Heat modes**	**See table B**	**See table B**

Table B Control probes

Value	Probe 1	Probe 2
0	Internal exchanger water/air inlet temperature **(CL30...CL34=0)**	External temperature NTC input **(CL30...CL34=8)**
1	Internal exchanger water/air outlet temperature **(CL30...CL34=1)**	
2	Circuit 1 and 2 internal exchanger water outlet average temperature **Average ((CL30...CL34=2), (CL30...CL34=3))**	
3	External exchanger inlet water temperature **(CL30...CL34=6)**	
4	External exchanger outlet water temperature **(CL30...CL34=7)**	
5	Circuit 1 and 2 external exchanger average temperature **Average ((CL30...CL34=4), (CL30...CL34=5))**	

*if one of the probes is in error or not configured, the average value will indicate a probe error

7.2.2 Proportional temperature control

This is a type of control that activates the capacity steps as a function of the divergence of the actual temperature from the real setpoint.

Homogeneous or capacity control compressors
The steps (heating or cooling) are discrete and there are a limited number of them (max 4 for SB devices).
The number of steps (resources) requested is linked to the difference between the control temperature and the **real** setpoint; the greater the difference, the larger the number of steps (resources) used to reach the setpoint.
The temperature interval between application of one capacity step and the next depends on the proportional band and the number of resources available (see Compressors section).

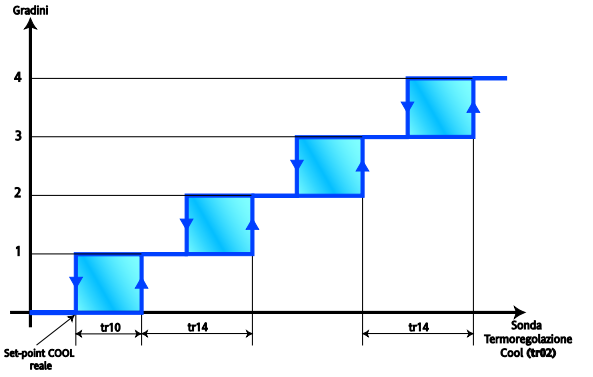
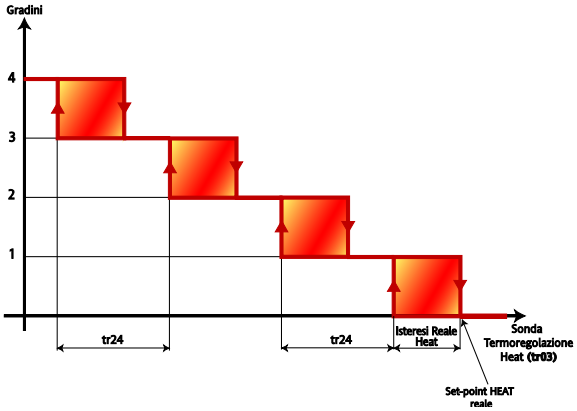
Temperature control is usually dependent on the inlet/outlet water/air temperature of the internal exchanger. Installations with double internal exchanger can control the temperature as a function of the average of the two temperatures measured at the exchanger outlets.

In some applications (e.g. machines with water reversal in Heat mode) it may be necessary to use the **external** (recovery) **exchanger** inlet/outlet water temperature for temperature control.

Various temperature control probes can be selected for Heat and Cool modes using the parameters given in **Table B Control probes**

7.2.3 Proportional capacity step temperature control in Cool / Heat mode

Temperature control is enabled in Heat mode only if *Enable heat pump* **tr01** = 1
Case tr00=0

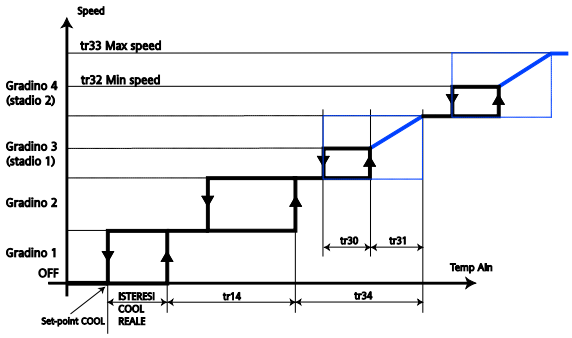
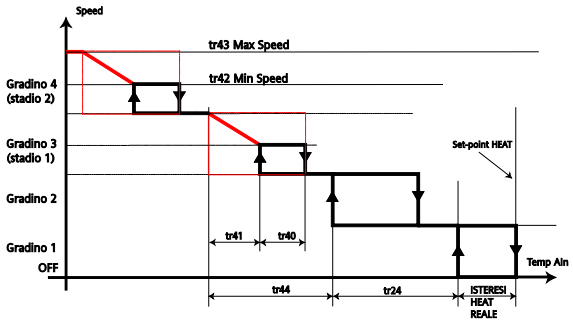
Diagram A	Diagram B
COOL	HEAT
	

Parameter		Description
COOL	HEAT	Description
tr02	tr03	*Select thermoregulation probe* **in Cool / Heat**
tr14	tr24	*Insert steps/compressors differential* **in Cool / Heat**
Setpoint		Real setpoint in Cool / Heat
Hysteresis		Real control hysteresis in Cool / Heat

N.B.: The real hysteresis may not be greater than the differential. In this case the hysteresis is considered equal to the differential.

7.2.4 INVERTER temperature control in Cool / Heat mode

Temperature control is enabled in Heat mode only if *Enable heat pump* **tr01** = 1
Case tr00=3

<table>
<tr><th colspan="2">Diagram A'</th><th colspan="2">Diagram B'</th></tr>
<tr><th colspan="2">COOL</th><th colspan="2">HEAT</th></tr>
<tr><td colspan="2"> 
</td><td colspan="2"> 
</td></tr>
<tr><td>COOL setpoint</td><td>Real setpoint in Cooling mode</td><td>HEAT setpoint</td><td>Real setpoint in Heating mode</td></tr>
<tr><td>COOL mode REAL hysteresis</td><td>Real control hysteresis in Cooling mode</td><td>HEAT mode REAL hysteresis</td><td>Real control hysteresis in Heating mode</td></tr>
<tr><td>AIn temp</td><td>Temperature read by the probe selected for temperature control in Cool
(parameter tr02 - Select temperature control probe in Cool)
or
for differential temperature control in Cool
(parameter tr04 - Select probes for temperature control differential in Cool)</td><td>AIn temp</td><td>Temperature read by the probe selected for temperature control in Cool
(parameter tr03 - Select temperature control probe in Heat)
or
for differential temperature control in Cool
(parameter tr05 - Select probes for temperature control in Heat)</td></tr>
</table>

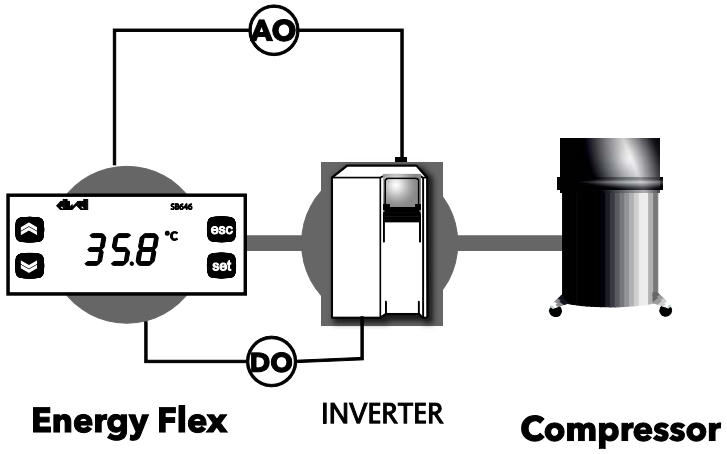
	Parameter		Description
	COOL	**HEAT**	
	tr14	**tr24**	***Insert steps/compressors differential* in Cool / Heat**
	tr30	**tr40**	**Temperature controller hysteresis with inverter in Cool / Heat**
	tr31	**tr41**	**Temperature controller band with inverter in Cool / Heat**
Speed	**tr32**	**tr42**	**Minimum speed with inverter in Cool / Heat**
Speed	**tr33**	**tr43**	**Maximum speed with inverter in Cool / Heat**
	tr34	**tr44**	**Insert Inverters/compressors differential in Cool / Heat**

N.B.: The real hysteresis may not be greater than the differential. In this case the hysteresis is considered equal to the differential.

Cooling
N.B.: the sum tr30+tr31 must be less than **tr34**
Heating
N.B.: the sum tr40+tr41 must be less than **tr44**
If this is not the case, the hysteresis + band value will be equal to the differential value.

7.2.5 Notes on inverter Management

Activation of the compressors is determined by the specified analogue signal, but also by a corresponding digital permissive, taken from the standard available digital outputs.



Digital and analogue signals both affect the inverter, and activation of the compressor is determined by said signals, but also by the regulatory mechanisms and parametrisations of the inverter interposed between the controller and the compressor. For example, the inverter typically influences the activation and deactivation modes of the compressors.

Consequently, on the basis of the type of inverter and the type of compressor, the resulting management can be more or less efficient and more or less appropriate for protecting the specific compressor employed.
To further improve management of the compressors and obtain benefits in terms of overall efficiency, it may be appropriate to "modulate" the digital permissive in specific situations, such as, for example, at the time of stopping (because the setpoint has been reached) and during defrosting.

Single circuit and single-compressor units
In the case of 1 circuit 1 compressor, and only in this case, there is a dedicated digital output available denoted **Inverter Compressor 1**

Stage	**Digital output Compressor 1 (CL90..95/CE90...95 = ±1)**	**Digital Compressor 1 Inverter and analogue output Compressor Inverter (CL96/97/CE96/97 = ±34)**
Starting for temperature control requirements	Starts in accordance with the standard temperature regulator	No change, it is typically the inverter that (in accordance with its settings) determines gradual starting of the compressor
Stopping due to fulfilment of temperature control demand	Stops in accordance with the standard temperature regulator	Digital output: remains on (for time **St06 - Delay time for switching of Heating to Defrost cycle inversion valve**, then switches off the same as the standard output) to allow inverter to reduce its speed before switching it off Analogue output: assumes value 0 (below minimum inverter threshold)
Alarms		
Dedicated alarms (*)	Output off	No change, in the case of dedicated alarms it is good practice to switch off the compressor
OFF / Stdby		
Instrument OFF (*)	Output off	No change, compressor and inverter switch off (=0)
Instrument STD BY	Output off in compliance with delay intervals	Digital output: remains on (for additional time **St06 - Delay time for switching of Heating to Defrost cycle inversion valve**, then switches off the same as the standard output) Analogue output: assumes value of **tr32 - Inverter minimum speed in Cooling** or **tr42 Inverter minimum speed in Heating** to allow the inverter to bring the compressor to the minimum speed before switching it off

(*) assumes priority over any active alarms

Stage	Digital output Compressor 1 (CL90..95/CE90...95 = ±1)	Digital output Compressor 1 Inverter (CL96/97/CE96/97 = ±34)
Defrost		
Defrost start	Behaviour dependent on parameters **St06/St07**	**Diagram A** →Digital output: remains on. →Analogue output: normally regulates up to the start of defrosting when it assumes a value equal to **tr42 Inverter minimum speed in Heating** to allow the inverter to bring the compressor to minimum speed After time **St06 - Delay time for switching of cycle inversion valve from Heating to Defrosting** the inversion valve is reversed and, after an additional time **St07 - Delay time for switching of cycle inversion valve from Defrosting to Heating** the analogue output is brought to the maximum value **tr43 - Inverter maximum speed in Heating**
Defrost end	Behaviour dependent on parameters **St06/St07**	**Diagram B** **dF23 - Drip time ≠ 0 and greater than St06** (**dF23** and **St06** are counted in parallel). → the digital output is switched off after time **St06** → the analogue output assumes value 0 and afterwards a value equal to **tr42** - **Inverter minimum speed in Heating** to allow the inverter to bring the compressor to minimum speed Compressori shutdown since digital output will be closed after **St06 (<dF23) time** After time **dF23 - Drip time** the inversion valve is reversed and, after an additional time **St07 - Delay time for switching of cycle inversion valve from Defrosting to Heating** the analogue output is brought to the value requested by the temperature regulator → the analogue output is brought to the value requested by the temperature regulator after **dF23 (>St06) + St07** **Diagram C** **dF23 - Drip time = 0 or lesser than St06** (**dF23** and **St06** are counted in parallel). →Digital output: remains on. → the analogue output is brought to the value requested by the temperature regulator after **St06 + St07**
Mode Change		
Mode Change	Behaviour dependent on parameter **St05**	**St05 - Cycle inversion valve switching delay time = 0**, no change, the mode changeover in progress is performed while keeping the compressor running. **St05 - Cycle inversion valve switching delay time ≠ 0**, the output remains on for an additional time **St06 - Delay time for switching of cycle inversion valve from Heating to Defrosting** Set **St05>St06** to be certain that the compressor is stopped when the valve is reversed In the mode change from heating/cooling the analogue output assumes the value **tr32 – Minimum speed with Inverter in Cool** In the mode change from heating/cooling the analogue output assumes the value **tr42 - Minimum speed with Inverter in Heat** It is set to 0 at turning off the digital output.

Note
Pay attention to the use of parameter **St06 -Delay time for switching of cycle inversion valve from Heating to Defrosting** as a sort of post-off of the **Compressor 1 Inverter** output in certain situations), whose value must be selected in accordance with the application (inverter and its parametrisation).

Diagram A

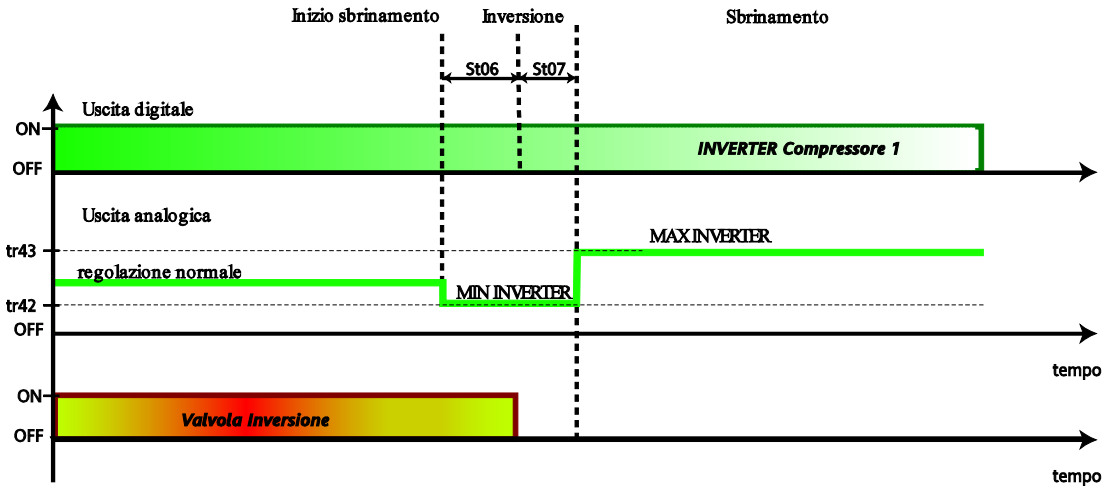


Diagram B (dF23> St06)

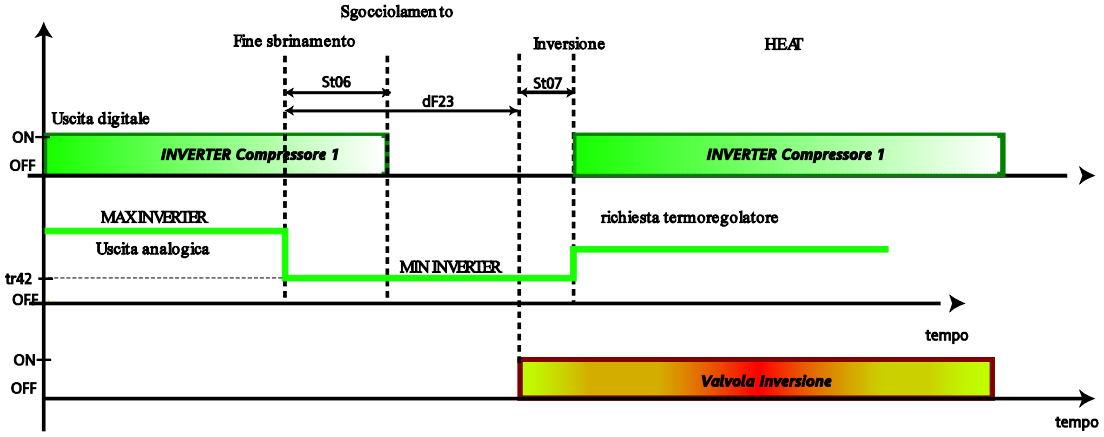
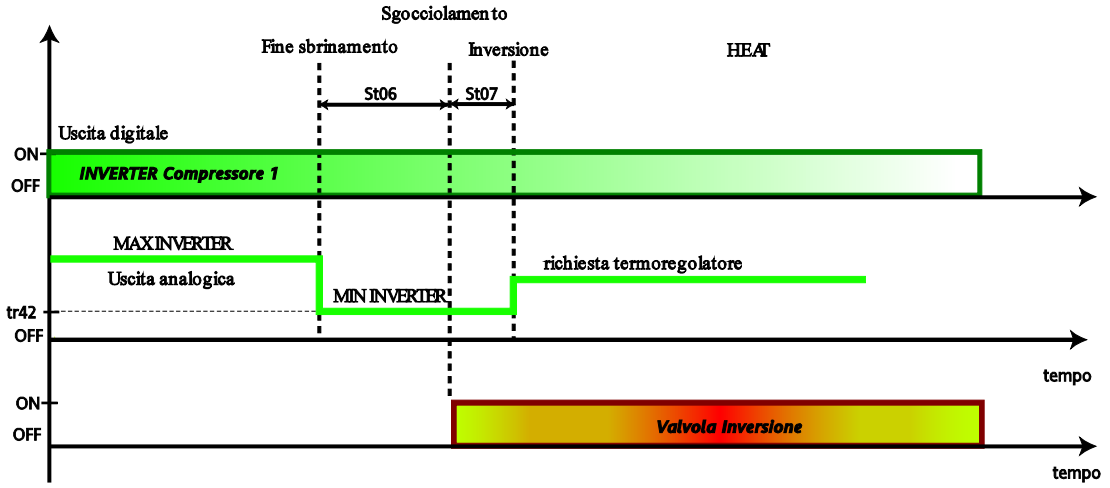


Diagram C (dF23 = 0 or < St06)



7.2.6 Activation of the XVD electronic expansion valve driver

If at least one capacity step is required by the compressor(s) on one of the two circuits, an ON command will be transmitted to the driver for the XVD electronic expansion valve relative to the circuit in question. If, on the other hand, the circuit does not require cooling or heating capacity (all compressors off) for any reason (e.g. alarm associated with the compressor), an OFF command will be transmitted to the relative XVD.

7.3 ENVELOPE control

Envelope control requirements
In the case of **1 circuit 1 compressor**, and only in this case, temperature control is available on a dedicated digital output also with ENVELOPE control.

Enabling
The envelope control functions are enabled by means of parameters:

Parameter	Description
ri00	**Enable discharge temperature limitation control** 0= disabled; 1= enabled
ri01	**Select compression ratio control mode** 0= Compression ratio control disabled 1=Compression ratio control enabled, minimum and maximum values 2=Compression ratio control enabled, minimum value 3=Compression ratio control enabled, maximum value
ri12	**Compressor running time in safety** If different from zero enables oil recovery function

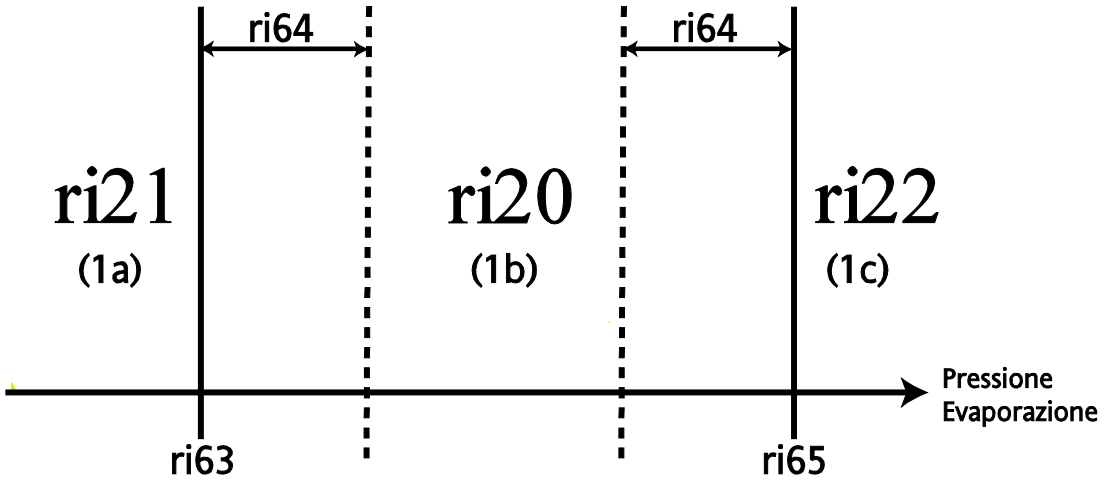
7.3.1 Discharge temperature limitation

Limitation of the discharge temperature with reduction of compressor rpm

Enabling
ri00 - Enable discharge temperature limitation control = 1
This logic cuts in to limit the value of discharge temperature to the threshold value defined by the parameters

	Parameter	Description
reference value Discharge temperature	**ri20**	**Discharge temperature limit zone 1b**
	ri21	**Discharge temperature limit zone 1a - 2**
	ri22	**Discharge temperature limit zone 1c - 3**
	ri16	**Compressor speed correction**
	ri34	**Discharge temperature correction period**
	ri63	**Evaporation pressure zone 1a/1b**
Hysteresis	**ri64**	**Evaporation pressure differential 2**
	ri65	**Evaporation pressure zone 1b/1c**

Discharge Temperature limitation



The discharge temperature is compared to the reference value, which will be ri20, ri21 or ri22, on the basis of the evaporation pressure value.
If the real discharge temperature exceeds the reference value, the compressor Inverter speed and ri16 are reduced and the resulting value is "frozen" for time ri34.
Subsequently the control is performed with a frequency defined by the same parameter ri34, with possible further reductions of ri16 at each instance.

If the discharge temperature returns to below the defined threshold value, the speed is restored as determined by the temperature control (offset zero setting) at that time.

Determination of the reference value:

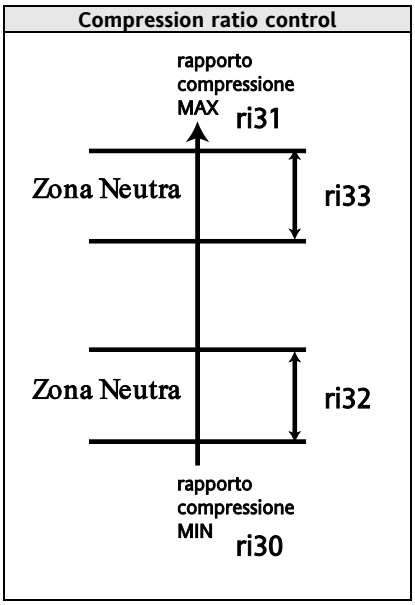
Parameter	Description
ri63	**Evaporation pressure zone 1a/1b**
ri64	**Evaporation pressure differential 2**
ri65	**Evaporation pressure zone 1b/1c**

- when the evaporation pressure falls below the value defined by parameter ri63 -> maximum discharge temperature value ri21;
- pressure that rises above value ri63+ri64 -> ri20;
- pressure that rises above value ri65 -> ri22;
- pressure that falls below value ri65-ri64 -> maximum discharge temperature ri20.

7.3.2 Compression ratio control

The control function of the compression ratio is enabled by the parameter
ri01 - Compression ratio control mode selection

Parameter	Description
ri14	Initial transient for compression ratio control
ri30	Minimum compression ratio
ri31	Maximum compression ratio
ri32	Minimum compression ratio range
ri33	Maximum compression ratio range
ri55	Superheating setpoint correction period/sampling time



The compression ratio given by ((High pressure value +1 bar)/(Low pressure value +1 bar)) is compared with parameter ri30 minimum compression ratio and ri31 maximum compression ratio in order to maintain it between these two values.
The logic utilised is as follows:

- after the initial transient defined by ri14, from starting of the compressor;
- with sampling time ri55 (for "synchronism" with the other controls of the command signal that use the same period as the scanning time) the compression ratio is calculated;
- if the result is less than ri30 a correction is introduced to increase the compressor control signal by the value defined by parameter ri16 and the resulting value is "frozen" for time ri55;
- if compression ratio is more than ri31 a correction is introduced to reduce the compressor control signal by the value defined by parameter ri16 and the resulting value is "frozen" for time ri55;
- if the compression ratio is between ri30 and ri30+ri32 or between ri31-ri33 and ri31 no action is taken ("neutral zones") and the resulting value is frozen for time ri55;
- if the compression ratio is between ri30+ri32 and ri31-ri33, the speed is restored as determined by the temperature control (offset zero setting) at that time.

7.3.3 Oil recovery

Parameter	Description
ri10	Compressor safety speed for oil recovery
ri11	Compressor safety speed
ri12	Compressor running time in safety

To guarantee correct recovery of oil in the circuit if the compressor is working at rotation speeds below ri10 for a maximum time ri13, the control signal is forced to ri11 for a period equivalent to ri12.

7.3.4 ENVELOPE control regulation priority

The oil recovery function assumes priority over all the other regulations that act on the compressor Inverter on the condition that the compressor is running.
The other two functions (discharge temperature and compression ratio) have priority over normal regulation and if there are conflicting actions the action that tends to reduce the compressor Inverter speed will prevail. For a capacity increase it is necessary that none of the controls constrain such an increase.

7.3.5 Temperature control differential

Differential temperature control is enabled with parameter **tr00** *Temperature control type*.
I.e. tr00=1 (differential) / tr00=4 (INVERTER differential)
The aim of differential temperature control is to maintain a constant difference between the external temperature and the temperature of the air/water used for heating/cooling.
The temperature differential in question is defined by

temperature control value = Probe 1 – Probe 2

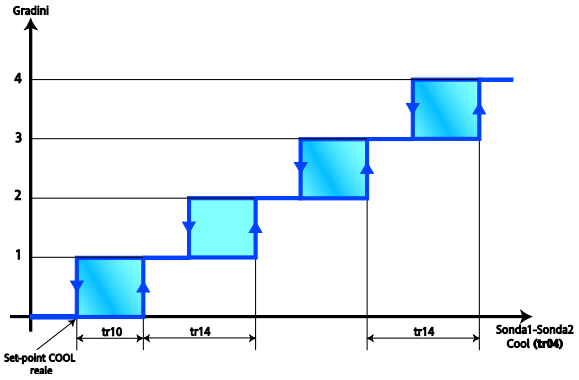
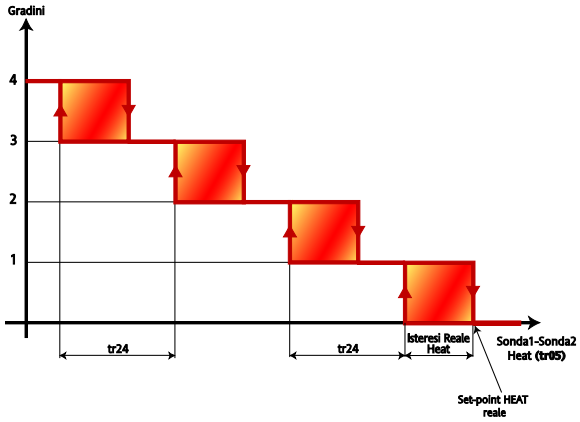
where **Probe 2** is the external temperature.

See **Control Probes Table**

Installations with double internal exchanger can control the temperature as a function of the average of the two temperatures measured at the exchanger outlets. The same applies to the external exchangers.

7.3.5.1 Differential temperature control in Cool / Heat mode

Temperature control is enabled in Heat mode only if **tr01:** *Enable heat pump* = 1.

Diagram C	Diagram D
COOL	HEAT
	

Parameter		Description
COOL	HEAT	Description
tr04	**tr05**	*Select probes for temperature control differential* **in Cool / Heat**
tr14	**tr24**	*Insert steps/compressors differential* **in Cool / Heat**
Setpoint		Real setpoint in Cool / Heat
Hysteresis		Real control hysteresis in Cool / Heat

N.B.: The real hysteresis cannot be greater than the differential. In this case the hysteresis is considered equal to the differential.

7.3.6 Digital temperature control

The function is enabled if parameter ***tr00***: *Temperature control type* = 2.
In the case of digital temperature control, the capacity step request depends on the state of specific digital inputs, typically driven by external thermostats, rather than analogue variables.
The operating mode can also be selected via a digital input.
N.B.: Safety timings, settings (compressor ON delay, pump ON, ..) and alarms are active as usual.

The digital input configuration depends on the type of thermostat used in the application.
We list below the meanings that can be associated with the digital inputs in question.

Type 1 thermostat

Value DIL1 to DIL5 / AIL1 to AIL5	**Description**
±8	Digital input heat step 1 request
±9	Digital input heat step 2 request
±10	Digital input heat step 3 request
±11	Digital input heat step 4 request
±12	Digital input cool step 1 request
±13	Digital input cool step 2 request
±14	Digital input cool step 3 request
±15	Digital input cool step 4 request

Type 2 thermostat

Value DIL1 to DIL5 / AIL1 to AIL5	**Description**
±3	Remote Summer/Winter
±4	Capacity step 1 request
±5	Capacity step 2 request
±6	Capacity step 3 request
±7	Capacity step 4 request

For further details, see the section on System Configuration (folder PAr/CL-Cr-CF) /
section on Configuration of digital inputs (DIL1 to DIL5 and AIL1 to AIL5) /
Table B - Digital inputs: configuration table

N.B.:
- If two digital inputs are configured as heat step request and cool step request activating both at the same time generates a *configuration error*, for further details see the alarms table;
- If a digital input has been configured as heat request and the digital input for summer/winter is in the summer position, this generates a *configuration error*;
- Temperature control depends directly on the activation of digital inputs which therefore must be activated in a logical sequence. For example, capacity steps must be activated and deactivated in the fixed sequence 1-2-3-4 and 4-3-2-1.

8 OPERATING STATES (FOLDER PAR/ST)

Once the Energy SBA600 plant has been configured it is ready to control the services on the basis of the temperature and pressure conditions detected by the probes and the temperature control functions definable by means of specific parameters.
Operating mode parameters can be viewed and configured in folder **St** (see User Interface and Parameters sections).
When Energy SBA600 is not in OFF or StdBy status, it is either in heating or cooling mode

Operating states

There are 3 possible operating states that can be set by parameter **St00- Working modes selection**:

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

Working modes

The working modes can be selected:

- from the keyboard - if keys are enabled in parameters:
  - **UI21 - Enable MODE function from key** Enables/disables mode selection from a key
  - **UI23 - Enable STANDBY function from key** Enables/disables ON/OFF key for switching the device on or off
- from appropriately configured digital inputs:
  - i.e. Remote ON/OFF
  - Remote STD-BY

NOTE: Remote mode changeover: to obtain the correct sequence STD-BY – DHW, enable 2 D.I. and configure one as STB and the other as DHW (±28)
If you enable only 1 D.I. in STD-BY and the machine is in DHW mode, it may occur that the from D.I. the status transitions to HEAT

		St00		
		0	**1**	**2**
		COOL	**HEAT**	**HEAT+COOL**
Working modes	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
	AS (see section on Domestic Hot Water)	**NA**	X	X
	Remote AS (see section on Domestic Hot Water)	**NA**	X	X

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

		Current working state (current mode)			**Working state 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, changeover 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, changeover key)

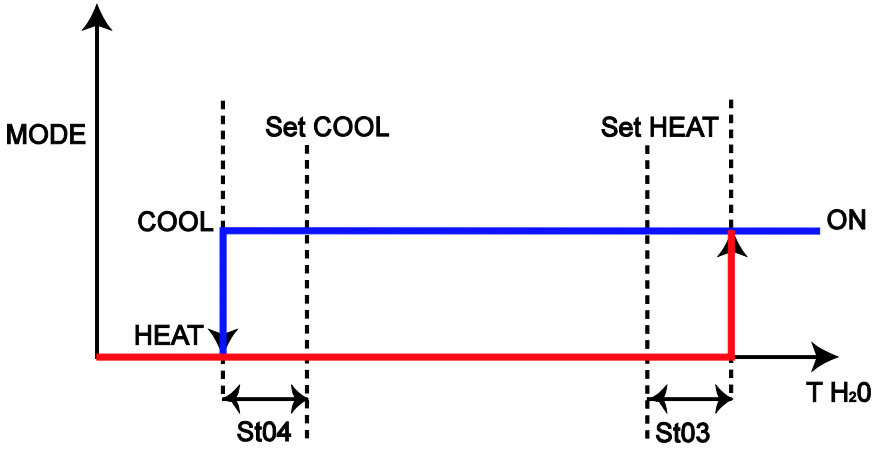
(§) In this case the key [local ON/OFF] has no effect on the operating mode
(*) it will not be possible to switch from COOL mode to HEAT mode (HEAT label not visible by pressing and holding ESC key (Mode changeover function))
(**) it will not be possible to switch from HEAT mode to COOL mode (COOL label not visible by pressing and holding ESC key (Mode changeover function))

8.1 Automatic changeover

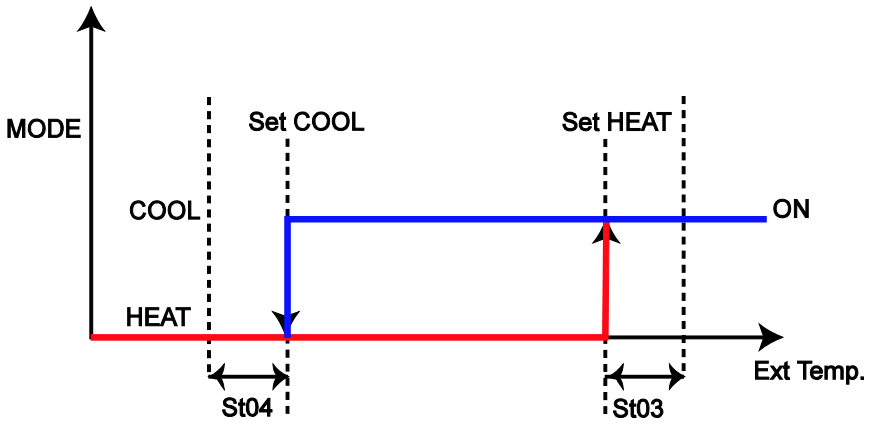
The automatic changeover function is enabled by parameter **St01- Enable changeover from analogue input**

The Cool/Heat modes are selected by means of two different differentials set by parameter (**St03 - Differential for change automatic mode in Heat** for heating mode and **St04 - Differential for change automatic mode in Cool** for cooling mode); in the neutral zone (between the two setpoints) the mode can also be set by pressing a key (if enabled). See the graph below for more details;

8.1.1 Example of automatic changeover based on water temperature



8.1.2 Example of automatic changeover based on external air temperature



MODE	Operating mode
T H2O	Water temperature (*)
Ext. Temp	External temperature (*)
COOL SETPOINT	**Real temperature control setpoint in Cool (**)**
HEAT SETPOINT	**Real temperature control setpoint in Heat (**)**
St03	Differential for automatic changeover in Heat
St04	Differential for automatic changeover in Cool

(*) If St01= 1 see parameters St02
(**) The real setpoints may differ from the values of parameters tr10 and tr20 – see Operating modes – Temperature control (folder PAr/tr)

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

8.2 Operating states table

Operating states and associated functions/algorithms enabled/disabled for each one are listed in the table below.
● Indicates 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	●	●		
Operating mode selection	●	●	●	
Compressor	●	●	●	
Internal circuit water pump	●	●	●	
Recirculation fan	●	●		
External exchanger fan	●	●	●	
External circuit water pump	●	●	●	
Internal circuit electric heaters	●	●	●	
External circuit electric heaters	●	●	●	
Auxiliary output	●	●	●	
Water heater		●	●	
Defrost		●		
Dynamic setpoint	●	●		
Economy	●	●		
Adaptive function	●	●		
Antifreeze with heat pump	●	●	●	
Power limitation	●	●		
Record running time	●	●	●	●
Reset manual alarms	●	●	●	●
Manual defrost		●		
MFK	●	●	●	●
Alarm log	●	●	●	●
Diagnostics	●	●	●	●
Serial communication	●	●	●	●

(°) In this case the button [local ON/OFF] has no effect on the operating mode

8.3 Reversal valve management

The change of state between chiller and heat pump requires the switching of the reversal valve.
In order to balance pressures in the circuits temporary inversion of valve status is performed prior to starting of the compressors in accordance with parameter **St08.**
Energy Flex makes it possible to set the valve switching mode ("slow"/"fast" switching) on the basis of the type of plant, by setting parameter **St05**.
Parameters **St06/St07** instead control transition at start and end of defrost.

INVERTER Compressor Note
Parameter **St06** is also used for inverter control of a BLDCM compressor to define the post-stopping time of the **Compressor 1 Inverter** output in certain situations: the value of this parameter must be selected in accordance with the application (inverter and inverter parametrisation).

Parameter	Changeover / transition	Changeover
St05	**Reversal valve switching delay**	**COOL - HEAT**
St06	**Reversal valve switching from Heat to Defrost delay**	**HEAT – defrost**
St07	**Reversal valve switching from Defrost to Heat delay**	**Defrost - HEAT**
St08	**Reversal valve activation time for pressure release**	temporary inversion of valve state

If switching time **St05** is other than zero, inversion of the valve for Heat-Cool or Cool-Heat changeover occurs only with the compressors off ("**soft inversion**" mode). The compressors are switched off and on according to set rules and times. This is a prudent mode but one that can guarantee the required efficiency and rapidity.

8.3.1 Changeover from Cool to Heat and vice versa

- The operation is described below – diagrams A...D.
- Operation in defrost is described in the related sections.
- Note that the mode changeover with St05=0 occurs also with the compressors running and operation is identical also in anti-freeze mode with a heat pump

Diagram	Parameter	Changeover	Antifreeze with heat pump
A	St05 different from 0	COOL - HEAT	//
B		HEAT - COOL	//
c	St05 = 0	COOL - HEAT	c
D		HEAT - COOL	D

Diagram A

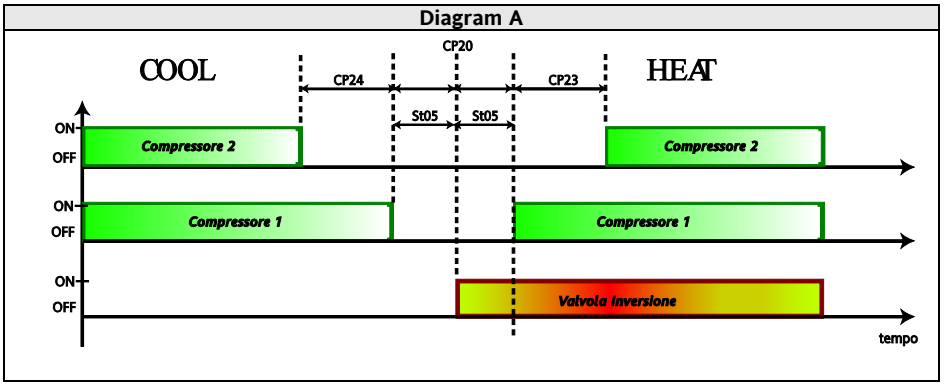
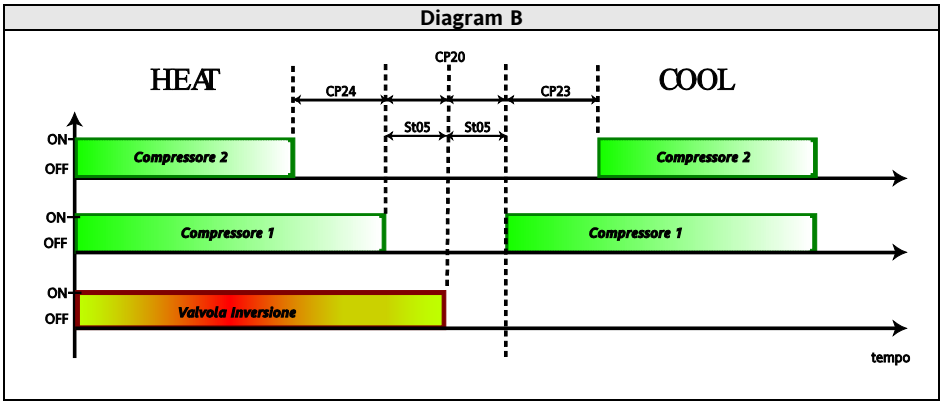


Diagram B



Parameter	Description
St05 different from 0	Reversal valve switching delay
CP20	Minimum off/on for same compressor
CP23	Minimum on/on time for same compressor
CP24	Minimum off/off time for different compressors

Diagram C

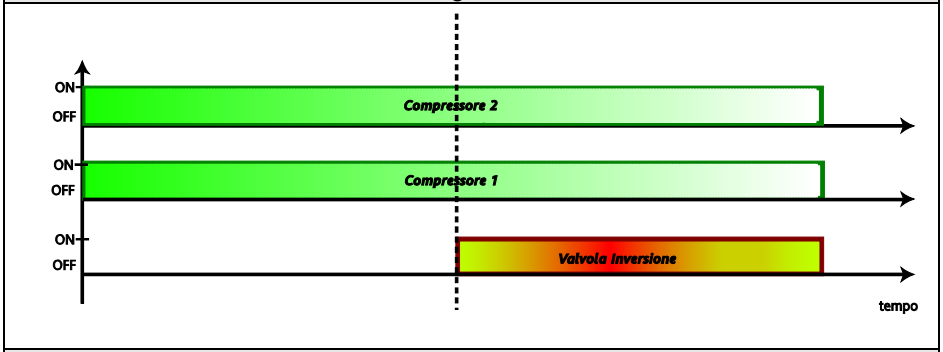
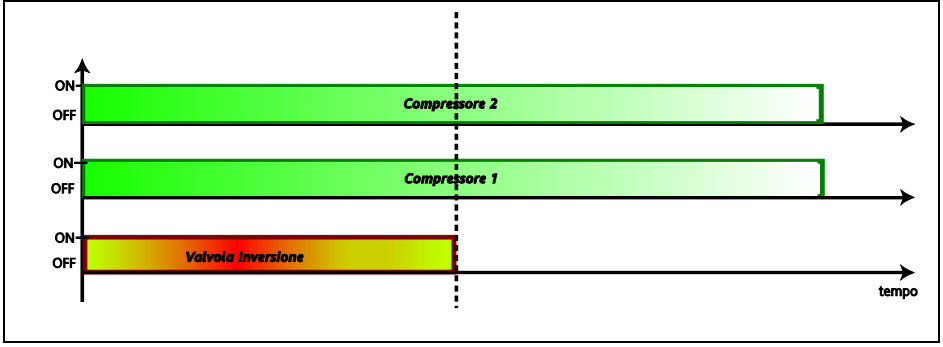


Diagram D



Parameter	Description
St05 = 0	Reversal valve switching delay

8.3.2 Changeover from Cool to Antifreeze and vice versa

Diagram	Parameter	Changeover
E	St05 different from 0	COOL - ANTIFREEZE
F		ANTIFREEZE - COOL

Diagram E

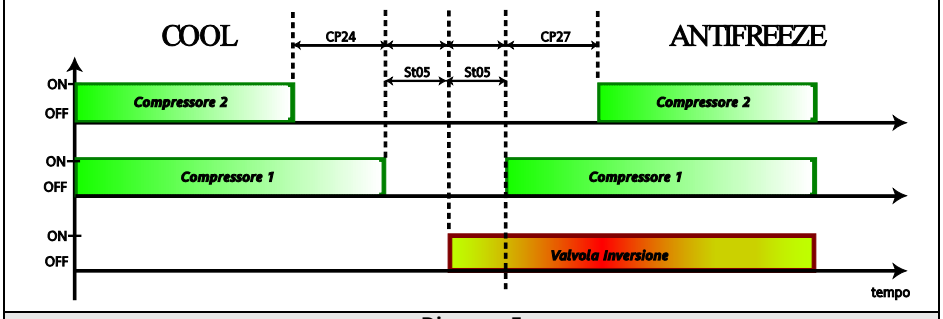
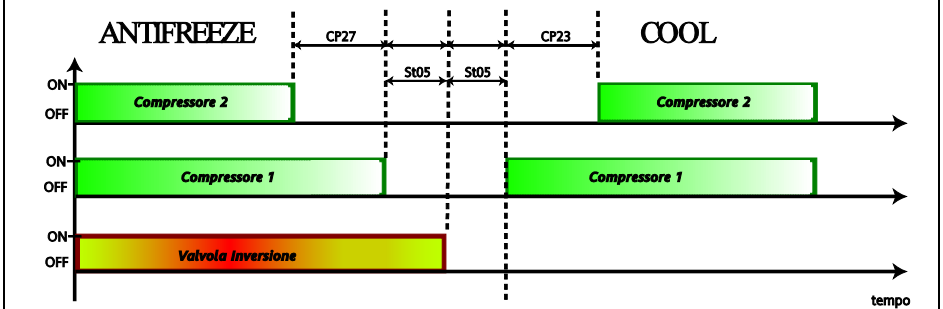


Diagram F



Parameter	Description
St05 different from 0	Reversal valve switching delay
CP27	Defrost compressor/step delay minimum

8.3.3 Heat – defrost mode changeover

Diagram	Parameter	Changeover
G	St06 different from 0	HEAT – defrost
H	St07 different from 0	Defrost - HEAT

Diagram G

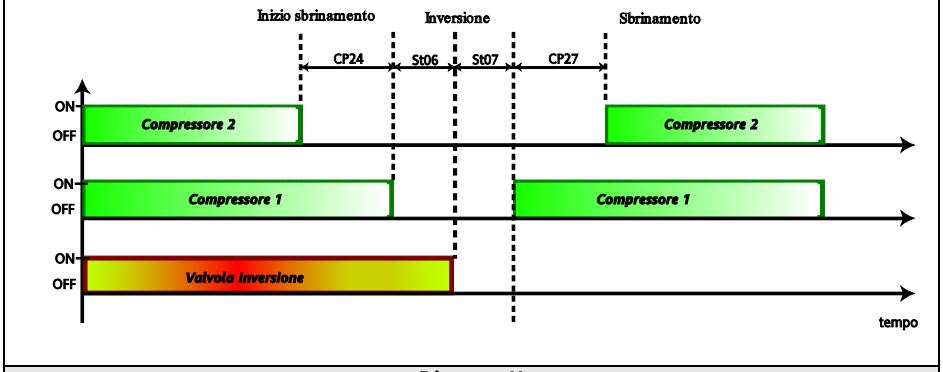
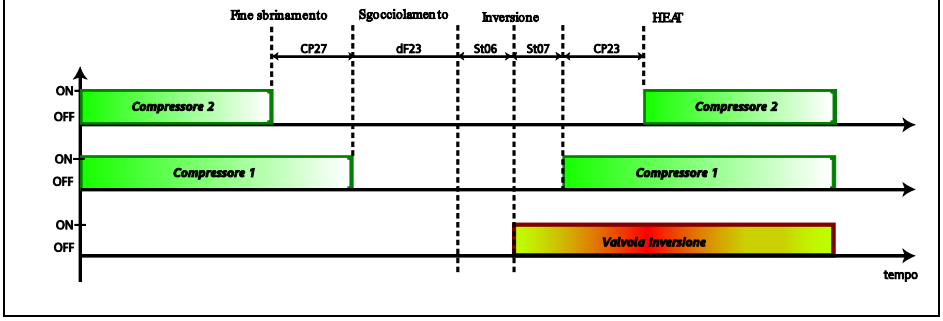


Diagram H



Parameter	Description
St06 different from 0	Reversal valve switching from Heat to Defrost delay
St07 different from 0	Reversal valve switching from Defrost to Heat delay
CP27	Defrost compressor/step delay minimum
dF23	Drip time

8.3.4 Circuit pressure release

If parameter **St08 – Reversal valve activation time for pressure discharge** is

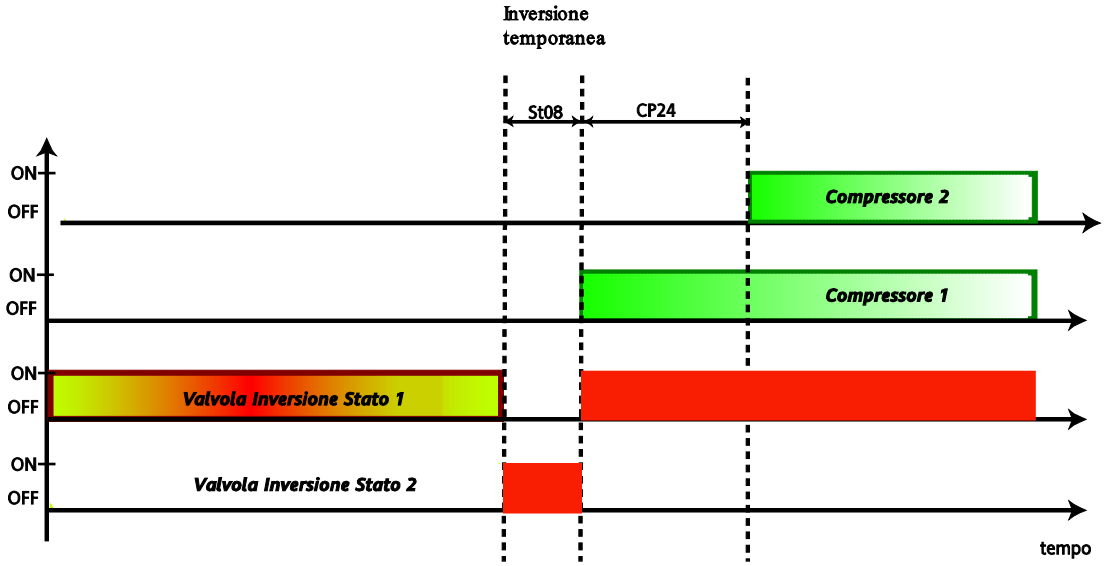
- set to a value different from zero
- none of the other control sequences described above are in progress, each time the compressors are switched on the reversal valve is temporarily inverted.

This results in improved balance in the circuits and ensures better restart of the compressors themselves

When the time **St08** has elapsed the valve returns to the previous position.

This activation of the valve always occurs exclusively with the compressors off,
The time interval is cancelled with immediate effect if new conditions arise that call for stopping of the compressors and immediate reset of the valve in the prior position.

Diagram



8.4 Cycle inversion and changeover of operating mode in XVD drivers

When the cycle in the refrigerant circuit is inverted it is very likely that the superheating regulation obtained by means of the XVD drivers will have very different performance specifications. This may be the case, for example, of the water/air circuits in which the exchangers, internal and external, are very different.
It may therefore be necessary to use 2 settings of the various regulation parameters (PID, superheating setpoint,...).
Hence operating mode command "1"=HEAT on activation of the inversion valve switching to HEAT mode, or operating mode command "0"=COOL on deactivation of the inversion valve at the time of return to cooling mode, will be transmitted to the XVD modules (if present).
The XVD modules can be set to disregard this command by setting the same parameters vector for the two operating modes (parameters 1E21, 1E22 and 2E21, 2E22).

More specifically, also to better explain the management of the vectors associated with the different operating modes, when 1E21 and 1E22 are set to 0, for both HEAT/COOL modes the values 1E30...1E53 will be used as specified in the parameters map of the SBA controller (transmitted to the XVD module via LAN like the other shared parameters, and overwritten on parameters dE30...dE53).
In contrast, when 1E21 and 1E22 assume values other than 0 (typically the permitted values are 12...16), for HEAT/COOL modes the values dE30...dE53 will be used as specified in vectors 12...16 of the parameters map of the XVD module.
The same occurs for the second XVD module, if present (parameters 2E21 and 2E22...).

9 COMPRESSORS (FOLDER PAR/CP)

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 timer intervals.

The Energy SBA600 is able to control "Reciprocating", "Scroll" and "Screw" compressors in a range of configurations.
The Energy SBA600 can control up to two refrigerant circuits, with one or two evaporators.
The Energy SBA600 can control from one to four capacity steps, at most two per refrigerant circuit.
The Energy SBA600 can also drive inverters for compressors by means of the following analogue outputs

- Analogue stage 1 for Compressor
- Analogue stage 2 for Compressor

The type of compressors management depends on the configuration of the analogue outputs;
The Energy SBA600 has 3 analogue outputs, 2 with voltage output 0-10V and one with current output 0-20 mA or 4-20 mA. Of the three outputs, a maximum of 2 can be configured as analogue outputs to control a compressor inverter; depending on the number of outputs configured only one or both the analogue stages (equivalent to a capacity step) are available.
NB: compressor management via inverter is only suitable for systems with non capacity-controlled compressors.

Safety time intervals can be set for the activation of compressors and capacity steps to prevent damage.
Special on/off sequences can be programmed to optimise the use of the available compressors and cooling capacity.

General conditions of operation
In **Off** status the compressors are stopped immediately and always (even when the safeties are active).
In Stand-by the compressors are normally OFF; during the transition from On to Standby, they are stopped in accordance with their timings. In Stand-by, the compressors are activated in anti-freeze with heat pump mode.

In **On**, in addition to the main control specified in subsequent paragraphs, the following situations are also possible (with priority given to the main control):

the compressors are switched off immediately in case of compressor shut-down alarms (see alarms table).

9.1 Types of compressor

Compressors may be controlled in a variety of ways according to their number, size and construction.
Parameter **CP00** indicates the **type of compressor**:

Value CP00	Description
0	Non capacity-controlled compressors
1	Reciprocating compressors with capacity control
2	Screw compressors with capacity control

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

- **CL90...CL95**= ±1...±4 for compressor 1...4

9.1.1 Non capacity-controlled compressors (CP00 = 0)

This is the simplest case, the single compressor is switched on/off via a single digital output. If several compressors are present they can be of the same or a different capacity and switched on according to the cooling capacity requirements of the installation.

Compressor without capacity control: **CP00** = 0.
N.B.: Set **CP03**=0

Capacity	Compressor
0	Off
100%	On

4 Identical compressors without capacity control: **CP00** = 0

Capacity	Compressor 1	Compressor 2	Compressor 3	Compressor 4
0	Off	Off	Off	Off
25%	On	Off	Off	Off
50%	On	On*	Off	Off
75%	On	On*	On*	Off
100%	On	On*	On*	On*

* In this case, the starting sequence is fixed. This may not always be the case.

Installations with inverter: since only two analogue outputs are available to drive compressors, if the installation has more than two compressors it must utilise mixed analogue and relay management; in this case the analogue capacity steps are always the "higher" steps, i.e. those that are furthest from the setpoint. Refer to the paragraph
Compressors Configuration / **Permitted configurations** in the case of compressors without capacity control (**CP00** = 0)
for the various combinations and configurations permitted based on the type of system, construed as the number of compressors and the number of circuits

9.1.2 Capacity controlled compressors (CP00 = 1,2)

The construction characteristics of these compressors enable them to modulate their cooling capacity output by means of capacity steps. Each compressor is switched on or off by a single digital output, but other digital outputs control its capacity in the same order as the cooling capacity required by the installation.
The compressor is always switched on or off without any capacity steps active.

There are two methods of activating capacity steps: for multiple cylinder reciprocating compressors, for screw compressors.
In the first case the capacity step is obtained by short circuiting the suction and discharge valves of the cylinders, in screw compressors it is obtained by diverting the discharge flow at various positions along the screw.
The activation logic for the capacity step relays is different in each case, see the following table:

Reciprocating compressors with 3 capacity steps: **CP00** = 1
3 capacity steps are provided, therefore the compressor can deliver 0%, 25%, 50%, 75% or 100% of its cooling capacity

Capacity	Compressor	Step 1	Step 2	Step 3
0	Off	Off	Off	Off
25%	On	On	On	On
50%	On	On	On	Off
75%	On	On	Off	Off
100%	On	Off	Off	Off

N.B.: The compressor control timings are different from those of the capacity steps. See Compressor intervals for more details.

N.B.: note that with **CP00** = 2, starting of the compressor (necessarily at 25% of its cooling capacity) occurs by activating two relays simultaneously.

9.2 Compressor configuration

The SB600 device can control from one to a maximum of four steps on a single circuit, or up to two steps per circuit for a total of two circuits.
The installation is configured with the parameters

- **CP01 - Number of circuits**
- **CP02 - Number of compressors per circuit**
- **CP03 - Number of capacity steps of compressor**

Multicompressor configurations always use compressors of the same type/construction.

Multicircuit installations always employ symmetrical circuits.

Permitted configurations:

- In the case of non capacity-controlled compressors (**CP0**0= 0)

CP00 = 0 (set **CP03**=0)		**Non capacity-controlled compressors**			
		CP02 = 1	**CP02 = 2**	**CP02 = 3**	**CP02 = 4**
Circuits	**CP01 = 1**	Compressor 1(§)	Compressor 1 (*) Compressor 2 (**) (§)	Compressor 1 Compressor 2 Compressor 3	Compressor 1 Compressor 2 Compressor 3 Compressor 4
	CP01 = 2	Compressor 1(*)	Compressor 1 Compressor 2	Not allowed	Not allowed
		Compressor 2(**)	Compressor 1 Compressor 2		
N.B.: Set CP03=0					

(§) Capacity step replaced by analogue stage 1 if a single analogue output is configured as compressor
(*) Capacity step replaced by analogue stage 1 if 2 analogue outputs are configured as compressor
(**) Capacity step replaced by analogue stage 2 if 2 analogue outputs are configured as compressor
N.B.: asymmetrical or unbalanced distributions of inverter controls for compressors are not permitted

- In the case of capacity controlled compressors (**CP00** = 1 and 2) with 1 capacity step per compressor (**CP03** = 1)

CP00 = 1 and 2 **CP03** = 1		**Compressors with 1 capacity strep**			
		CP02 = 1	**CP02 = 2**	**CP02 = 3**	**CP02 = 4**
Circuits	**CP01 = 1**	Compr 1, Step 0 Compr 1, Step 1	Compr 1, Step 0 Compr 1, Step 1 Compr 2, Step 0 Compr 2, Step 1	Not allowed	Not allowed
	CP01 = 2	Compr 1, Step 0 Compr 1, Step 1 Compr 2, Step 0 Compr 2, Step 1	Not allowed	Not allowed	Not allowed

KEY: (Compr. = compressor)

- In the case of capacity controlled compressors (*Type of compressor* = **CP00** = 1 and 2) with 2 capacity steps per compressor (*Number of capacity steps per compressor* **CP03** = 2)

CP00 = 1 and 2 **CP03** = 2		**Compressors with 2 capacity steps**			
		CP02 = 1	**CP02 = 2**	**CP02 = 3**	**CP02 = 4**
Circuits	**CP01 = 1**	Compr 1, Step 0 Compr 1, Step 1 Compr 1, Step 2	Not allowed	Not allowed	Not allowed
	CP01 = 2	Not allowed	Not allowed	Not allowed	Not allowed

- In the case of capacity controlled compressors (**CP00:** *Type of compressor* = 1 and 2) with 3 capacity steps per compressor (**CP03:** *Number of capacity steps of compressor* = 3)

CP00 = 1 and 2 **CP03** = 2		**Compressors with 3 capacity steps**			
		CP02 = 1	**CP02 = 2**	**CP02 = 3**	**CP02 = 4**
Circuits	**CP01 = 1**	Compr 1, Step 0 Compr 1, Step 1 Compr 1, Step 2 Compr 1, Step 3	Not allowed	Not allowed	Not allowed
	CP01 = 2	Not allowed	Not allowed	Not allowed	Not allowed

9.3 Compressor time intervals

Compressor and capacity step on/off states must be "time limited" to ensure the mechanical and electrical safety of the equipment.
The SBA600 provides a set of safety parameters for protection of compressors and capacity steps.
In some cases these parameters are not considered, such as during defrosting, to guarantee the required machine performance. In other cases the safety times may influence or modify the compressor starting logic.

- **CP20: Minimum on/off for same compressor** **[Secx10]**
- **CP21: Minimum on/on time for same compressor** **[Secx10]**
- **CP22: Minimum compressor on time** **[Secx10]**
- **CP23: Minimum start/start time for different compressors** **[Sec]**
- **CP24: Minimum on/on time for different compressors** **[Sec]**
- **CP25: Minimum compressor on time per splitting increment** **[Sec]**
- **CP26: Minimum compressor on time per splitting decrease** **[Sec]**
- **CP27: Defrost compressor/step delay minimum** **[Sec]**

9.3.1 Minimum time between stops/starts for the same compressor

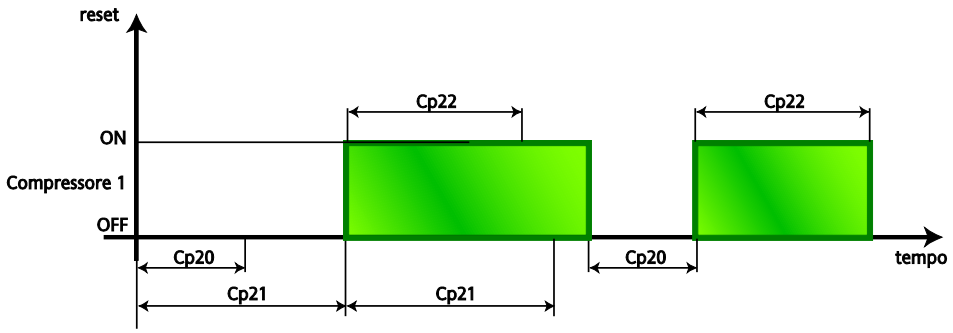
Defined by parameter **CP20:** *Minimum on/off time for same compressor* is the minimum time that must elapse between one switch-off and the next start-up. This is expressed in seconds x 10 and is active even after a reset.

9.3.2 Minimum time between start/start for the same compressor

Defined by parameter **CP21:** *Minimum on/on for same compressor* is the minimum time that must elapse between one start and the next. This is expressed in seconds x 10 and is active even after a reset.

9.3.3 Minimum compressor on time

Parameter **CP22:** *Minimum compressor on time* defines the minimum time between a compressor start and compressor stop. It is expressed in seconds x 10.

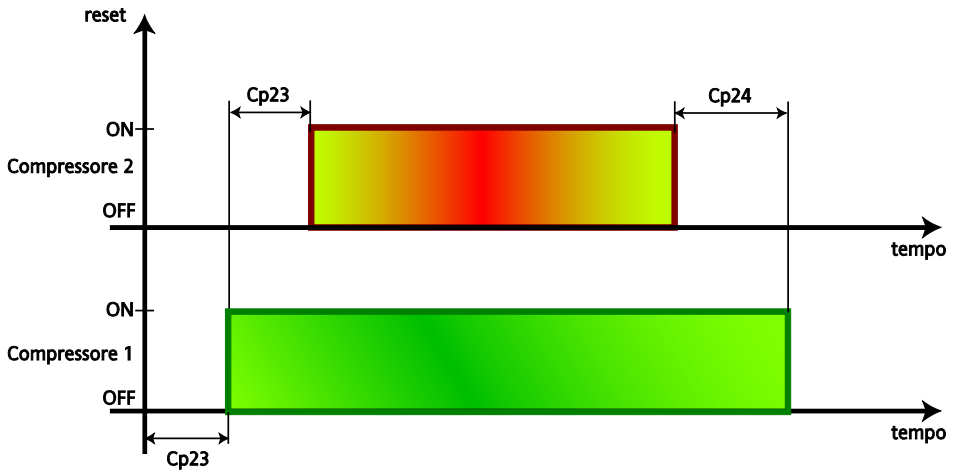


9.3.4 Minimum on-on for different compressors

Parameter **CP23:** *Minimum compressor on/on time for different compressors* defines the minimum time lag between starting of two different compressors. If requested, a compressor can be started only after this time has elapsed since the previous compressor was stopped. This is expressed in seconds and is active even after a reset.

9.3.5 Minimum off-off time for different compressors

Parameter **CP24:** *Minimum off/off time for different compressors* defines the minimum time lag between stopping of two different compressors If requested, a compressor can be stopped only after this time has elapsed since the previous compressor was stopped. This is expressed in seconds and is active even after a reset.



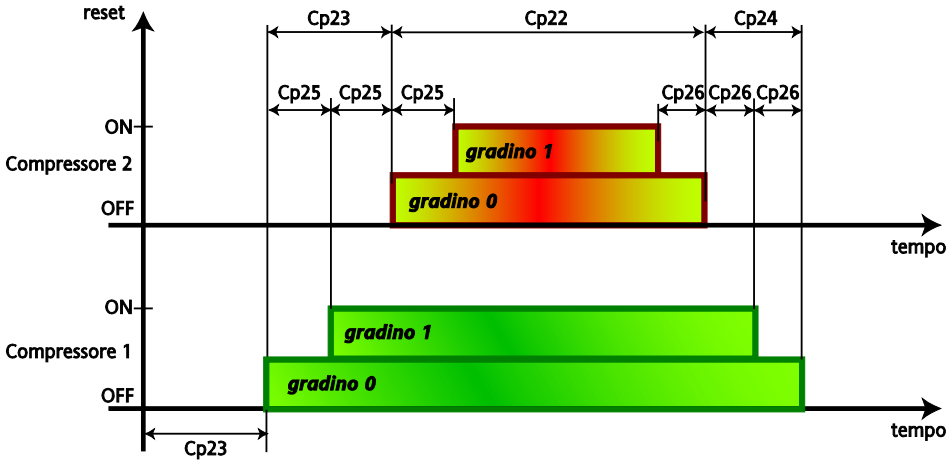
9.3.6 Minimum compressor on time for increase in capacity control

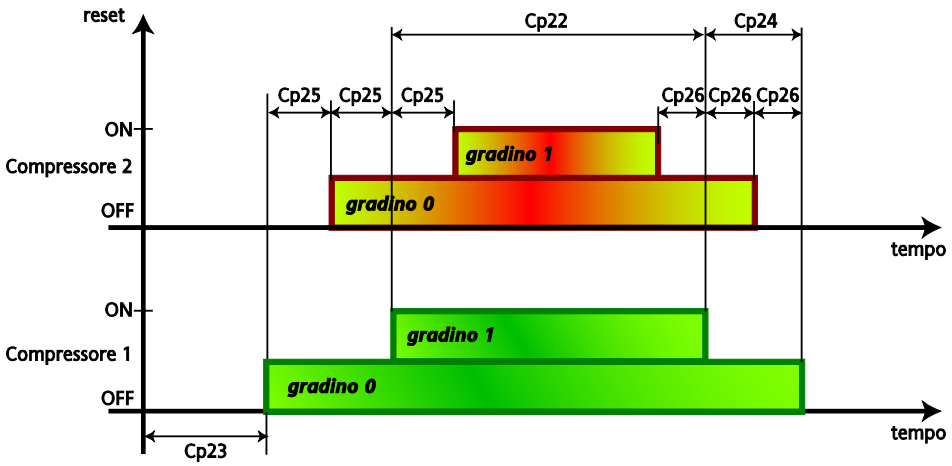
Parameter **CP25:** *Minimum compressor on time for splitting increment* defines the minimum time between capacity increases (steps) associated with capacity control. It is expressed in seconds.

9.3.7 Minimum compressor on time for decrease in capacity control

Parameter **CP26:** *Minimum compressor on time per splitting decrease* defines the minimum time between capacity decreases (steps) associated with capacity control. It is expressed in seconds.

Note. **CP25** and **CP26** assume priority over **CP23** and **CP24**





Note: When safety time intervals “overlap”, the longest one prevails.

9.3.8 Minimum on-off time in defrost mode

In defrost mode and during antifreeze with heat pump, times **CP23**, **CP24**, **CP25** and **CP26** are disregarded and replaced with parameter **CP27:** *Defrost compressor/step delay minimum* is the single minimum time for increase or release of a generic capacity step.
In other words, this safety timing applies both between compressors, between capacity steps, and between compressors and capacity steps.
All other safety timings are ignored in this phase. This speeds up the start and end of defrost cycles, or at least, controls their duration.

9.3.9 Other timings

Compressors are also subject to other timings related to the operational status of other services such as water pumps, cycle inversion valves, etc.
For details, see the chapters devoted to such services.

9.4 Compressor on/off sequence

9.4.1 Availability of resources

A resource is available if it can be used (switched on/off).

A compressor (or its capacity control, if applicable) is available if
- it is not blocked due to an alarm (see alarms section)
- it is not blocked by safety timings (see compressors section)
- it is not blocked by the configuration (see compressors section)
- there are no blocks caused by temperature control (e.g. heat pump block, capacity limitation, etc.)

In checking the availability of resources, the sequence Compressors → Circuits is always followed.

When selecting (activating/deactivating) resources the opposite sequence is followed: Circuits → Compressors (selection of the evaporator coincides with selection of the relative circuit).

A circuit is said to be saturated when it is delivering all the capacity steps available from its compressors. A circuit is said to be active or on if at least one compressor is running, and off if none of the compressors is running. The current activation level of a particular circuit is defined as the total number of capacity steps that the compressors are supplying at the time (for example, a circuit that has 2 compressors with 1 capacity step has a maximum activation of 4 levels/steps).

A compressor is said to be saturated when it is supplying its maximum number of deliverable steps (for example, a compressor with 3 capacity steps can supply at most 4 activation levels/steps). A compressor is said to be active or on if it has at least one active step. The current activation level of a compressor is defined as the total number of capacity steps that it is supplying at the time (for example, a compressor with 2 capacity steps can supply up to 3 activation levels/steps).

9.4.2 Resources management

If the number of active steps satisfies the current request, it is not modified.

If the temperature regulator requests activation/deactivation of a capacity step, the availability of the compressors and circuits is first analysed in order to manage the services on the basis of two possible logics, saturation and balancing.
The procedure is to first select the best circuit and then the best compressor in that circuit.

Saturation: The saturation policy attempts to distribute resources equally over the smallest possible number of services compatible with the constraints imposed by other requirements, for example compressor safety timings.
The resulting allocation is intended to have the largest possible number of compressors switched of and the largest possible number of circuits deactivated at any one time.

Balancing: The balancing policy attempts to distribute resources equally over the largest possible number of services compatible with the constraints imposed by other requirements, for example compressor safety timings.
The resulting allocation is such as to have compressor and circuit output levels equalized as far as possible at all times (in other words, the smallest number of compressors and circuits off).

There are two parameters that make it possible to establish circuit (and evaporator) activation separately as well as activation of the compressors for each circuit;
- **CP10: Enable circuit balancing**
- **CP11: Enable compressor balancing**

Value CP10 CP11	Description CP10	Description CP11
0	Saturation (circuits)	Saturation (compressors)
1	Balancing (circuits)	Balancing (compressors)

9.4.3 Resource selection criterion

When the two management selections are applied (saturation and balancing), it may become necessary to choose between resources available at the same conditions (for example, when switching on the very first service of all). This selection must therefore also take into account factors such as hours of operation and fixed on/off sequences.
The hours of operation of a circuit is the sum of the operating hours of its compressors.

Hours of operation: When making a choice the strategy is to select the circuit or compressor that has the fewest running hours when switching on, and the one with most running hours when switching off. This strategy ensures that all resources are used equally.

Fixed sequence: **On(1-2-3-4), Off(4-3-2-1)**
In this case, selection of the circuit or compressor follows a fixed sequence (assuming the resources are available). This option uses the resources in a preset manner, which can be useful in case of steps of different capacity or when managing secondary backup resources in special circumstances.

Fixed sequence INVERTER compressor: **On(1-2-3-4), Off(4-3-2-1)**
Only usable option in the case of single-circuit configuration with at least one compressor managed by INVERTER

Running time: This option applies on when there is a single circuit with two compressors (without capacity control) or two circuits with two compressors each, and uses the compressor resources (in this case, non-homogeneous) in a manner that is equal to the load.
If the effective operating time of the circuit (TE, time between starting the first compressor and stopping the last compressor during the previous cycle) is less than the time set by parameter, on the next request from the temperature regulator (for that specific circuit) the first compressor resource to be activated will be the one with the lowest index ("resource 1") and then resource 2; if the effective operating time of the circuit is greater than the time set by parameter, on the next request from the temperature regulator the first compressor resource to be activated will be the one with the highest index ("resource 2") and then resource 1;

There are two parameters that serve to establish, independently, the circuits selection criterion and the compressors selection criterion for each circuit:

- **CP12: Circuit selection criterion**
- **CP13: Compressor selection criterion**

Value	Description CP12	Description CP13
0	Hours balancing	Hours balancing
1	Sequence On 1,2; Off 2, 1	Sequence On 1,2,3 and 4; Off 4,3,2 and 1
2	//	Operating time

9.4.4 Selecting the circuit/evaporator

Parameter **CP10:** *Enable circuit balancing* is only relevant if there are 2 circuits. If set to 0 (saturation) first all the capacity steps of one circuit are activated, followed by those of the other circuit. If set to 1 (balancing), the capacity steps are activated in such a way that both circuits deliver the same cooling capacity, or such that the difference is no more than one step.
The choice of circuit depends on parameter **CP12: Circuit selection criterion**

CP12	**Saturation** **CP10 = 0**	**Balancing** **CP10 = 1**
Hours of operation **CP12 = 0**	When switching on, the circuit with the least hours of operation is selected (with compressors available for starting) up to saturation, then the second circuit is activated. When switching off, first the circuit with the fewest active capacity steps is switched off (with compressors available for switch-off), or (for an equal number of active capacity steps) the one with the more running hours.	When switching on, the procedure starts with a step of the circuit with the fewest running hours (with compressors available to start), this is then balanced with a step from the other circuit and so forth until both circuits are saturated. When switching off, the opposite sequence is followed, giving priority to the circuit with most running hours (with compressors available for switch-off).
Fixed sequence **On(1,2) Off(2,1)** **CP12 =1**	When switching on, the first circuit is used up to saturation, after which the second circuit is activated. When switching off, first the entire second circuit is switched off, followed by the first circuit.	When switching on, the procedure starts with a step of the first circuit, this is then balanced with a step from the second circuit and so forth until both are saturated. When switching off, the opposite sequence is followed.

9.4.5 Selecting the compressor or capacity step

Parameter **CP11:** *Enable compressor balancing* is relevant only if there are 2 compressors with capacity control in the same circuit (which for the SBA600 remains single, since it cannot control a second compressor with the same characteristics).
Selecting 0 (saturation) all the capacity steps of one compressor are first activated, followed by those of the other compressor. Selecting 1 (balancing), the capacity steps are activated in such a way that both circuits deliver the same cooling capacity, or such that the difference is no more than one step. The choice of compressor depends on parameter **CP13:** *Compressor selection criterion*.
Parameter **CP14:** *Compressor operating time for on sequence* is used if the running time in the previous cycle is used as the selection criterion.

CP13	**Saturation** **CP11 = 0**	**Balancing** **CP11 = 1**
Hours of operation **CP13 = 0**	When switching on, the available compressor with the fewest running hours is started and operated up to the saturation point, after which the other compressors are started. When switching off, first the available compressor with the least capacity steps active is selected, or (for an equal number of capacity steps active) the one with the most running hours.	When switching on, the procedure starts with the first capacity step stage of the compressor with least hours of operation, then the first step of the next compressor until all compressors are operating, then the second steps, etc. When switching off, the procedure switches off the capacity steps of the available compressors with the same logic, with priority awarded to those with the most running hours.
Fixed sequence **On(1,2,3,4)** **Off(4,3,2,1)** **CP13 = 1**	When switching on, the first compressor is started up to saturation, after which the second compressor is started, and so forth. When switching off, first the compressor with the highest index is deactivated until it is completely stopped, and so forth.	When switching on, the procedure starts with the first capacity step of the first compressor, then the first capacity step of the second compressor until all compressors are running, then the second capacity steps, and so forth. When switching off, the capacity steps are switched off with the same logic, starting from the one with the highest index.
Operating time **CP13 = 2**	CP11 is irrelevant inasmuch as selection by operating time is not envisaged if there are 2 capacity controlled compressors in the same circuit. If the effective operating time of the *circuit* is less than the time set in parameter CP14, at the next temperature regulator request the start sequence On(1,2) and the stop sequence Off(2,1) will be used. In the case of two circuits with two compressors each, the start sequence will be On(3,4) and the stop sequence will be Off(4,3), independently for the two circuits. In contrast, if the operating time is greater than CP14 the next sequences will be On(2,1) and Off(1,2).	

10 INTERNAL CIRCUIT PUMP (FOLDER PAR/PI)

The **SBW600** controls one or two hydraulic pumps on the internal exchanger water circuit. Control may be digital or analogue, and depends on a number of system variables such as temperature controller status, external exchanger fan speed and internal exchanger water temperature.
For systems with two pumps, these are connected in parallel, and at most one is operational at a time.

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

The following must be configured:

Digital control
- at least one digital output as internal circuit water pump 1, using the parameters **CL90...CL97 / CL80-CL81 if digital / CL61...CL63 if digital = ±14.**
- **at least one digital output as internal circuit water pump 2, using the parameters **CL90...CL97 / CL80-CL81 if digital / CL61...CL63 if digital = ±15.**

Analogue control
- at least one analogue output as modulating internal circuit water pump 1, using the parameters **CL80-CL81 if analogue / CL61...CL63 if analogue = ±59.**
- **at least one analogue output as modulating internal circuit water pump 2, using the parameters **CL80-CL81 if analogue / CL61...CL63 if analogue = ±60.**

** in the case of two pumps

The configurable outputs for digital pump control are relays, whereas in modulating operation they are the internal triac (for direct control) or the pulse outputs (for external triacs) and the analogue outputs.

10.1 Configuration of internal circuit water pump

Enabling
The controller is enabled by setting parameter (**Pi00 -Select internal circuit water pump operating mode)** not equal to 0.
Control of the second pump is enabled only if parameter **(Pi05 - Maximum internal circuit water pump changeover start time** is not equal to 0.

Table 1

	Parameter	Description	value		
			0	**1**	**2**
I pump	**P100**	**Select internal circuit water pump operating mode**	Pump disabled	Continuous operation (Always ON)	on request (pump on when compress or on)
			0	**Not equal to 0**	
II pump	**PI05**	**Maximum internal circuit water pump changeover start time**	Pump disabled	after this time (in minutes) the active pump is switched off and replaced by the second pump if available.	

Table 2

	Par	Description	value		
			0	**1**	**2**
antifreeze heater	**PI10**	**Enable internal circuit water pump on when antifreeze heaters active**	Internal circuit water pump disabled	Internal circuit water pump enabled	//
Boiler	**PI11**	**Enable internal circuit special water pump**	No enabling	Enable pump when the boiler is on	Enable modulating pump on the basis of the difference between internal exchanger water/air inlet temperature and Internal exchanger water/air outlet temperature. See configuration of analogue inputs

General conditions of operation
At any given time, only one of the pumps may be operating, so that we will talk below of "the pump", rather than "the pumps".

- In **Off** the internal circuit pump is immediately and always off (even if post-pumping is underway).
- In **Standby** the internal circuit pump is normally off; during the transition from On to Stand-by, the pump is switched off in accordance with its timings (e.g. post-pumping). In Standby, the pump is activated in: antilock, antifreeze with water pump, antifreeze with internal heater, antifreeze with heat pump.
- In **On**, further to the principal regulation specified in the following paragraphs, the following situations (with priority over the principal regulation itself) may occur:
- In *Defrosting* the internal circuit pump is always on (at maximum speed if of the modulating type);
- The pump is forced on (at maximum speed if of the modulating type) if *antifreeze with water pump* is active, which is also active in Standby;
- The pump is forced on (at maximum speed if of the modulating type) if *antilock* is active, which is also active in Standby;
- The pump is forced on (without delays) if the internal heater is on in integration mode, both to prevent damage to the exchanger and to ensure that the heat is effectively dispersed/used.
- The pump be forced on (at maximum speed if of the modulating type) if *antifreeze with* internal circuit heater is active, depending on parameter **Pi10:** *Enable internal circuit water pump on when antifreeze heaters active* (also active in Standby);
- The pump may be forced on (without delays and at maximum speed if modulating) if the *boiler* is active, depending on parameter **Pi11:** *Enable internal circuit special water pump*; with **Pi11** = 0, if only the boiler is active and the pump is enabled on request, the pump is normally off;
- The pump is influenced by the Sanitary Water regulator if the value of parameter AS00 is 4 or 6 e.g. with systems provided with the Sanitary Water pump rather than the Sanitary Water valve. This influence is due to the fact that the two pumps cannot both be ON at the same time; see the section on Sanitary Water
- The pump is switched off immediately in case of pump block alarm (see alarms table and flow switch paragraph).

Note: If an automatic reset flow switch alarm occurs, the pump is kept on to allow it to be reset; if the alarm becomes manual reset, the pump is switched off.

Note: The minimum pump off/on period is fixed at 10 seconds. This applies to both pumps individually.

10.1.1 Control of the second pump

The system's two pumps are connected in parallel, and at most one is operational at a time.
At each activation request the pump with least operating hours is activated, if available, i.e. if there is no thermal switch alarm.
If it is not available, the other pump is activated.

If the active pump is active for longer than the time given in parameter **Pi05 - Maximum internal circuit water pump changeover start time**, it is switched off and the other is turned on (if available, otherwise the timer is set to zero and the same pump keeps running).

10.2 Continuous operation

Case **Pi00**= 1.

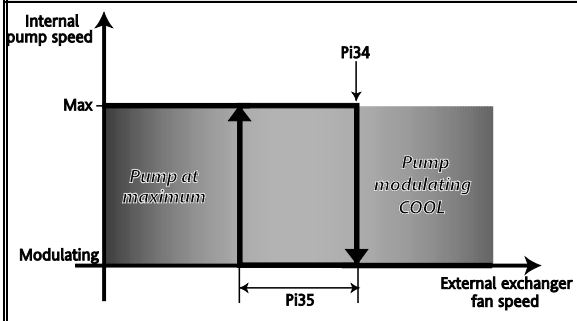
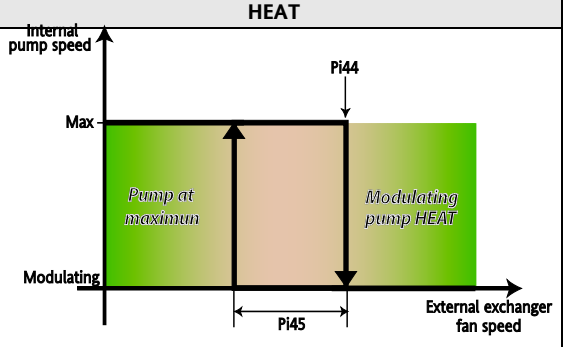
10.2.1.1 Internal circuit pump digital control in Cool / Heat

One of the two digital outputs is always active.

10.2.1.2 Internal circuit pump analogue control in Cool / Heat

One of the two analogue outputs is always active and controlled in continuous mode.

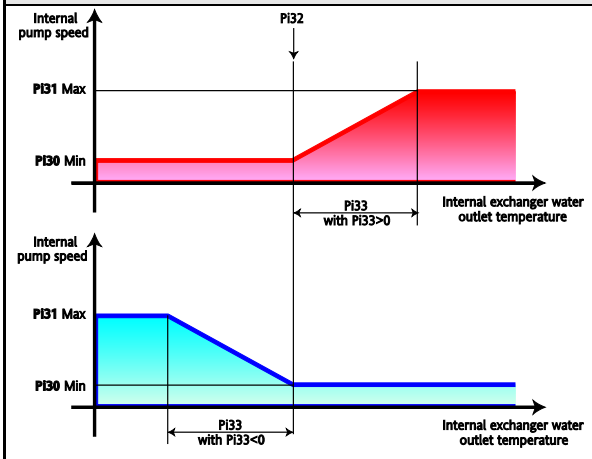
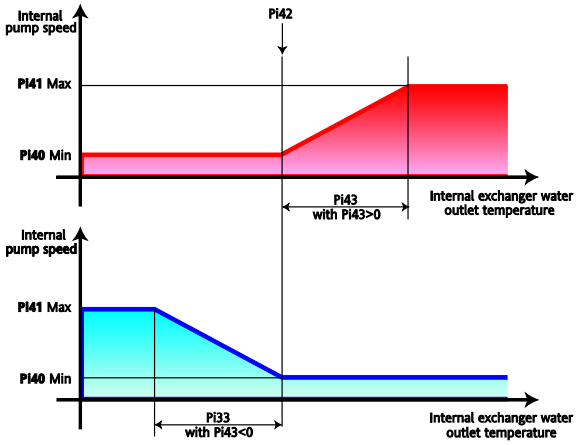
The modulating operation of the internal circuit water pump is either active or not depending on the external exchanger fan speed. In the case of two circuits, we take the average speed of the two fans.

Diagram A	Diagram B
COOL	HEAT
	

Parameter		
COOL	HEAT	Description
PI02		Internal circuit water pump pick-up time.
PI30	PI40	Minimum speed internal circuit water pump in Cool / Heat
PI31	PI41	Maximum speed internal circuit water pump in Cool / Heat
PI34	PI44	Fan speed setpoint to modulate internal circuit water pump in Heat
PI35	PI45	Fan speed hysteresis to modulate internal circuit water pump in Heat
Control sensor		Internal exchanger water/air outlet temperature or the difference between • Internal exchanger water/air inlet temperature and • Internal exchanger water/air outlet temperature

Modulating function in Cool / Heat mode

The internal circuit modulating pumps connected to the analogue outputs are switched on at maximum speed (relative to the current mode of operation) for a period given in parameter **Pi02 - Internal circuit water pump pick-up time**. After this time, the pump is run at the speed requested by the controller.

Diagram C	Diagram D
COOL	HEAT
	

Parameter		
COOL	HEAT	Description
PI02		Internal circuit water pump pick-up time.
PI30	PI40	Minimum speed internal circuit water pump in Cool / Heat
PI31	PI41	Maximum speed internal circuit water pump in Cool / Heat
PI32	PI42	Minimum internal circuit water pump speed setpoint in Cool/Heat
PI33	PI43	Internal circuit water pump proportional band in Cool / Heat
Control sensor		Internal exchanger water/air outlet temperature or the difference between • Internal exchanger water/air inlet temperature and • Internal exchanger water/air outlet temperature

Note The pump runs *at minimum speed* if the compressors are off.
Note A probe must be configured as *Internal exchanger water/air outlet temperature* and if two probes are so configured, the average **is taken.**
Note: If Pi00=2 e.g. if the difference between
- Internal exchanger water/air inlet temperature and
- Internal exchanger water/air outlet temperature

is considered, it is not permitted to have two output probes.

10.3 Operation on call

Case **Pi00**= 2.

10.3.1.1 Internal circuit pump digital control in Cool / Heat

One of the two digital outputs is active in parallel with the compressor. The internal circuit pump is activated when the main temperature controller calls the first step. The compressor starts after the delay given in parameter **Pi20:** *Delay internal circuit water pump on and compressor on* (Pre-pumping). Once the last power stage of the compressor is off, the pump is switched off after the delay given in **Pi21**: *Delay compressor off - internal circuit water pump off* (Post-pumping).

Note: Post-pumping is also observed in standby mode.

10.3.1.2 Internal circuit pump analogue control in Cool / Heat

The two analogue outputs are activated in the same situations in which the digital outputs are activated (with pre / post-pumping) but allow for analogue control, with modulating operation according to the diagrams in the previous paragraphs for continuous operation (modulation as a function of the internal exchanger water/air outlet temperature probe value or the **average** of the two).

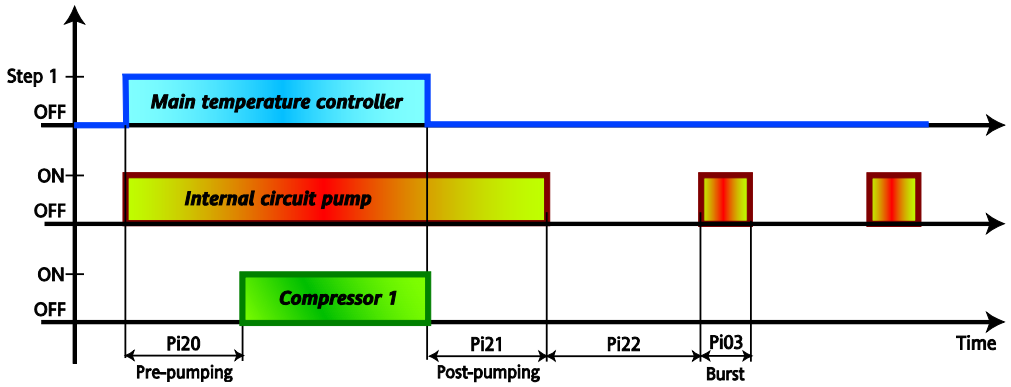
Note. The pump runs *at minimum speed* if the compressors are blocked by alarms.

10.3.1.3 Operation on call: periodic pump activation

The function is **enabled** of **Pi22** is not equal to 0, and allows water to be driven round the circuit at regular intervals for improved temperature control (the real water temperature in the circuit can always be measured periodically), with consequent energy savings.

Use **parameter Pi22:** *Maximum pump of time in operation on call* to establish a maximum time for the pump to stay off after which it is forced on (so long as there are no block alarms, and at maximum speed if modulating) for the minimum time defined in **Pi03:** *Minimum pump on time*.

Note: This function is disabled in standby.



Note: The activation of the compressor could also be delayed by other safety timings, this means that the pre-pumping time could be longer (never shorter).

10.4 Pump antilock mode

This function prevents any mechanical faults due to extended disuse.

The antilock function is active when:

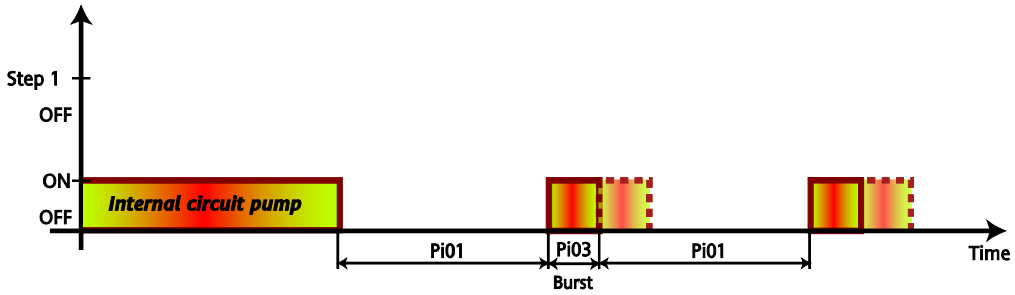
- enabled by parameter (**PI01 -** Internal circuit water pump idle time due to antilock > 0). See **table 3**
- always active, except for OFF (local and remote) unless alarms switch off the pump

If the pump stays off for longer than or equal to **Pi01:** *Internal circuit water pump idle time due to antilock*, the controller forces it on (at maximum speed if modulating) for the time set in parameter **Pi03:** *Minimum pump on time*.

Table 3

Antilock	Parameter	Description	Value	
			0	**>0**
	PI01	Internal circuit water pump idle time due to antilock	Function disabled	Function enabled
Diagram E	**PI03**	**Minimum internal circuit water pump start time**	Time in seconds x 10	

Diagram E Pump antilock



Note: the broken line indicates the second pump, if present

10.5 Antifreeze operation with pump

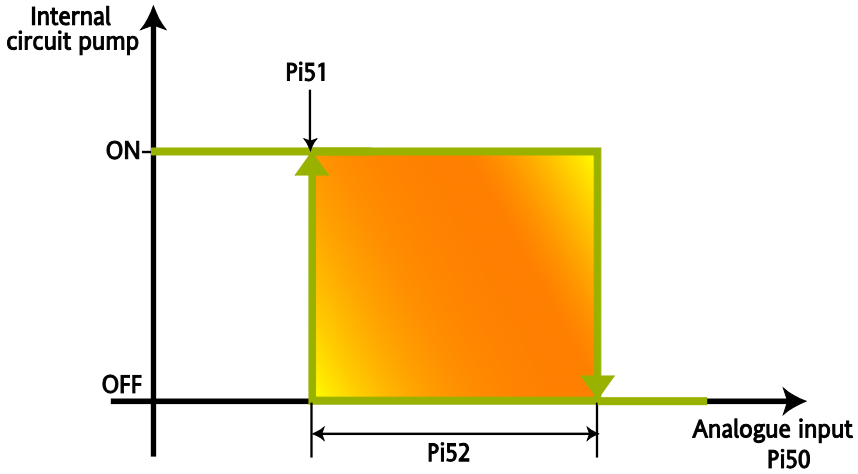
The antifreeze function runs when:
enabled by parameter **Pi50 -Select probe for internal circuit + water pump antifreeze.**

- See **table 4**
- always active, except for OFF (local and remote) and Stdby (local and remote) unless alarms switch off the pump

Table 4 - Pi50

Value	Probe
0	No probe (pump in antifreeze disabled)
1	Internal exchanger water/air inlet temperature
2	Internal exchanger water/air outlet temperature
3	Internal exchanger water outlet temperature circuit 1
4	Internal exchanger water outlet temperature circuit 2
5	Circuit 1 and 2 internal exchanger water outlet minimum temperature
6	External temperature

Diagram F Antifreeze operation with pump



Parameter	Description
PI51	**Internal circuit water pump regulator setpoint for antifreeze**
PI52	**Internal circuit water pump regulator hysteresis for antifreeze**
Control probe Pi50	**Select probe for internal circuit + water pump antifreeze**

Note. If the probe selected for antifreeze with the internal circuit pump is in error, the machine is blocked.

11 RECIRCULATION FAN (FOLDER PAR/FI)

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

The following must be configured:

- at least one digital output as recirculation fan using parameters **CL90...CL97 / CL80-CL81 if digital / CL61...CL63 if digital = ±18.**

Enabling
The controller is enabled by setting parameter (**Fi00 -Select recirculation fan operation)** not equal to 0.

Table 1 - Parameter Fi00

	Parameter	Description	value		
			0	**1**	**2**
Enabling	**Fi00**	**Select recirculation fan operation**	Recirculation fan disabled	Recirculation fan continuous operation	Recirculation fan operation on temperature controller call

General conditions of operation
- In **Off** the recirculation fan is immediately off (even when post-ventilation in underway).
- In **Standby** teh fan is off, in accordance with established timings (e.g. post-ventilation). ote: the fan remains on until all of the compressors have been switched off
- In **On**, further to the principal regulation specified in the following paragraphs, the following situations (with priority over the principal regulation itself) may occur:
  - In defrost, the recirculation fan is off (as per parameter **Fi03:** *Post-ventilation time in Heat mode*);
  - if at least one of the internal exchanger heaters is on, the fan is *forced* on (absolute priority); after the last heater has been turned off, parameter **Fi03:** *Post-ventilation time in Heat mode* applies;
  - if alarm **Er30:** *Internal circuit antifreeze alarm*, is active, the fan is forced on;
  - the recirculation fan is immediately switched off in case of a blocking alarm (see alarms table)

11.1.1 Continuous operation

Case Fi00 = 1.
The digital output recirculation fan, is always on except in the conditions specified in the general conditions of operation section.

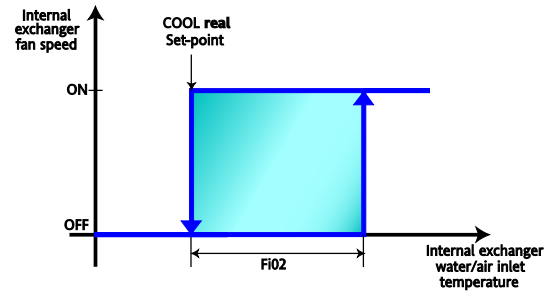
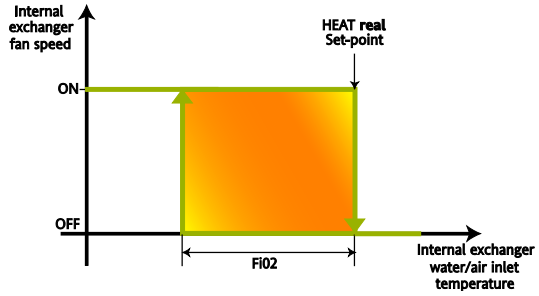
11.1.2 Operation on call

Case Fi00 = 2.
Activation of the recirculation fan depends on the status of the compressors (not of the compressor temperature controller), of the temperature measured by the internal exchanger water/air inlet temperature probe, and the real temperature controller setpoint (Heat or Cool).
The fan is switched on only is at least one compressor is running and the exchanger inlet air temperature is adequate.

Note. if the Internal exchanger water/air inlet temperature is in error (or has not been configured), recirculation fan activation depends exclusively on the compressor status.

11.1.2.1 Recirculation fan in Heating / Cooling

Control is dependent on the real setpoint as shown

Diagram A	Diagram B
COOLING	HEATING
	

Parameter		
COOL	HEAT	Description
Fi01	Fi02	Recirculation fan hysteresis in Cool / Heat
Setpoint		Real setpoint in Cool / Heat
Control probe		Internal exchanger water/air inlet temperature

11.2 Post-ventilation

In Heat mode, the fan is switched off after a delay set in parameter **Fi03**: *Post-ventilation time in Heat mode* after the internal circuit integration heaters have been switched off.
This post-ventilation time allows for the heat generated by the heaters to disperse, thus preventing damage or fire.

12 EXTERNAL EXCHANGER FAN (FOLDER PAR/FE)

The **SBA** controls (via digital outputs) the ventilation of the air condensation units of the two chiller/heat pump temperature control circuits.
Alternatively, it can control ventilation in a modulating mode, via analogue outputs .

The configurable outputs for digital pump control are relays, whereas in modulating operation they are the internal triac (for direct control) or the pulse outputs and the analogue outputs (indirect control).

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

The following must be configured:

- at least one digital output as external exchanger fan with parameters **CL90...CL97 / CL80-CL81 if digital / CL61...CL63 if digital = ±19 (circuit 1)/ ±20 (circuit 2).**

Enabling
The controller is enabled by setting parameter **FE00 - External exchanger fan mode selection** not equal to 0.

Table 1 - Parameter FE00

	Parameter	Description	Value		
			0	**1**	**2**
Enabling	**FE00**	**External exchanger fan mode selection**	Ventilation disabled	Continuous operation (Always ON)	Operation on call (ON when compressor ON)

General conditions of operation

- In**Off** the fans are switched off immediately and always (even when the cut-off bypass is active).
- In **Standby** the fans are normally switched off; during the transition from On to Standby, the fans are switched off in accordance with their timings (e.g. bypass on current cut-off). If **FE11**=2 the fans are active at the same time as the external exchanger heaters in antifreeze mode.
- In **On**, further to the principal regulation specified in the following paragraphs, the following situations (with priority over the principal regulation itself) may occur:
- In *Defrost* the behaviour of the fans depends on parameter **FE11**: *Enable special open system intercooler fan on* (see below for details);
- if the external exchanger heaters are on (or if at least one is on in the case of 2 heaters), the fans are activated if FE11=2 . In the case of two circuits, the fans of both circuits are activated;
    - the external exchanger fans are switched off immediately in case of fan shut-down alarms (see alarms table)

Parameter		
COOL	**HEAT**	**Description**
FE30	**FE50**	Minimum speed external exchanger fan **in Cool / Heat**
FE31	**FE51**	Average speed external exchanger fan **in Cool / Heat**
FE32	**FE52**	Maximum speed external exchanger fan **in Cool / Heat**
Setpoint		**Real setpoint in Cool / Heat**
Control probe		**External exchanger water/air inlet temperature**

External exchanger fan on pick-up
The external circuit modulating pumps connected to the analogue outputs are switched on at maximum speed (relative to the current mode of operation) for a period given in parameter **FE01:** *External exchanger fan pick-up time*. After this time, the pump is run at the speed requested by the controller.

External exchanger fan control input
Control is achieved with the value of the analogue input configured with parameters **FE33:** Select probe for external exchanger fan regulation in Cool and **FE53:** Select probe for external exchanger fan regulation in Heat.

Parameters table **FE33** and **FE53**

Value	Description	Regulation
0	No probe	On or On/Off
1	External exchanger temperature (circuit 1 and 2)	Direct
2	High pressure input (circuit 1 and 2)	Direct
3	Low pressure input (circuit 1 and 2)	Reversal
4	External exchanger pressure (circuit 1 and 2)	Direct
5	Internal exchanger pressure (circuit 1 and 2)	Reversal
6	Internal exchanger water/air inlet temperature	Direct
7	Internal exchanger water/air outlet temperature	Direct

If the plant has two circuits, the fans on the two external exchangers are controlled independently, on separate probes: both circuits must have analogue inputs configured for this purpose.
If not, ventilation will always be active.

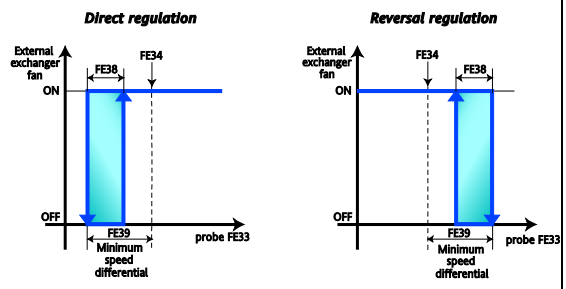
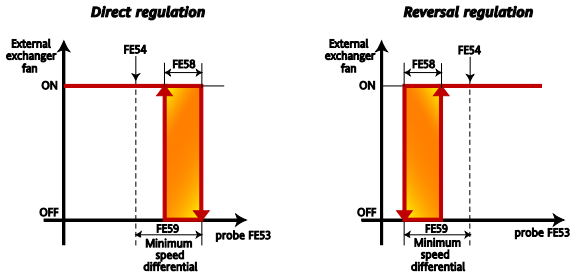
Analogue inputs for ventilation control

Description	U.M.
External exchanger temperature circuit 1	°C
External exchanger temperature circuit 2	°C
High pressure input circuit 1	Bar
High pressure input circuit 2	Bar
Low pressure input circuit 1	Bar
Low pressure input circuit 2	Bar
External exchanger pressure circuit 1	Bar
External exchanger pressure circuit 2	Bar
Internal exchanger pressure circuit 1	Bar
Internal exchanger pressure circuit 2	Bar
Internal exchanger water/air inlet temperature	°C
Internal exchanger water/air outlet temperature	°C

12.1.1 Continuous operation

Example **FE00**= 1.
Ventilation is activated, independently of the state of the compressors on the basis of the value of the analogue input configured for control.
The parameter **FE21- External exchanger fan preventilation time** must be set to 0.
Note: If an analogue input is not configured or if the configured analogue input is in error, ventilation is always active (at maximum speed if modulating).

12.1.1.1 External exchanger fan digital control in Cool / Heat

Diagram A		Diagram B	
COOLING		HEATING	
Analogue input control			
External exchanger temperature High pressure input External exchanger pressure	Low pressure input Internal exchanger pressure	External exchanger temperature Low pressure input External exchanger pressure	High pressure input Internal exchanger pressure
			

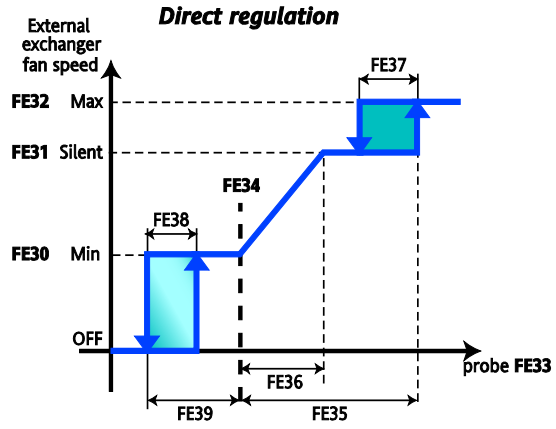
Parameter		
COOL	HEAT	Description
FE33	FE53	Select external exchanger fan control probe in Cool/Heat
FE34	FE54	Minimum external exchanger fan speed setpoint in Cool / Heat
FE38	FE58	External exchanger fan cut-off hysteresis in Cool / Heat
FE39	FE59	External exchanger fan cut-off differential
Control probe		External exchanger water/air inlet temperature

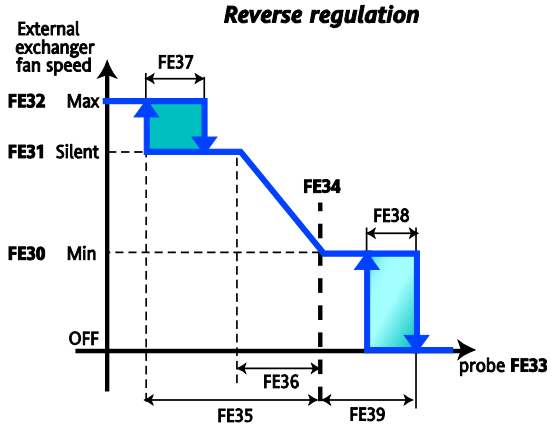
12.1.1.2 External exchanger fan analogue control in Cool / Heat

Analogue input control:
External exchanger temperature
High pressure input
External exchanger pressure circuit

Analogue input control:
Low pressure input
Internal exchanger pressure

COOL

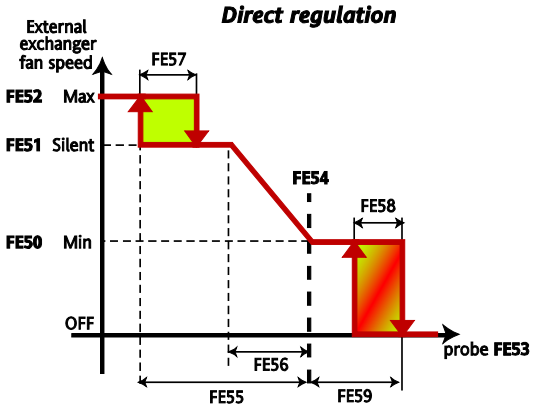


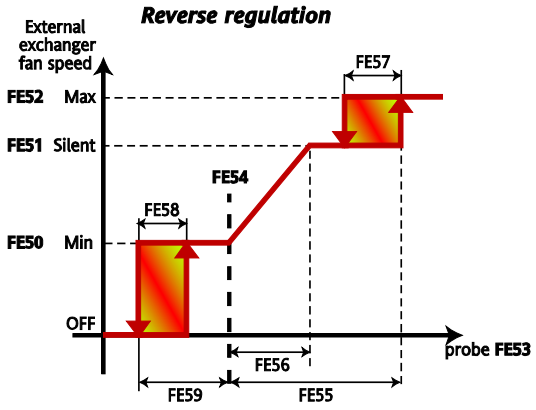


Analogue input control:
External exchanger temperature
Low pressure input
External exchanger pressure circuit

Analogue input control:
High pressure input
Internal exchanger pressure

HEAT





Parameter		
COOL	**HEAT**	**Description**
Control probe		**Select probe for external exchanger fan control in Cool/Heat**
FE33	**FE53**	
FE34	**FE54**	**Minimum external exchanger fan speed setpoint in Cool / Heat**
FE35	**FE55**	Maximum external exchanger fan speed differential **in Cool / Heat**
FE38	**FE58**	**External exchanger fan cut-off hysteresis in Cool / Heat**
FE39	**FE59**	**External exchanger fan cut-off differential**
Control probe		Select external exchanger fan control probe in Cool/Heat

12.1.2 Operation on call

Case FE00 = 2.
Ventilation is activated, on the basis of the value of the analogue input configured for control and depending on the situation (eg. fan start or shutdown), based on thermoregulator or compressors state.

If output inverter compressor 1 is configured, compressor status is considered as the state of this output (circuit 1 only).

Note: If an analogue input is not configured or if the configured analogue input is in error, ventilation is activated exclusively on the basis of the state of the compressors (at maximum speed if modulating).

12.1.2.3 External exchanger fan digital control in Cool / Heat

External exchanger fan control is activated at the moment in which the main temperature controller calls the first step of the temperature control circuit (to which the external exchanger belongs).

The compressor starts after the delay given in parameter **FE21:** *External exchanger fan preventilation time*.
Note: compressor activation may be delayed by other *safety timings*.

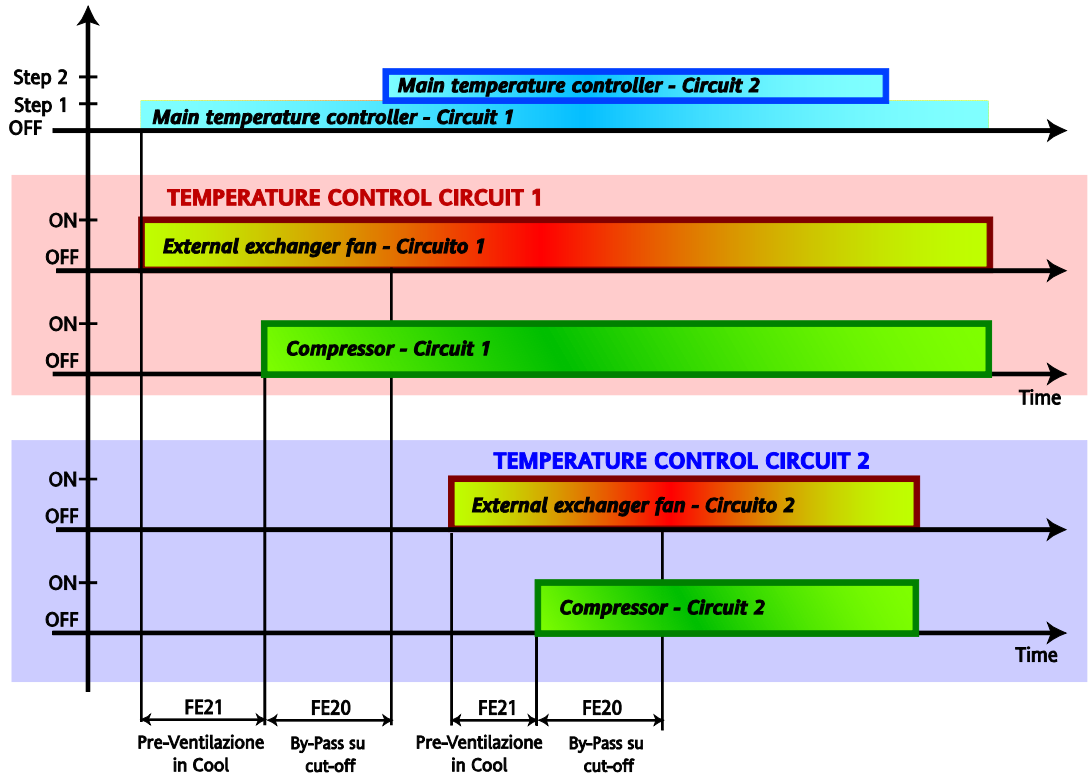
Furthermore, the digital outputs are controlled by parameter **FE34:** *External exchanger fan minimum speed setpoint in Cool* as for continuous operation, with the following exception: after the compressor is activated (meaning the first compressor or power stage of the circuit in question), for the delay given in parameter **FE20:** *Bypass time for external exchanger fan cut-off* the fans are forced on even if the controller is requesting cut-off.

Pre-ventilation is used in Cool to prevent high temperatures on the exchanger when the compressor is switched on.
The cut-off bypass prevents extreme temperatures on the exchanger.

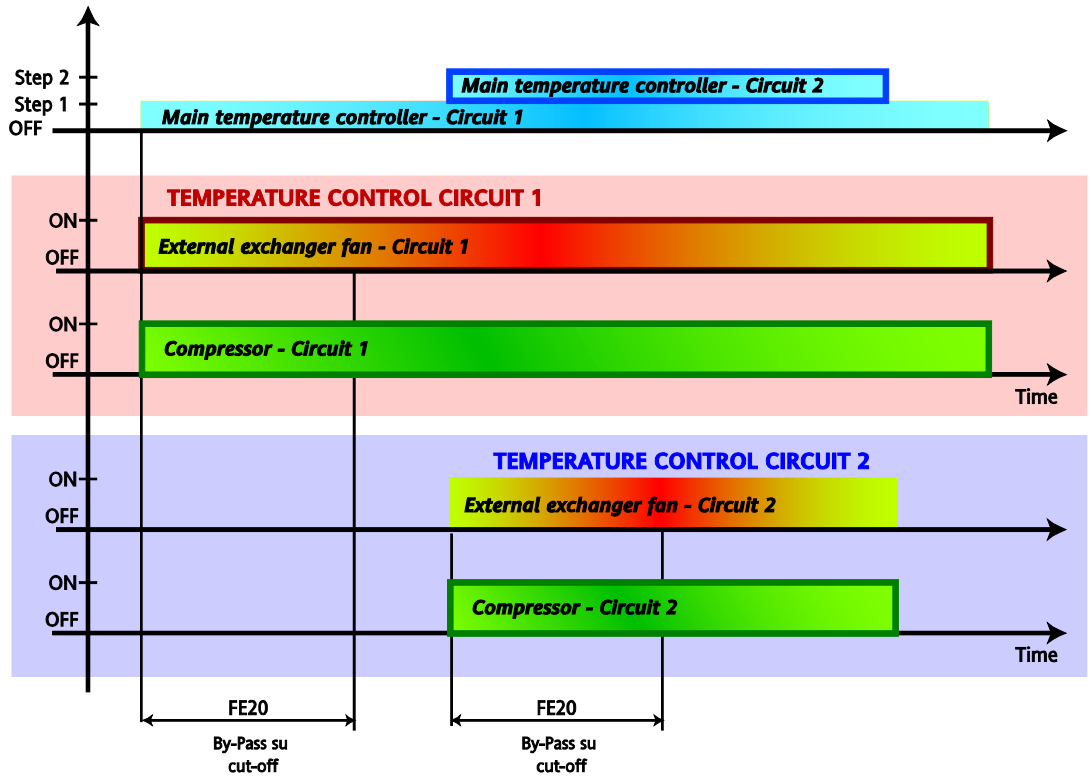
Note: if there are alarms blocking the compressors, external exchanger fan control remains active even with the compressors off.

Note: The activation of the compressor could also be delayed by other safety timings, this means that the pre-ventilation time could be longer (never shorter).

COOL



HEAT



Note: if there are alarms blocking the compressors, external exchanger fan control remains active even with the compressors off.

12.1.2.4 External exchanger fan analogue control in Cool

The analogue outputs are activated exactly as the respective digital outputs (with pre-ventilation and cut-off bypass) and are modulated, except for the cut-off bypass period (where the fans are activated at minimum speed if the controller requests cut-off), according to parameter **FE34:** *External exchanger fan minimum speed setpoint in Cool* as for continuous operation.
If there is no request for steps the fan is normally off.

12.1.2.5 External exchanger fan analogue control in Heat

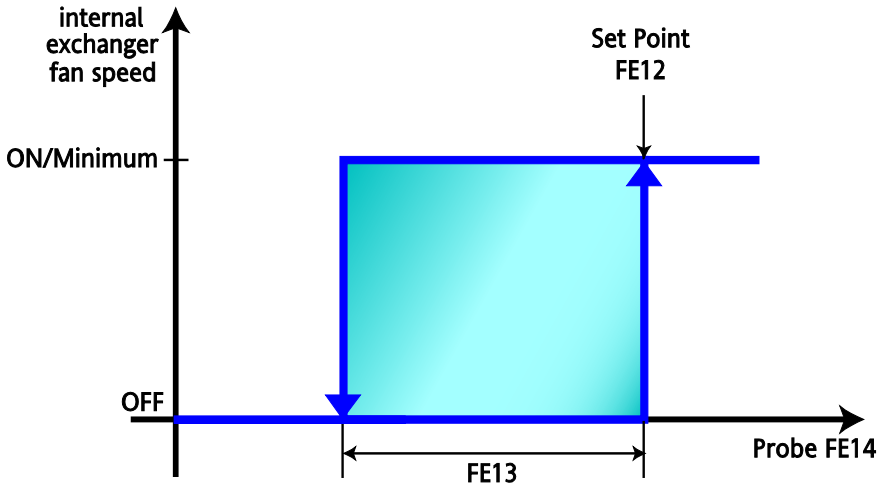
The analogue outputs are activated exactly as the respective digital outputs (with cut-off bypass) and are modulated, except for the cut-off bypass period (where the fans are activated at minimum speed if the controller requests cut-off), according to parameter **FE54:** *External exchanger fan minimum speed setpoint in Heat* as for continuous operation.
If there is no request for steps the fan is normally off.

12.2 Fan control in defrost

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 prevent a high pressure alarm in this situation, the fans are run (at minimum speed if modulating).

The behaviour of the external exchanger fan during defrost is determined by **FE11:** *Enable special open system intercooler fan on,* in which the fans run at maximum speed.
If the machine has two temperature control circuits, the status of the fan is dependent on the defrost condition of its respective circuit.
On completion of defrosting the fan resumes operation as requested by its controller.

- If **FE11 =** 0, the fan is forced off throughout defrosting.
- If **FE11 =** 1, the fan is off or on at minimum speed (digital output active) depending on the analogue input configured for control of the fan in defrost and parameter **FE12:** *External exchanger fan on setpoint in defrost* in the following way:



FE12: External exchanger fan on setpoint in defrost
FE13: External exchanger fan on hysteresis in defrost
FE14: Select probe for external exchanger fan regulation in defrost

Parameter table **FE14**

Value FE14	Description
0	No probe
1	External exchanger temperature (circuit 1 and 2)
2	High pressure input (circuit 1 and 2)
3	External exchanger pressure (circuit 1 and 2)

Note: if there are two temperature control circuits, each must have a probe configured for this purpose. If no analogue input is configured or if the configured input is in error, ventilation is always at minimum during defrost (maximum in coil drainage).

Note: At the end of defrost, the fans are switched on (at maximum speed if modulating) for the time set in parameter **dF23:** *Coil drainage time*, before the reversing valve switches.

12.3 Fan control with single condensation

Parameter **FE10:** *Enable single condensation* configures 2 circuit machines with single condensation.

if **FE10** = 0 the two fans are independent and depend on the condensation pressure/temperature and the state of the compressors on the individual circuits.
If **FE10** = 1 the 2 (in reality 2 digital and 2 analogue) external exchanger fan outputs operate in parallel at the maximum output value of the two controllers for the two circuits.

13 EXTERNAL CIRCUIT PUMP (FOLDER PAR/PE)

The parameters for the external circuit water pump can be viewed and configured in folder **PE**

At least one digital output must be configured as External Circuit Water Pump

Enabling
The external circuit water pump can be enabled by parameter **(PE00 - External circuit water pump mode selection≠0)**

Parameter	Description	Value			
		0	**1**	**2**	**3**
PE00	External circuit water pump mode selection	Pump Disabled	Continuous operation (Always ON)	In response to a request from the temperature regulator	Operation synchronised with external exchanger fans

On the basis of **PE00** the external circuit pump can function
- continuously
- In response to a request from the temperature regulator
- or in synchrony with the external exchanger fans.

General conditions of operation
- In **Off** the pump is always off
- In **Stand-by** the pump is normally off; however, it is started together with the external exchanger heating elements in antifreeze mode (if **PE00**=1 or 2).
  If **PE00**=3 the pump is started only if the external exchanger fans are started.
- In **On** the pump is always on if **PE00** = 1.
  If **PE00=2** the external circuit water pump is switched on when requested by the temperature regulator.
  If PE00=3 the External Circuit Water Pump is activated "in parallel" with the external exchanger heaters: i.e. the pump is activated if the external exchanger fan is activated (single-circuit systems), or if at least one of the two fans is activated (dual-circuit systems).

N.B.:
- The pump is switched off immediately in the event of pump trip alarm (see alarms table).
- If an automatic reset flow switch alarm occurs, the pump is kept on to allow it to be reset; if the alarm becomes manual reset, the pump is switched off.
- The minimum time between the pump switching off then switching back on again is fixed and set at 10 seconds.

13.1 Operating modes

13.1.1 Continuous operation

Case **PE00** = 1.
See **General conditions of operation**

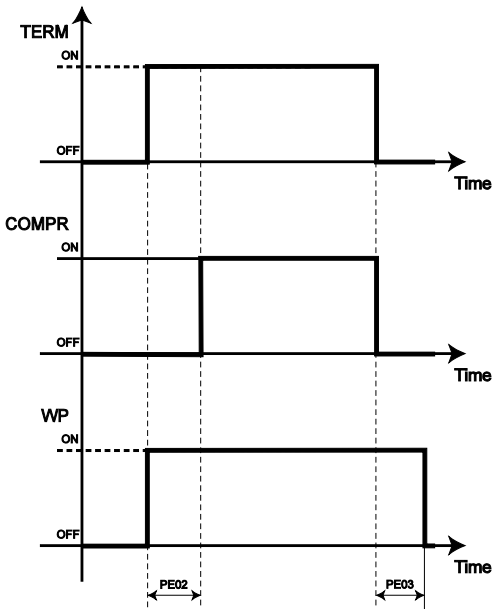
13.1.2 In response to a request from the temperature regulator

Case **PE00** = 2.
See **General conditions of operation**
In addition
- The compressor is switched on with a set delay (**PE02**) after the internal circuit water pump switches on.
- The internal circuit water pump is switched off with a delay (**PE03**) after the temperature regulator enters the OFF state or after machine standby.

Table 2 (par. PI02-PI03)

Parameters	Description
PE02	**External circuit pump switch-on - compressor switch-on delay**
PE03	**Compressor switch-off - external circuit pump switch-off delay**

Diagram A



TERM: temperature regulator	COMPR: compressor
WP: external circuit water pump	Time: time in seconds
PE02: **External circuit pump switch-on - compressor switch-on delay**	PE03: **Compressor switch-off – external circuit pump switch-off delay**

13.1.3 Operation synchronised with external exchanger fans

Case **PE00** = 3.
See **General conditions of operation**

The External Circuit Water Pump is activated "in parallel" with the external exchanger heaters: i.e. the pump is activated if the external exchanger fan is activated (single-circuit systems), or if at least one of the two fans is activated (dual-circuit systems).

13.2 Pump anti-lock (anti-sticking) mode

This function prevents any mechanical faults when the pump has been idle for an extended period.

The anti-lock function is activated when:

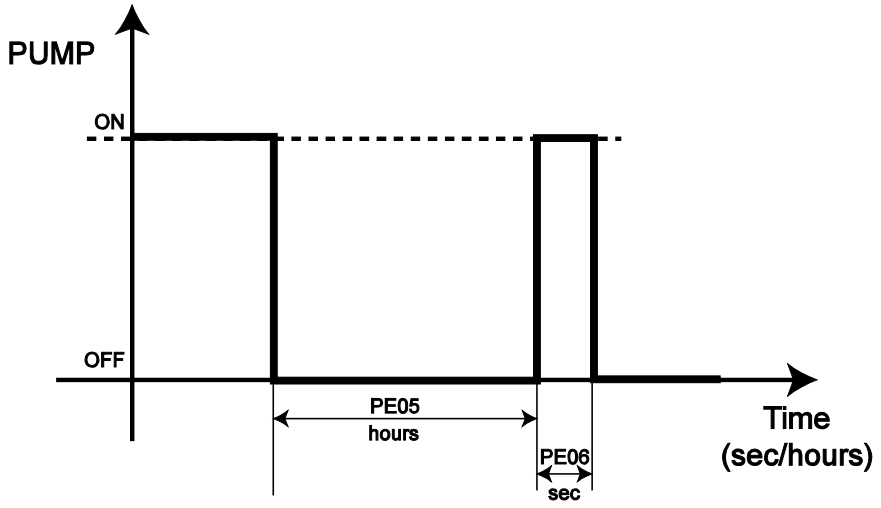
- it has been enabled via parameter (**PE04 -** *External circuit water pump antilock function enabling* = 1). See **Table 3**
- It is always active except when OFF (local and remote) and on Stand-by (local and remote) unless an alarm switches off the pump

If the pump is off for a time equal to or greater than the value in parameter **PE05:** *External circuit water pump off time for antilock*, the regulator forces it on (at maximum speed if modulating) for the time set in parameter **PE06:** *External circuit water pump ON time for antilock*.
See Table 3 and diagram B

Table 3, parameters PE04..PE06

Anti-lock	Parameter	Description	Value	
			0	**1**
	PE04	**External circuit water pump antilock function enabling**	Function disabled	Function enabled
Diagram B	**PE05**	**External circuit water pump OFF time for antilock**	Time in hours	
	PE06	**External circuit water pump ON time for antilock**	Time in seconds	

Diagram B Pump anti-lock



N.B.: PE05 is in hours, PE06 is in seconds

13.3 Antifreeze operation with pump

The antifreeze function runs when:
enabled via parameter (**PE07 – Antifreeze function enabling with external circuit water pump** =1). See Table 4.
always on in any machine operating state except local or remote OFF, unless alarms block the pump

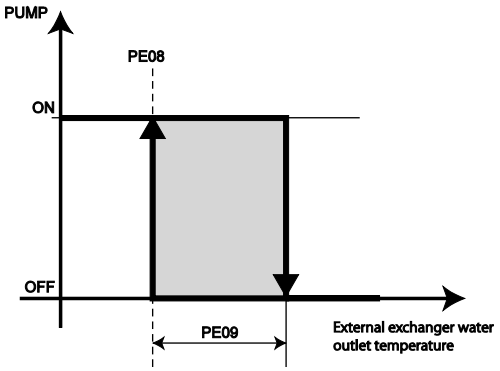
To ensure the efficient operation of the pump, the following must be configured correctly
an analogue input, configured as NTC external temperature input
a digital or analogue output, configured as pump

Table 4 parameter PE07...PE09

	Parameter	Description	Value	
			0	**1**
	PE07	**Antifreeze function enabling with external circuit water pump**	Function disabled	Function enabled
Diagram C	**PE08**	**External circuit water pump set point control for antifreeze**		
	PE09	**External circuit water pump hysteresis control for antifreeze**		

The pump is running if **External circuit exchanger water temperature < PE08**
The pump is running if **External circuit exchanger water temperature > PE08+PIE09.**

Diagram C - antifreeze function with pump



14 INTERNAL EXCHANGER ELECTRIC HEATERS (FOLDER PAR/HI)

Device **SBA600** controls internal exchanger heaters 1 and 2, which act both for the antifreeze function (typically in machines with water-type internal exchanger) and integration for the heat pump/heating function (air and water).

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

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

- The heaters are active only if the relative enabling parameter HI00, HI02=1 (see table)

(°) The configurable heater control outputs are all and exclusively outputs with ON/OFF control.
The heaters can be used in a variety of ways depending on the type of installation. There may be one or two internal exchangers and one or two circuits.

In the case of a single exchanger on a single / double circuit: in antifreeze, defrost and integration the electric heaters are driven in "equivalent" mode.

In the case of a double exchanger on a double circuit: in antifreeze and defrost the two heaters are driven differently in accordance with the variable conditions of the relative refrigerant circuit; however, in integration they are driven in "equivalent" mode.

To obtain the greatest application configurability:

- the number of antifreeze heaters and integration heaters can be set independently;
- the control analogue output can be determined individually;
- the heaters (1 or 2) can be used only for antifreeze, only for integration/heating, or for both functions at the same time.

Heaters	Parameter	Description	Value	
			0	**1**
Antifreeze (Standby mode)	**HI00**	Enable internal exchanger heater regulator in standby for antifreeze	Heaters disabled	Heaters enabled
See Heaters in defrost paragraph	**HI01**	Enable force heaters on during defrost	See parameters table **Hi01**	
Antifreeze	**HI10**	**Select probe for antifreeze internal exchanger with heater 1**	See parameters table **Hi10** and **Hi11**	
Antifreeze	**HI11**	**Select probe for antifreeze internal exchanger with heater 2**		
Integrated use	**HI20**	Enable integrated use of internal exchanger heaters	See parameters table **Hi20**	

14.1 Internal antifreeze heater

Enabling
The internal exchanger antifreeze heaters are enabled with parameters

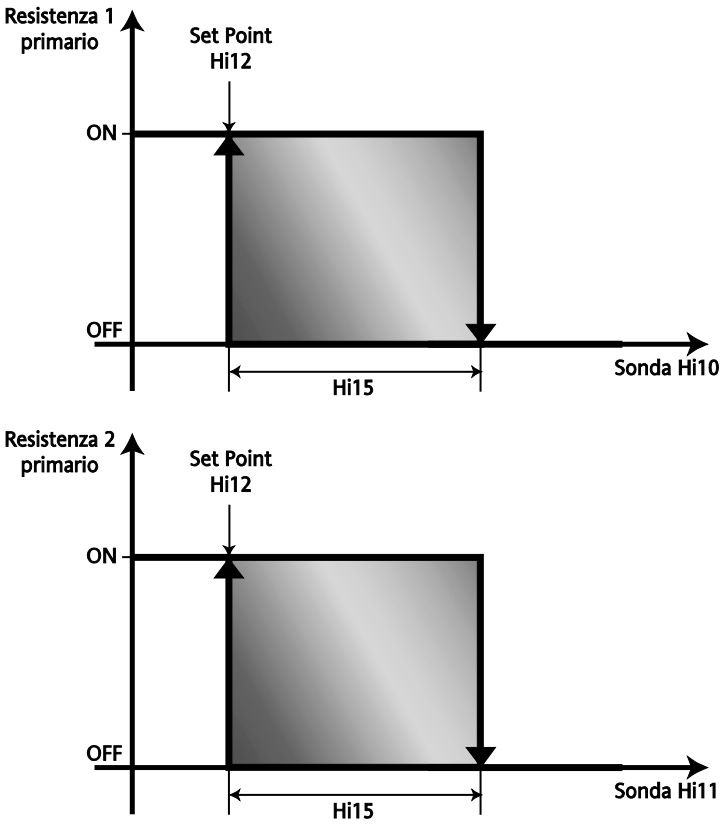
- **HI10 - Select probe for antifreeze internal exchanger with heater 1**
- **HI11 - Select probe for antifreeze internal exchanger with heater 2**

General conditions of operation

- In Off the internal exchanger antifreeze heaters are switched off immediately and remain off.
- In Stand-by the internal exchanger antifreeze heaters are active if so set in parameter **Hi00:** *Enable internal exchanger antifreeze heaters in standby*.
- In **On**, in addition to the main control specified in subsequent paragraphs, the following situations are also possible (with priority given to the main control itself):
  - In *Defrost* the internal circuit heaters are controlled by parameter **Hi01:** *Enable forcing heaters on during defrost*. See dedicated paragraph
  - The internal circuit heaters are turned off immediately during heater block alarms (see alarms table).

N.B.: There are no safety times for heater on/off

14.1.1 Internal circuit antifreeze heater control



Parameter	Parameter	
Control sensor	**Hi10**	**Select probe for antifreeze internal exchanger with heater 1**
	Hi11	**Select probe for antifreeze internal exchanger with heater 2**
Setpoint	**Hi12**	**Primary intercooler heaters regulator setpoint for antifreeze**
	Hi13	**Primary intercooler heaters regulator maximum setpoint for antifreeze**
	Hi14	**Primary intercooler heaters regulator minimum setpoint for antifreeze**
Hysteresis	**Hi15**	**Primary intercooler heaters dynamic differential setpoint in integration**

Parameters table **Hi10** and **Hi11**

Value Hi10 / Hi11	Probe
0	No sensor (antifreeze heater disabled)
1	Internal exchanger water/air inlet temperature
2	Internal exchanger water/air outlet temperature
3	Circuit 1 internal exchanger water outlet temperature
4	Circuit 2 internal exchanger water outlet temperature
5	Circuit 1 and 2 internal exchanger water outlet minimum temperature

N.B.: depending on settings, the heaters can be turned on together (using the same probe) or separately (using different probes).

N.B.: The machine is blocked in the event of a control probe error

14.2 Configuration of integration heaters

Enabling
With parameter **Hi20:** *Select heater mode for internal exchanger in integration mode* to activate the regulator for heaters in integration mode.
Either 1 or 2 heaters will be controlled, depending on the value of parameter **Hi26:** *Primary intercooler heater 2 switch-on setpoint differential in integration:* 1 heater if **Hi26** = 0, 2 heaters if **Hi26** ≠ 0.

General conditions of operation

- In Off the integration heaters are switched off immediately and always.
- In Stand-by the integration heaters are switched off immediately and always (note that since there are two regulators controlling the same heaters, the same heaters may stay on in Standby if so required by the antifreeze heater regulator).
- In On, in addition to the main control specified in subsequent paragraphs, the following situations are also possible (with priority given to the main control itself):
- In *Defrost* the internal circuit heaters are controlled by parameter **Hi01** *Enable force heaters on during defrost*. See dedicated paragraph
- The internal circuit heaters are switched off immediately in the case of heater block alarms.
- In DHW mode regulation occurs on the *real* DHW setpoint in place of the *real* Heat setpoint
- In Anti-Legionnaire's Disease DHW mode regulation occurs on the DHW setpoint for Anti-Legionnaire's Disease instead of the *real* Heat setpoint

Operating mode
The integration heaters are active only in Heat mode; regulation is based on the setpoint obtained by *subtracting* a differential from the *real* Heat setpoint.
This differential can be calculated in a variety of ways by configuring parameter **Hi20:** *Select heater mode for internal exchanger in integration mode*.

Parameter table **Hi20**

Value Hi20	Description
0	Integration heaters disabled
1	Integration heaters with setpoint differential proportional to external temperature
2	Integration heaters with setpoint differential in steps on external temperature
3	Integration heaters with setpoint differential fixed

14.2.1 Integration heater differential

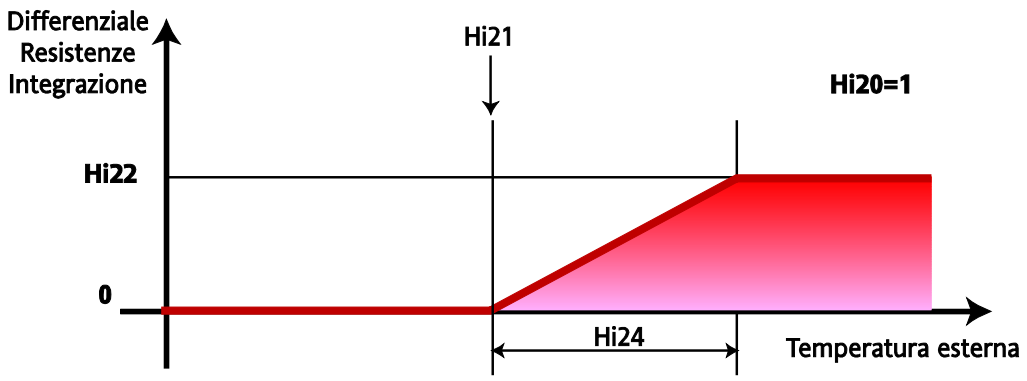
The integration heater regulation setpoint is calculated by subtracting a differential from the real Heat setpoint.

Integration heater setpoint = real Heat setpoint – integration heater differential

The Integration Heater Differential is calculated in a variety of ways: proportional, step, or fixed.

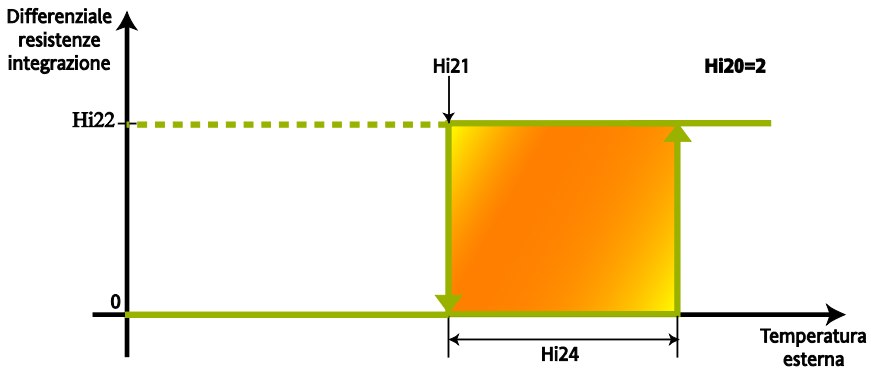
N.B.: When the heat pump is blocked, the differential for heaters in integrated assumes a fixed value equivalent to the value of parameter **Hi23:** *heater differential in integration mode with heat pump lock*. This serves to better control the heating capacity steps of the integration heaters in special circumstances.

Integration heaters with differential setpoint proportional to ambient temperature
Case **H20 =** 1.

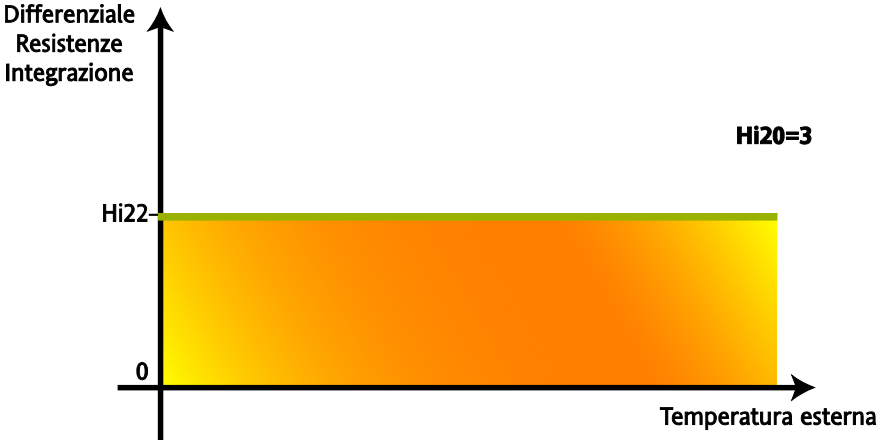


Parameter	Parameter	
Control sensor	**//**	**External temperature**
Setpoint	**Hi21**	**Primary intercooler heaters dynamic differential setpoint in integration**
	Hi22	**Primary intercooler heaters maximum dynamic differential in integration**
	Hi24	**Primary intercooler heaters dynamic differential proportional band in integration**
Hysteresis	**//**	

Integration heaters with differential in steps on external temperature
Case **H20 =** 2.



Integration heaters differential fixed, independent of external temperature
Case **Hi20 =** 3.



N.B.: In case of error or lack of configuration of the external probe, the differential value is set to fixed values **Hi22** or **Hi23** depending on circumstances.

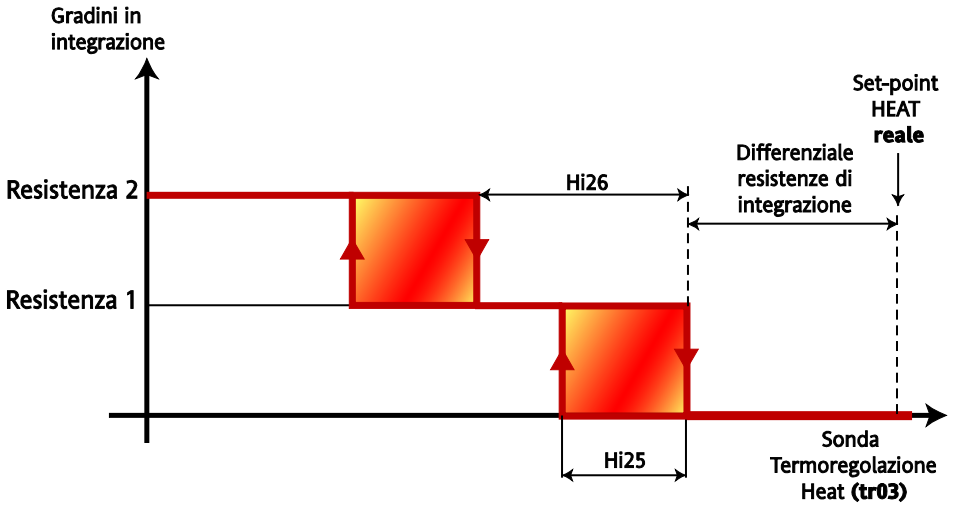
14.2.2 Integration heater regulation

Regulation occurs on the Integration Heaters Setpoint calculated with the Integration Heaters Differential as explained in the preceding paragraph. The expression step here refers to activation of internal exchanger heater 1 or 2.
The analogue input used for regulation is the main temperature controller probe for Heat mode.

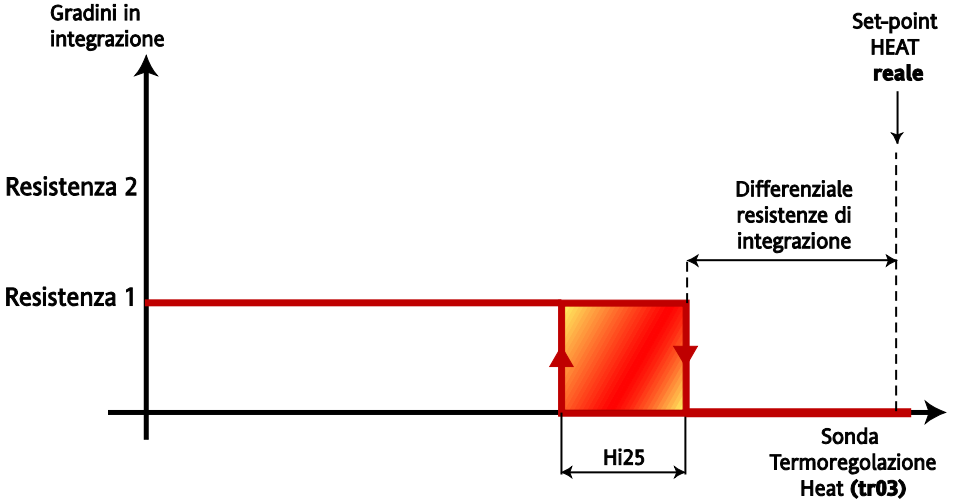
Depending on the value of **Hi26:** *Primary intercooler heater 2 switch-on setpoint differential in integration* it can be decided whether or not to activate the second heater in integration.

Note: if activating both heaters "simultaneously" is of interest (using two outputs to keep the thermal cut-outs separate), simply award a small value to **Hi26** although a value other than 0 and greater than hysteresis **Hi25** (hysteresis cannot be larger than the differential value, otherwise the hysteresis value considered will coincide with the differential value).

With **Hi26** different from 0



With **Hi26** = 0



Parameter	Parameter	
Control sensor HEAT	tr03	Select temperature control probe in Heat
Setpoint	//	Integration Heater Setpoint
Hysteresis	Hi25	Primary intercooler heaters regulator hysteresis in integration
	Hi26	Primary intercooler heater 2 switch-on setpoint differential in integration

14.3 Heaters in defrost mode

Parameter **Hi01:** *Enable force heaters on during defrost* makes it possible to characterise operation of the internal exchanger heaters during defrost and dripping.
One or both of the heaters can be forced on, or heater 1 can be linked to defrosting circuit 1 and heater 2 to circuit 2

Parameter table **Hi01**

Value	Description
0	Free operation (no forcing)
1	Heater 1 forced on
2	Both heaters forced on
3	Heater 1 forced on for defrost circuit 1, heater 2 for defrost circuit 2 (double exchanger)

N.B.: For cases with values 1 and 2, the heaters are switched on if at least one of the two circuits is in defrost or drip status (typically used in case of single exchanger).

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

The external exchanger heater parameters can be viewed and modified in folder **HE** (see User Interface and Parameters chapters).

The following must be configured:
at least one digital output as external exchanger 1 heater with parameters **CL90...CL97 / CL80-CL81 if digital / CL61...CL63 if digital = ±25.**
at least one digital output as external exchanger 2 heater with parameters **CL90...CL97 / CL80-CL81 if digital / CL61...CL63 if digital = ±26.**
See chapter System configuration (folder PAr/CL-Cr-CF) / Configuration of digital outputs

The **SBW600** controls external exchanger heaters 1 and 2 with antifreeze function (as heat pumps with water external exchanger).
The heater control outputs are all and exclusively those outputs with ON/OFF control.
The heaters can be used in a variety of ways depending on the type of system. We can have one or two external exchangers (one or two circuits).

For greatest configurability:
the number of antifreeze heaters can be set;
the control analogue input can be determined individually.

Enabling
The external exchanger heater 1 antifreeze probe is enabled and selected with parameter **HE10 - Select probe for antifreeze external exchanger + heater 1.**
The external exchanger heater 2 antifreeze probe is enabled and selected with parameter **HE11 - Select probe for antifreeze external exchanger + heater 2.**

General conditions of operation
In **Off** the external exchanger antifreeze heaters are immediately and always off.
In **Standby** the external exchanger antifreeze heaters are active if so configured with **(HE00 - Enable external exchanger antifreeze heaters in Stand-By).**
In **On**, further to the principal regulation specified in the following paragraphs, the following situations (with priority over the principal regulation itself) may occur:

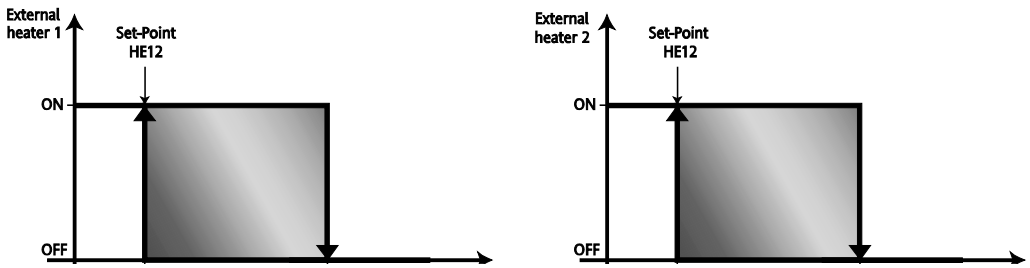
The external circuit heaters are immediately turned off during heater block alarms.

Note: There are no safety times for heater on/off.

Table A - external exchanger heater parameters

heaters	**Parameter**	**Description**	**Value**				
			0	**1**			
External exchanger (Standby mode)	**HE00**	Enable external exchanger heater regulator in standby for antifreeze	Heaters disabled	Heaters enabled			
Heaters	**Parameter**	**Description**	**Value**				
			0	**1**	**2**	**3**	**4**
External exchanger Enable heater 1	**HE10**	Select probe for antifreeze external exchanger + heater 1	No probe (antifreeze heater disabled)	External exchanger average temperature circuit 1 and 2	External exchanger inlet water temperature	External exchanger outlet water temperature	External temperature
External exchanger Enable heater 2	**HE11**	Select probe for antifreeze external exchanger + heater 2					
Heaters	**Parameter**	**Description**	**Value**				
External exchanger	**HE12**	External exchanger heater switch on setpoint for antifreeze	Range defined by parameters **HE14**....HE13 Hysteresis defined by parameter HE15				

External exchanger heaters
Regulation is performed as shown in the figure:



HE10	Analogue input - see table A
HE11	Analogue input - see table A
HE12	Setpoint - see table A
HE13	Maximum external exchanger heater regulator setpoint for antifreeze
HE14	Minimum external exchanger heater regulator setpoint for antifreeze
HE15	External exchanger heater regulator hysteresis for antifreeze

Note: depending on the settings, the heaters can be turned on together or separately.
Note: In case of control probe error, the machine is blocked.

16 AUXILIARY OUTPUT (FOLDER PAR/HA)

Auxiliary output parameters can be viewed and configured in folder **HA** (see User Interface and Parameters chapter).

The following must be configured

- at least one digital output as Auxiliary Output with parameters **CL90...CL97 / CL80-CL81 if digital / CL61...CL63 if digital = ±32**

The auxiliary output controller can be used, for example, to control heaters in units with air cooling to evaporate the condensation water.

Enabling
The parameter **(HA00 - Select probe for auxiliary output regulator)** is used to enable the auxiliary output regulator.

Table A - meaning of parameter HA00:

Value HA00	Probe
0	No probe (auxiliary output disabled)
1	External temperature
2	External exchanger temperature circuit 1
3	External exchanger temperature circuit 2
4	External exchanger inlet water temperature
5	External exchanger outlet water temperature
6	NOT USED

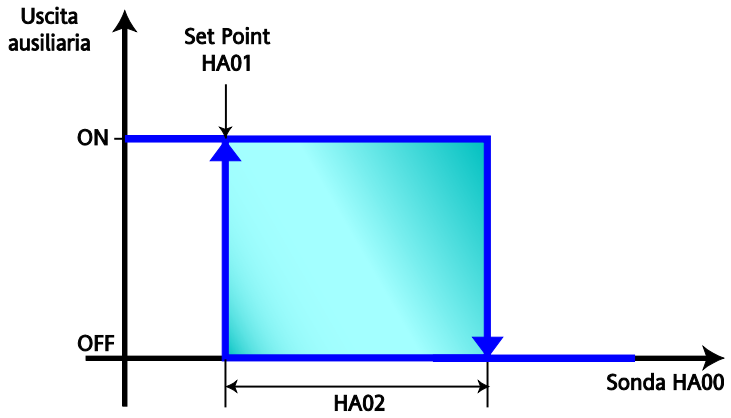
General conditions of operation

- In **Off**, the auxiliary output is always switched off immediately.
- In **Standby**, the auxiliary output is always switched off immediately.
- In **On**, as well as the main regulation function specified in the paragraphs below, the following situation is also possible (with priority over the main regulation): the auxiliary output is always switched off immediately when it is subject to a blocking alarm.

N.B.: There are no safety times for activation and deactivation of the auxiliary output.

Auxiliary heaters

Regulation occurs as shown in the diagram:



Parameter	Description
HA00	**Control probe – see table A**
HA01	**Auxiliary output regulator setpoint**
HA02	**Auxiliary output regulator hysteresis**
Auxiliary output	**Auxiliary output**

N.B.: In case of a probe error, the output is switched off/disabled.

16.1.1 Auxiliary output regulation conditional on defrosting

Regulation of the defrosting conditional auxiliary output is the same as regulation of the normal auxiliary output, except for the fact that it is activated only at the start of a defrost cycle (either of the two possible circuits) and it is forced to off after a time equal to 3 times parameter **dF22- Maximum defrost time.**

17 BOILER (FOLDER PAR/BR)

Via a suitably configured digital output device **SB600** controls the pump or the permissive signal for a water heater or boiler to supply hot water which can be used for heating or as a back-up for the heat pump (hot water).
The outputs configurable to control the water heater are all exclusively the outputs with ON/OFF piloting.
Device SA600 also controls an analogue output (value = ±58)
There are different types of plant and therefore different ways to use the water heater, especially in residential applications.

17.1 Water heater configuration

The water heater is used as a heating capacity step both for chillers and heat pumps.
Combined with the integration/heating elements and the compressors (in heat pump mode), the water heater produces hot water on the internal hydraulic circuit.

For maximum configurability, the water heater parameters and other system component parameters can be set separately. You can thus determine when to use the water heater capacity step for heating and when to inhibit water heater operation.

In both modes, heating and integration, the water heater setpoint can be set as a differential (fixed or proportionally variable depending on the ambient temperature) with respect to the real setpoint in heating mode.

N.B.: Normally, when there is no heat pump (in heating mode), the differential is set as fixed and at zero (the regulation setpoint is the same as the real heating mode setpoint).

N.B.: by setting the *Water heater maximum dynamic differential* to 0, the setpoint coincides with the real heating setpoint.

Enabling
With parameter **br00:** *Select water heater operation* different from zero to enable the water heater regulator.

General conditions of operation
- In **Off** the water heater is switched off immediately and always.
- In **Stand-by** the water heater is switched off immediately and always.
- In **On**, as well as the main regulation function specified in the paragraphs below, the following situation may also occur (with priority over the main regulation):
- The water heater is switched off immediately in case of a water heater tripping alarm (see alarms table).
- In Domestic Hot Water mode the water heater regulates in relation to the *real* DHW setpoint instead of the *real* Heat setpoint.
- In DHW mode for Anti-Legionnaire's Disease operation the water heater regulates in relation to the Anti-Legionnaire's Disease DHW setpoint instead of the *real* Heat setpoint

N.B.: There are no protection times for water heater on/off cycles.

Operating mode
The water heater regulator is active only in Heat mode; regulation is based on the setpoint obtained by subtracting a differential from the *real* Heat setpoint.
The water heater differential can be calculated in several ways, selectable by configuring the parameter *Select Water Heater* Mode **br00**.

Table for parameter **br00:**

Value br00	Description	
0	Water heater disabled	
1	Water heater with differential Setpoint proportional to ambient temperature	**Diagram A**
2	Water heater with differential Setpoint in steps dependent on external temperature	**Diagram B**
3	Water heater with differential Fixed setpoint	**Diagram C**

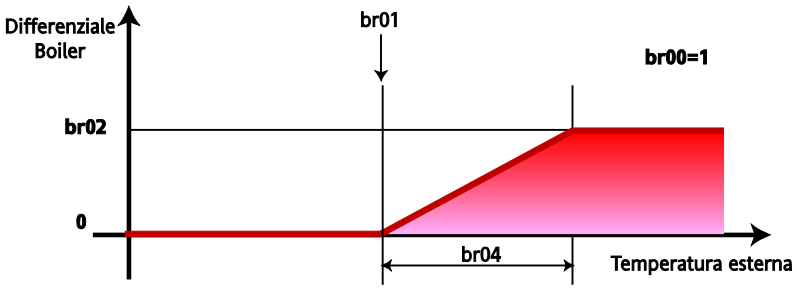
17.1.1 Water heater Differential

Water heater regulation is performed on a setpoint calculated by subtracting a differential from the real Heat setpoint.

Water heater setpoint = Real Heat setpoint – Water heater differential

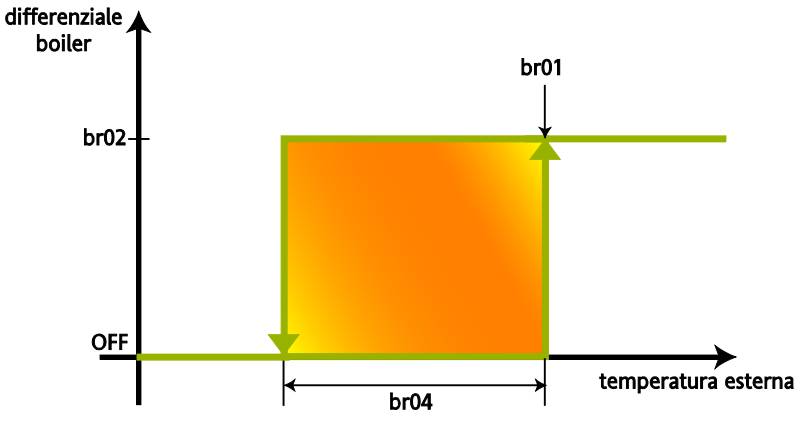
In case of heat pump block, the Water heater differential assumes the fixed value of parameter **br03:** *water heater differential with heat pump block*. This serves to improve the control of the water heater capacity step in special cases.

Water heater differential proportional to ambient temperature
Example **br00**= 1
Diagram A



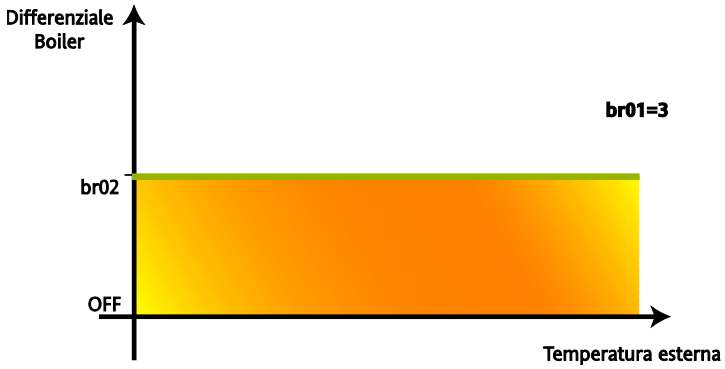
Parameter	Parameter	
Control sensor	//	External temperature
Setpoint	br01	Water heater dynamic differential setpoint
	br02	Maximum water heater differential
	br04	Water heater differential proportional band

Water heater differential in steps as a function of external temperature
Example **br00 =** 2
Diagram B



	Parameter	
Control sensor	//	External temperature
Setpoint	br01	Water heater dynamic differential setpoint
	br02	Maximum water heater differential br02
	br04	Water heater differential proportional band
Hysteresis	br05	Water heater regulator hysteresis

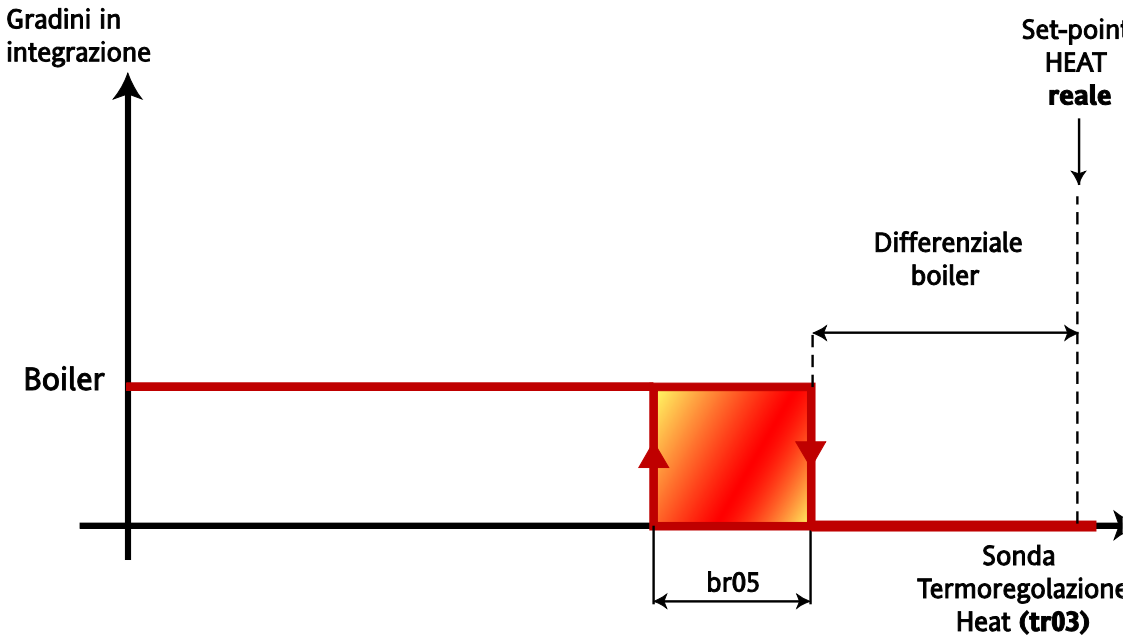
Fixed Water Heater differential, independent of ambient temperature
Example **br00=** 3
Diagram C



N.B.: In case of an error of the external probe, the differential value is set to br02 or br03 (both fixed) depending on circumstances.

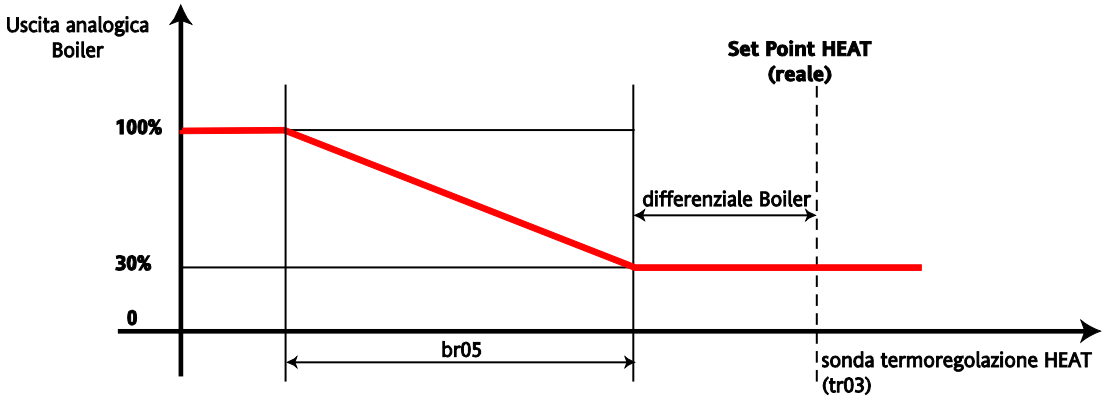
17.1.2 Water heater regulation

The regulation uses the Water heater setpoint calculated with the water heater differential as explained in the previous paragraph.



	Parameter	
Water heater differential	br00	See Water heater differential section
HEAT regulator probe	tr03	Select temperature control probe in Heat
Setpoint	//	Water heater setpoint
Hysteresis	br05	Water heater regulator hysteresis

In parallel, an analogue output can be activated on the water heater, which will be modulated as follows:



18 DEFROST (FOLDER PAR/DF)

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

Defrosting is only possible in HEAT mode.

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 considerably reduces the thermodynamic efficiency of the machine and can also result in damage to the machine itself.

Enabling
Defrosting is enabled if:

- it is enabled via parameter (**dF00 - Enable defrost function** =1,2)

Parameter table **dF00**

Value	Description
0	Defrosting disabled
1	Simultaneous defrost (only for dual-circuit systems)
2	Independent defrost (for single circuit plants and double circuit plants with separate condensation)

General conditions of operation

- In **Off** defrosting is disabled.
- In **Stand-by** the defrost function is disabled.
- In **On**, as well as the main regulation function specified in the paragraphs which follow, the following situation is also possible (with priority over the main regulation): the defrost request is inhibited/cancelled if antifreeze with heat pump is active.

Types of defrost
SBW600 manages both single defrosting of the single or double external exchanger, and independent defrosting of the exchangers of the two refrigerant circuits.

In the first case, single defrosting, the two circuits defrost at the same time when at least of them requires it. This mode is applied to machines with single condensation (parameter **FE10:** *Enable single condensation* = 1). The circuit which completes defrosting first, before it resumes normal operation, waits (with compressors off) for the other circuit to complete defrosting.

N.B.: In the case of single condensation, two start probes must be configured (on for circuit 1 and one for circuit 2) along with two 2 defrost end probes. The times for starting defrosting are nonetheless independent.

In the case of independent defrosting each circuit defrosts separately.

The start and end of the defrost cycle depends on the values of the probes and the parameter settings described below;

Defrost	Parameter	Description
Start	dF01	Enable maximum power for non-defrost circuit
	dF10	Select probe to enable interval count between defrost cycles
	dF11	Setpoint for enable interval count between defrost cycles
	dF12	Setpoint to clear cumulative time between defrost cycles
	dF13	Cumulative time between defrost cycles
	dF14	Minimum interval between defrost cycles
Output	dF20	Select probe to disable defrost
	dF21	Disable defrost setpoint
	dF22	Maximum defrost time
	dF23	Drip time
	dF30	Maximum dynamic defrost differential
Setpoint	dF31	Defrost dynamic differential setpoint
	dF32	Defrost proportional band dynamic differential

Defrosting is done in heat mode, by reversing the cooling cycle, switching the position of the cycle inversion valve and operating the circuit in chiller mode.

In Defrost mode, switching of the inversion valve occurs with the same methods as those envisaged for the mode changeover (see Inversion valves management section), with the time set by parameter **ST05 – Reversal valve switching delay**, and with compressor stopping and starting times that are unique and specific for defrosting (parameter **CP27 – Defrost compressor/step delay minimum**).

In multi-circuit systems, defrosting can be run separately (*independently*) or at the same time (*single*) for the various cooling circuits, depending on the general operational requirements of the plant.

Analogue inputs for defrosting start/end
Defrosting can be started in relation to the pressure or temperature measured by the probe selected in parameter **dF10: Select probe to enable interval count between defrost cycles.**

Defrosting can be ended in relation to the pressure or temperature measured by the probe selected in parameter **dF20: Select probe to disable defrost.**
In the case of a double circuit, each circuit must have an analogue input configured for the requested function.

Defrosting function analogue inputs

Description
External exchanger temperature circuit 1
External exchanger temperature circuit 2
High pressure input circuit 1
High pressure input circuit 2
Low pressure input circuit 1
Low pressure input circuit 2
External exchanger pressure circuit 1
External exchanger pressure circuit 2

Parameters table **dF10** and **dF20**

Value	Description
0	No probe
1	External exchanger temperature (circuit 1 and 2)
2	High pressure input (circuit 1 and 2)
3	Low pressure input (circuit 1 and 2)
4	External exchanger pressure (circuit 1 and 2)

18.1 Defrost

18.1.1 Start defrost

Defrosting can be started in relation to the pressure or temperature measured by the probes selected in parameter *Select probe to enable interval count between defrost cycles* **dF10.**
If there is a probe error or no probe is configured, start of defrosting depends solely on the effective operating time of the compressors and the parameter *Cumulative time between defrost cycles* **dF13**.
Between two successive defrost cycles there must elapse a minimum time interval equivalent to the parameter *Minimum time between two defrost cycles* **dF14**.
N.B.: If **dF00** = 2 in plants with two circuits, the minimum time between two defrost cycles is applicable to both circuits, so defrosting cannot occur on both circuits simultaneously

The conditions required for starting defrosting of a circuit are as follows:

- When the pressure or temperature detected by the start defrost probe on the circuit drops below the value of the start defrost setpoint and the circuit is supplying at least one power step, the cumulative defrost delay counter is started, the value of which can be set with parameter **dF13:** *Cumulative time between defrost cycles*.
- The start defrost setpoint is a dynamic value calculated on the basis of parameter **dF11:** *Setpoint for enable interval count between defrost cycles* (see specific paragraph).

- When the pressure or temperature read by the defrost start probe for the circuit returns above the value of the defrost start setpoint of the circuit is no longer delivering any power steps, the cumulative defrost delay count is stopped.

- The count is reset to zero after a defrost cycle or after a reset (e.g. power down).

- The counter for cumulative time for defrost start is reset also in the case wherein the temperature or pressure of the probe configured as a defrost entry probe of the circuit rises above the value set in parameter **dF12:** *Setpoint to clear cumulative time between defrost cycles*

- When the defrost start cumulative time counter ends (i.e. the time specified in the parameter elapses), the circuit activates a defrost cycle.

Given the above, the start time for the defrost cycle corresponds to the time at which the count ends (before valve reversal).

Note: In the case of mode changeover, the count is suspended but not reset. In this way, at the next mode changeover (e.g. from OFF or Standby to Heat), the count resumes from its preceding value.

In the case of *independent* defrosting or a single circuit, defrosting starts only when the compressor safety times are reset, and the conditions for starting defrosting are satisfied (the circuit is delivering at least one power step, etc.).

In the case of *single* defrosting, defrosting starts only when the compressor safety times of both circuits are reset and the conditions for starting defrosting on the requesting circuit are satisfied. The two circuits defrost in a fully harmonised manner.

The defrost stage starts with the sequence of switching of the inversion valve of the circuits in question with a procedures similar to those of the mode changeover (see the paragraph Inversion valves management).

The pause time after switching of the inversion valve before restarting of the compressors at maximum capacity is equivalent to **St07 – Reversal valve switching from Defrost to Heat delay**.

N.B.:
If the parameters
St06 – Reversal valve switching from heat to Defrost delay = 0 and
St07 – Reversal valve switching from Defrost to heat delay = 0
Inversion of the valve occurs on the fly ("fast inversion") also with the compressors running, without any form of safety.

18.1.2 Defrost cycle

After cycle reversal the compressors are *all on* (max. available capacity). If there is an alarm which inhibits operation of one or more compressors, defrosting proceeds anyway (as in the case of defrosting during a simple stop).
In the case of independent defrosting of the two circuits, with parameter **dF01: Enable maximum capacity of circuit not in defrost** the capacity of the alternative circuit (the one not being defrosted) can be forced to maximum for compensation purposes.

18.1.3 End defrost and coil drainage

Defrost terminates:

In accordance with temperature /pressure:	if the temperature or pressure of the probe configured as the circuit defrost exit probe increases above the value set in parameter **dF21:** *Disable defrost setpoint***.**
Due to duration:	if defrosting does not end due to temperature or pressure within the maximum time set in parameter **dF22:** *Maximum defrost time*.
By digital input:	if the Circuit 1 Defrost End and Circuit 2 Defrost End digital inputs are configured and active

If the probe is in error or not configured, defrosting may end in the two other modes (time and digital input)

The end of defrosting is always independent for each circuit, depending on the analogue or digital end defrost inputs for the circuit in question.

The defrost exit stage starts with the switching sequence of the circuit inversion valve with procedures similar to those envisaged for entry into defrosting (**St06**), apart from the dripping stage.
The compressors are stopped observing only the time set with parameter **Cp27** *Defrost compressor/step delay minimum*.
Before the valve reverses, coil drainage runs for a period given in **df23**.
In this phase the compressors stay off and the external exchanger fan of the circuit is run at maximum power.

After the drip stage, if performed, if time St06 is less than dF23, switching of the valve is immediate and circuit defrosting is terminated.

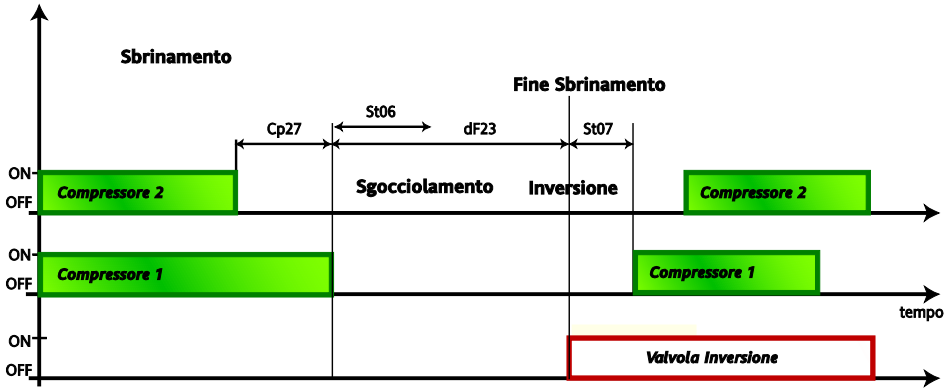
The end of the defrosting phase corresponds to the moment the valve is reversed.

After inversion of the valve the compressor will restart after time **St07**.

Note: after the end of defrosting, the compressor safety times are no longer regulated by **CP27** (the compressor start sequence of the circuits after defrosting observes normal timings).

N.B.: If all parameters **St06, St07 and dF23** are set to zero, inversion of the valve occurs "on the fly" ("fast inversion"), also with the compressors running, without any form of safety.

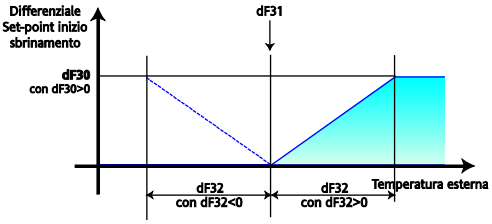
In the case of *single* defrosting on two circuits, the compressors are available for temperature control only if both circuits have stopped defrosting.
In the case of *independent* defrosting the compressors of the circuit that has finished defrosting will be immediately available to the temperature regulator.
The circuit for which compensation is active (if either) is controlled by the Heat temperature controller on termination of defrosting.

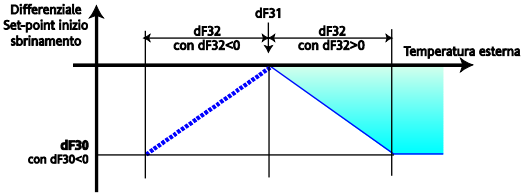


18.2 Start defrost setpoint

In very dry and cold climates, it is good to be able to vary the reference temperature for the start of defrosting as a function of the external temperature.
This regulator compensates, in a linear manner, the defrosting start temperature or pressure with a positive or negative differential value according to the external temperature.
The real defrost start setpoint is calculated by adding this dynamic differential to the value of parameter **dF11:** *Setpoint for enable interval count between defrost cycles*.

Enabling
The controller is enabled by setting parameter **dF30:** *Maximum dynamic defrost differential* to a value other than 0. Also, an analogue input must be configured as external temperature.





Defrost	Parameter	Description
External temperature		External temperature
Differential	dF30	Maximum defrost dynamic differential
Setpoint	dF31	Defrost dynamic differential setpoint
	dF32	Defrost dynamic differential proportional band

N.B.: In case of error of the external probe, the differential value is set to zero (compensation disabled).

18.3 Defrost alarm management

For the actuation of loads during alarms, see the diagnostics section.

To summarise, and specifically for defrosting, if probe errors or alarms occur which lock the compressors, the start defrost and end defrost cycles are already defined and are typically based on parameter timings.
E.g. if during defrosting the compressors are made unavailable by alarms, defrosting will terminate when the maximum time expires. It may terminate differently if the compressors become available again during the defrosting cycle.

18.4 Manual defrost

EnergySBW600 provides the facility to force defrosting manually by means of a long press of the [UP] key.
Manual defrost is possible when:

- **dF00** = 1,2
- **UI20 -Enable defrost function from key**
- if the external exchanger temperature/pressure is below the value set in parameter
  dF01 Enable maximum power for non defrost circuit

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 about “End Defrost”

18.5 Power failure during defrost

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

19 DYNAMIC SETPOINT (FOLDER PAR/DS)

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

- Analogue input set as dynamic setpoint input.
  N.B.: valid only for AIL3 (CL32=25) / AIE3 (CE32=25) or AIL4 (CL33=25) / AIE4 (CE33=25)

or

- external or ambient temperature

This function has two purposes: to save energy, or to operate the machine under particularly harsh outdoor temperature conditions.

Enabling
Dynamic setpoint
a) Depending on ambient or external temperature, the dynamic setpoint is enabled if:

- The activation / selection of the dynamic differential parameter **dS00= 1 or 2.**
- an analogue input is configured as Ambient temperature (value =10) or as External temperature (value =9) (if both are configured, temperature control is performed in relation to the Ambient temperature).

b) depending on the dynamic setpoint input

- probe AI3 (analogue inputs) is configured as a dynamic setpoint input (**CL32=25**) / **CE32=25**) or
- probe AI4 (analogue inputs) is configured as a dynamic setpoint input (**CL33=25**) / **CE33=25**)

The function is enabled independently with respect to the differential on dedicated input, with the parameter Temperature dynamic differential selection on external temperature dS00, in addition, an analogue input must be configured as Ambient temperature or as External temperature (if both are configured, regulation occurs on ambient temperature).

N.B.:

- These two options (a) and (b) are independent.
- If the external temperature probe is in error or the ambient temperature probe is not configured with the external probe in error, the associated dynamic differential is cancelled (function "disabled")
- The dynamic setpoint input must be a voltage input (V) or a current input (I); it cannot be an NTC temperature probe. The Min and Max values of the graphs are associated with the Min (start scale value) and Max (full scale value) values that the input can assume. If the dynamic setpoint input is in error, the associated dynamic differential is annulled (function disabled).

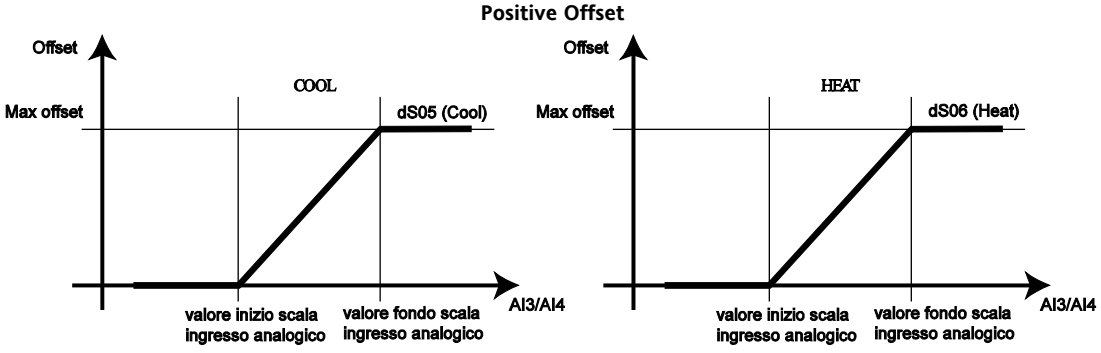
When the function is active, the Economy LED lights up (if configured: **UI07=1**)

19.1 Modification (decalibration) of the setpoint as a function of the dynamic setpoint input

19.1.1 Modification (decalibration) of the setpoint as a function of the dynamic setpoint input with positive offset

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

Modification based on the dynamic setpoint input with positive offset



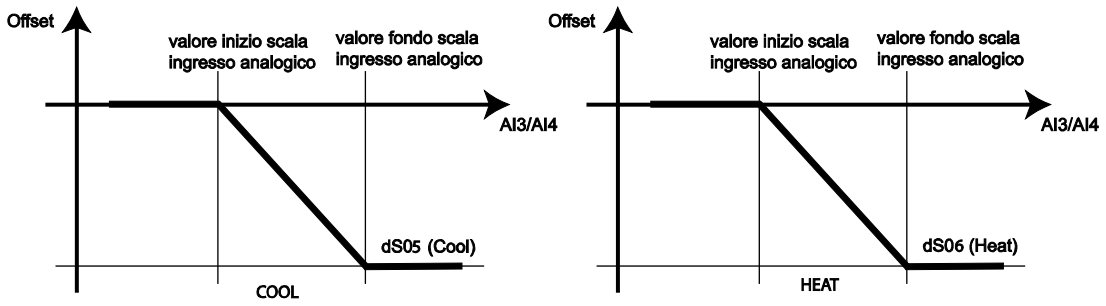
N.B
The dynamic setpoint input must be a voltage input (V) or a current input (I); it cannot be an NTC temperature probe, i.e. **CL02/CL03= 3,4,5 or 6**.
The Min and Max values of the graphs are associated with the Min (start of scale value) and Max (full-scale value) values of the input itself, in other words

- Min = CL11 for AI3; CL13 for AI4
- Max = CL10 for AI3; CL12 for AI4

19.1.2 Modification (decalibration) of the setpoint based on the dynamic setpoint input with (offset) negative.
See above

Modification in accordance with the input for dynamic setpoint with negative offset

Negative Offset



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

Decalibration of the setpoint in accordance with the external temperature may occur in a proportional manner or with fixed decalibration; the setting is performed by configuring parameter **dS00 - Selection of temperature regulator dynamic differential on ambient or external temperature.**
This allows enabling/selecting the temperature controller dynamic digital differential

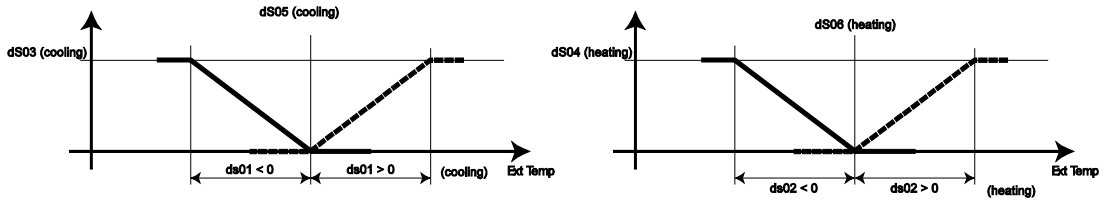
- 0 = disabled
- 1 = Proportional
- 2 = Fixed (by steps)

19.2.1 Modification (decalibration) of the setpoint based on the external temperature (dS00=1)

Proportional offsetting of set-point with positive differential (offset).
The figure shown above shows decalibration in both cooling and heating modes

Modification based on the external temperature with positive offset

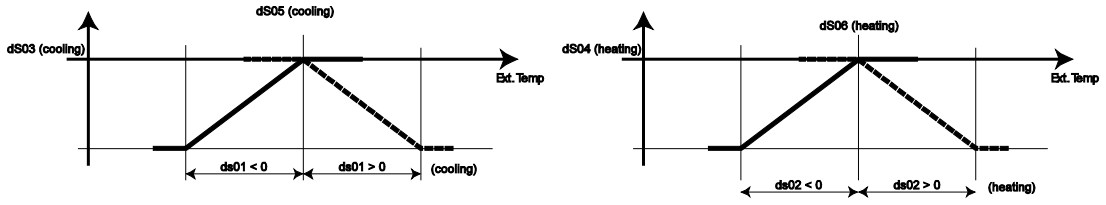
Positive Offset



Proportional offsetting of set-point with negative differential (offset).
See above

Modification depending on outdoor temperature with negative offset

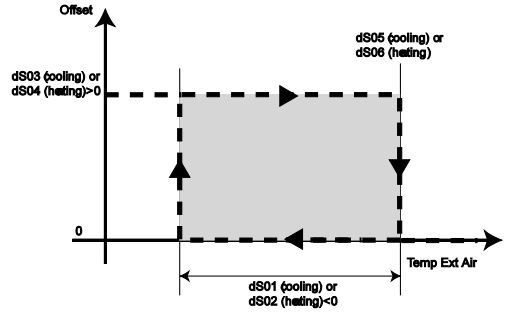
Negative Offset



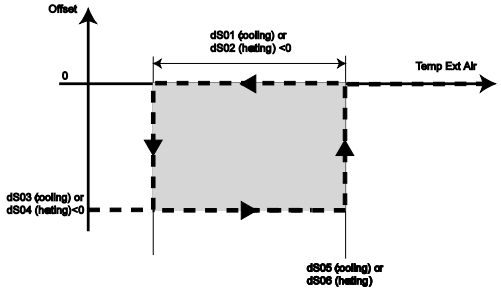
Cool	Heat	
dS01	**dS02**	**Temperature regulator dynamic differential proportional band in Cool / Heat**
dS03	**dS04**	**Maximum temperature regulator dynamic differential in Cool / Heat**
dS05	**dS06**	**Temperature regulator dynamic differential setpoint in Cool / Heat**
		Ext. Temp: external or ambient temperature

19.2.2 Fixed modification (decalibration) of the setpoint (dS00=2)

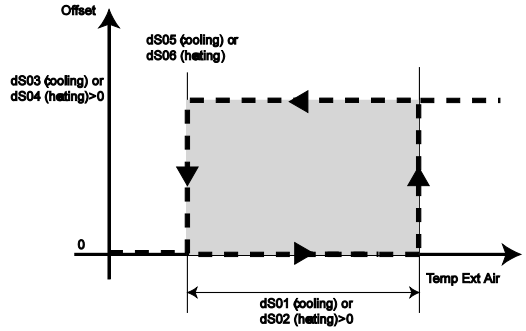
Differential > 0
Band < 0



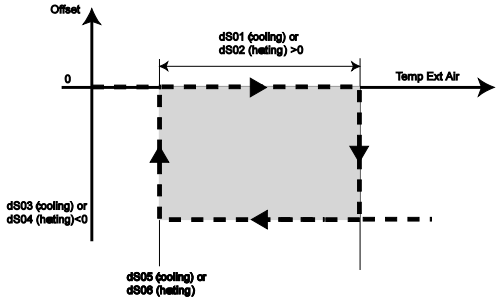
Differential < 0
Band < 0



Differential > 0
Band > 0



Differential < 0
Band > 0



Cool	Heat	
dS01	**dS02**	**Temperature control proportional band dynamic differential in Cool / Heat**
dS03	**dS04**	**Maximum temperature control dynamic differential in Cool / Heat**
dS05	**dS06**	**Temperature control dynamic setpoint differential in Cool / Heat**
		Ext. Air Temp: external or ambient temperature
		Offset: Differential

20 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).

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

Enabling
Use parameter **Ad00 - Select no accumulation mode**
when set not equal to zero enables the function and enables selecting the amount to which the adaptive function temperature differential is to be added or subtracted.

		0	1	2	2
Ad00	**Select no accumulation mode**	Accumulation disabled	Setpoint	Hysteresis	Setpoint + hysteresis

General conditions of operation
- In Off the adaptive function is disabled.
- In Stand-by the adaptive function is disabled.
- In On the adaptive function is enabled.

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 **Ad06 - Reference compressor on time for adaptive accumulation**

Parameter	Description
MT	
Ad06	**Reference compressor on time for accumulation offset**

Real time ET

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

Type of plant	ET
Single circuit 2 / 4 compressors / Segmented compressors	Count [first compressor on / first partialization, last resource switched off]
Double circuit 1 / 2 compressors / Segmented compressors	Count [first compressor on / first partialization, last resource switched off] Independently of the circuits
Ordinary compressor	Count [compressor on, compressor off]

20.1 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)* Ad01)/10 + Ad02**

Where:

Ad01	**Accumulation offset constant**
Ad02	**Accumulation offset differential**

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: HYSTERESIS (0) = HYSTERESIS (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**

  See differential regression

Adaptive function Modification of setpoint in heating

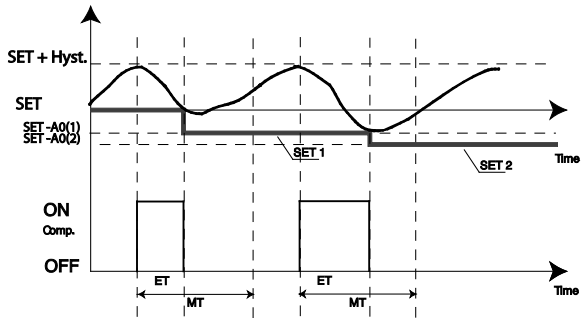
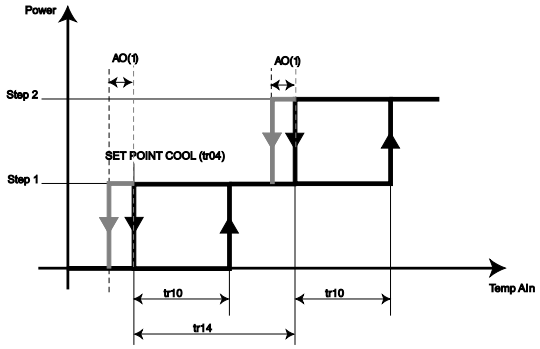
HEATING MODE

Same as heating example. The offset is ADDED to the setpoint:

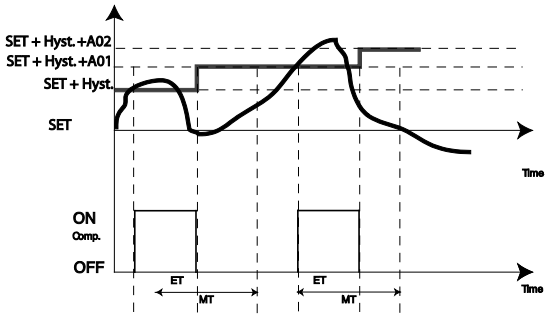
- SET(0) = SET (HEAT)
- SET(1) = SET(HEAT)+AO(1)
- SET(2) = SET(HEAT)+AO(2)

...

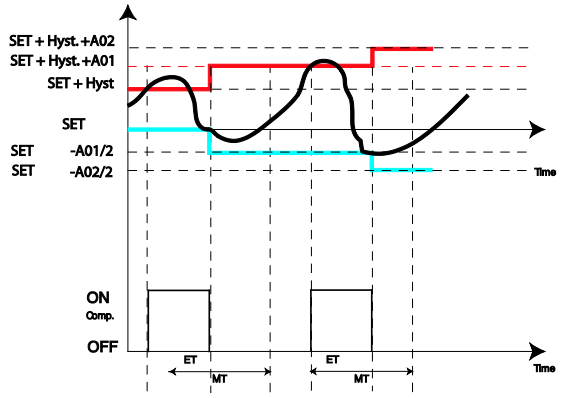
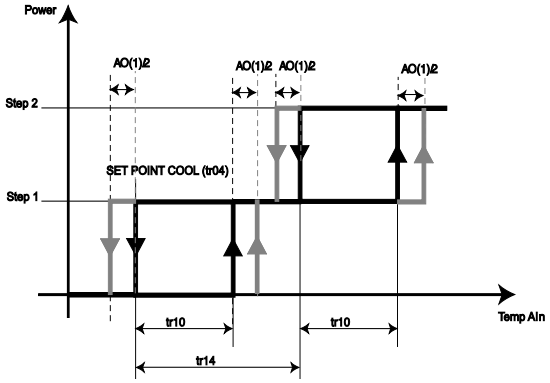
Note that in both modes, the compressor on temperature is the same for each operating cycle, even when the adaptive function is activated.
This extends the zone between the setpoint and on temperatures, reducing the number of times the compressor switches on and off and thereby reducing any overlap with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

Cooling mode	
Adaptive function with setpoint modification (Ad00=0)	**Setpoint modification after calculation of AO1**
	
SET1 = SET(1), SET2=SET(2)	

20.2 Adaptive function with hysteresis modification

Adaptive function with hysteresis modification (Ad00=1)	Hysteresis modification after calculation of AO1
	

20.3 Adaptive function with setpoint and hysteresis modification

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

20.4 Setpoint regression

ET≥MT example

<u>If ET ≥ MT:</u>

If the cycle time is long enough (and greater than MT), regression of the real setpoint occurs: for each interval of Ad05 (from the start of the cycle), the setpoint is modified by the value set in Ad02.

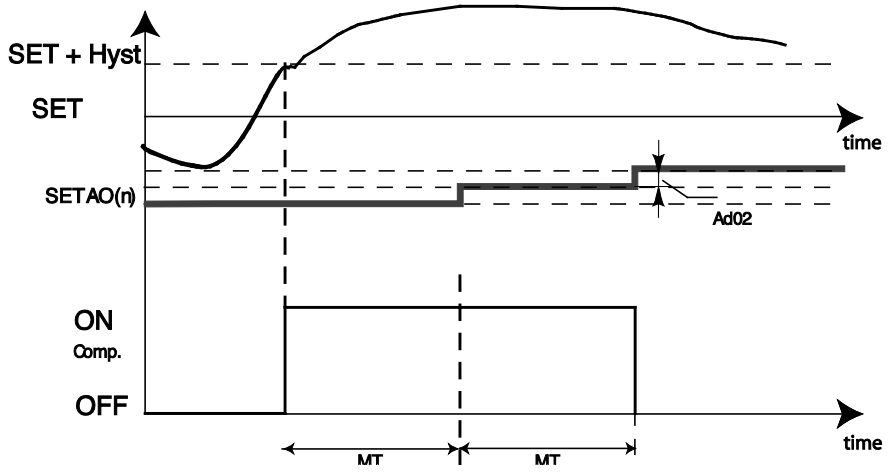
- in cooling, the setpoint (real for cycle N) is increased:
  after Ad05: SET(N) + Ad02
  after 2*Ad05: SET(N) + 2*Ad02
  and so on until the maximum value (setpoint / hysteresis)

- 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
Ad01	Accumulation offset constant	**See Modify setpoint offset calculation formula**
Ad02	Accumulation offset differential	**See Modify setpoint offset calculation formula**
		See Setpoint regression
Ad03	Block accumulation offset setpoint in cooling mode	**See Protection in cooling mode**
Ad04	Block accumulation offset setpoint in heating mode	**See Protection in heating mode**
Ad05	Compressor on time for accumulation offset regression	**See setpoint regression**
Ad06	Reference compressor on time for accumulation offset	**See MT**

20.5 Protection

COOL
If the outlet temperature < Ad03 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 Ad03 > AL12 Internal circuit antifreeze alarm regulator setpoint

HEAT
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 high pressure alarm (the cycle stops without generating an alarm) should the adaptive function lead to a very high real setpoint.

To set Ad06, we recommend you refer to the high pressure safety devices in use (pressure switch configuration, type of refrigerant used, and so on)

Note: if the plant is of the two circuit type and two water temperature sensors are configured on circuit 1 and 2 primary output, consider the minimum of the two values.

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

Anti-freeze parameters can be viewed and configured in folder **AF** (see User Interface and Parameters chapters).

The anti-freeze function with heat pump serves to prevent breakdowns due to internal heat exchanger icing (typically in machines with water-type internal heat exchangers).
SBW600 enables control of machines with one or two cooling circuits and one or two internal heat exchangers.
The anti-freeze function with heat pump is controlled separately for each cooling circuit.

The function is always active in any machine operating state, i.e. cooling, heating and standby.
Anti-freeze function with heat pump is enabled
via parameter (**AF00 - Select antifreeze probe with circuit 1 heat pump** ≠ 0)
via parameter (**AF01 - Select antifreeze probe with circuit 2 heat pump** ≠ 0)

The Heating LED flashes when this function is active.

Mode change is disabled when this function is enabled.
Defrosting is disabled when this function is enabled.

Analogue inputs for anti-freeze function with heat pump
The analogue inputs used for regulation are selected distinctly for each cooling circuit, using parameters
AF00 - Select antifreeze probe with circuit 1 heat pump
AF01 - Select antifreeze probe with circuit 2 heat pump
Note: For machines with a single circuit **AF01 - Select antifreeze probe with circuit 2 heat pump** must be set = 0.

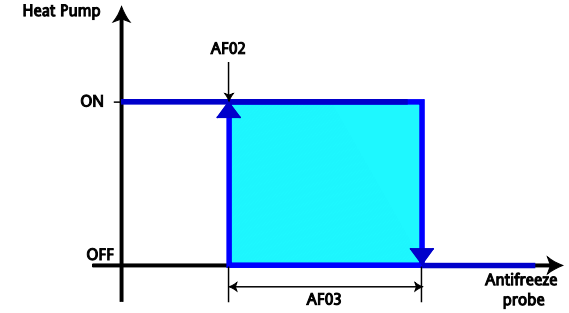
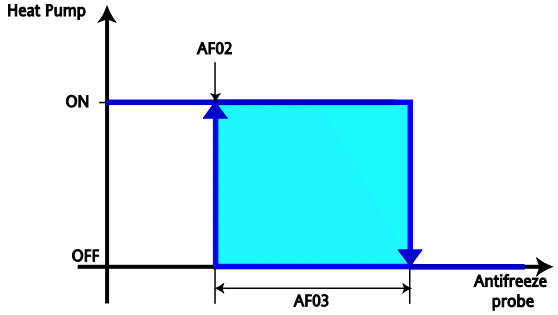
Value AF00 / AF01	Probe
0	No probe (anti-freeze function with heat pump disabled)
1	Internal exchanger water/air inlet temperature
2	Internal exchanger water/air outlet temperature
3	Circuit 1 internal exchanger water outlet temperature
4	Circuit 2 internal exchanger water outlet temperature
5	Circuit 1 and 2 internal exchanger water outlet minimum temperature

General conditions of operation
In **Off** the anti-freeze function with heat pump is disabled.
In **Stand-by** the anti-freeze function with heat pump is enabled, as in On.
In **On**, further to the principal regulation specified in the following paragraphs, the following situation (with priority over the principal regulation itself) may occur: anti-freeze function with heat pump inhibited during defrosts.

NOTE:
The valve reverses with a delay **ST05 - Reversal valve switching delay**.
Furthermore, during the anti-freeze phase, the compressors run at maximum power and are turned off and on with reference only to the delay **CP27 - Defrost compressor step/delay minimum**

Heat pump activation
The function is enabled (°) if the temperature measured
Circuit 1: by the anti-freeze with heat pump probe for circuit 1 < **AF02 - Anti-freeze regulator setpoint with heat pump**
Circuit 2: by the anti-freeze with heat pump probe for circuit 2 < **AF02 - Anti-freeze regulator setpoint with heat pump**

(°) the heat pump is activated if previously switched off; if previously activated, it remains active

Circuit 1	Circuit 2
	
Heat Pump = pompa di calore	Heat Pump = pompa di calore
Anti-freeze probe anti-freeze function heat pump probe for circuit 1 (AF00)	Anti-freeze probe anti-freeze function heat pump probe for circuit 2 (AF01)

Parameter	Description
AF02	Anti-freeze regulator setpoint with heat pump
AF03	Anti-freeze regulator hysteresis with heat pump
Regulator probe	AF01 (circuit 1) / AF02 (Circuit 2)

22 SANITARY WATER AND ANTI-LEGIONNAIRE'S DISEASE (FOLDER PAR/AS)

Small/medium installations (typically residential installations) require “integrated” management of sanitary water (also referred to as ACS) by means of the heat pump system (for heating and cooling the interior environment).
In practice, this involves controlling the sanitary water temperature (ACS temperature) in a dedicated accumulator.

The switch between 'normal' mode (heating/cooling) and ACS mode can occur in 2 ways, depending on the type of system:

- With ACS Valve: the flow will be diverted from the heating/cooling circuit to the ACS accumulator
- With ACS Pump: the heating/cooling circuit pump will be switched off and the ACS accumulator pump switched on

Type of system
The type of system is configured using parameter **AS00 - Select ACS mode**

Enabling
When parameter **AS00 - Select ACS mode** is different from zero, the regulator is *enabled*.
The possible values of parameter **AS00** are:

- 0 = Disabled
- 1 = Enabled only heat pump for sanitary water system with sanitary water valve
- 2 = Enabled only sanitary water heater
- 3 = Enabled sanitary water heat pump and heater system with sanitary water valve
- 4 = Enabled only heat pump for sanitary water system with sanitary water pump
- 5 = Enabled only sanitary water heater
- 6 = Enabled sanitary water heat pump and heater system with sanitary water pump

Refer also to the following table where the AS00 values are indicated in relation to the type of system used

	Par.	Description	value			
			0	**1 or 4**	**2 or 5**	**3 or 6**
Enabling	**AS00**	**Select ACS mode**	disabled	Heat pump	only sanitary water heater	Heat pump + sanitary water heater

system	**Sanitary water valve**		AS00 = 1 system with sanitary water valve		AS00 = 3 system with sanitary water valve
	Sanitary water pump		AS00 = 4 system with sanitary water pump		AS00 = 6 system with sanitary water pump

Notes.

- The term heat pump actually denotes the entire machine (e.g. *including the* integrated internal exchanger heaters, if any)
- Since the behaviour of the sanitary water heater is independent from the type of system, the values 2 and 5 determine the same device behaviour.
- When parameters *Anti-legionnaire's disease event duration, Monday – Tuesday* - etc. **AS25, AS26...** are different from zero (at least one must be) the Anti-legionnaire's disease function is *enabled* .Furthermore the RTC must be present and enabled for operation (it must not be faulty and/or not set, for further details refer to the specific alarms)

General conditions of operation

- In **Off** the regulator is *switched off* immediately and continuously.
- In **Standby** the regulator is on, with exclusive reference to activation of the ACS antifreeze heater.
- In **On**, in addition to the main control specified in subsequent paragraphs, the following situations are also possible (with priority given to the main control itself):
  - If there is an *error* in the sanitary water temperature *sensor,* the compressor associated with that sensor is disabled
  - The ACS valve / pump is immediately switched off in the event of valve / pump shutdown alarms
  - The ACS heater is immediately switched off in the event of heater shutdown alarms
  - On start-up of SBW600 (power on or reboot from OFF or Stdby), ACS mode is inhibited for 120 seconds in order to prevent multiple settings competing on start-up, with impulsive activations of the loads (e.g. internal pump).

Sanitary Water Setpoint

Regulation occurs on the **actual** ACS Setpoint.
The Actual Setpoint is determined by the following contributing factors:

- At start-up of the instrument, the Sanitary Water Setpoint = **AS01 - ACS setpoint**
- If Time Bands are active (**tE00 - Enable time band operation** = 1) the Sanitary Water Setpoint will be determined by the **ACS Set Point** of the corresponding event / profile (see Time Bands section (folder PAr/tE))
- If **AS11 - ACS set point dynamic constant** is different from zero then the Dynamic ACS Setpoint function is activated on the Sanitary Water Setpoint

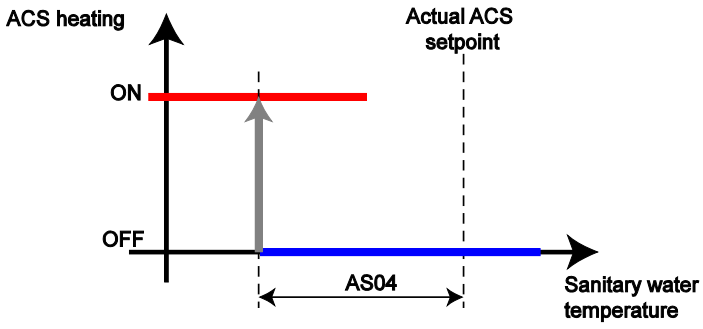
22.1 Sanitary Water in HEAT mode

Sanitary water consent
In Sanitary Water mode, the machine's operation is governed by the **request/consent** concept. Consent may be given (with resulting switchover from normal mode to the mode determined by the Sanitary Water regulator) *if and only if all* of the following conditions are satisfied:

- Sanitary Water Setpoint not reached (a function of the temperature of the ACS accumulator – **See diagram A**
- the time **AS10 - ACS minimum deactivation/activation time has elapsed**
- NO Anti-Legionnaire's Disease period is in progress*
  *example: Saturday 21.30. AS40 different from 0; AS41 = 22, AS42 = 0

This request, which was described above, takes priority over the "normal" **ACS heating request**.

Diagram A
Sanitary water CONSENT



Par.	Description
AS04	**ACS hysteresis**
AS01	**ACS setpoint**
AS02-AS03	**Note:** using the parameters: **AS02 - ACS minimum setpoint** **AS03 - ACS maximum setpoint** It is possible to limit the maximum and minimum configuration values of **AS01**
Setpoint	**Actual ACS Setpoint**
Control sensor	**Sanitary water temperature**

Regulation, machine in HEAT
In the event of a sanitary water heating request:

- the machine remains in Heat Pump mode (and maintains the same control sensor that it uses in normal Heat mode) but modifies the control setpoint from actual Heat Setpoint to **AS01 -**ACS Setpoint (ACS) with **AS05 - ACS disengage setpoint differential**
- the ACS valve / pump is activated with the following actions:
  - machine with ACS valve: the ACS valve is activated without switching off the internal pump
  - machine with ACS pump: the ACS pump is activated at the same time as the internal pump is switched off; to prevent flow switch alarms, it is necessary to re-enter the time **AL14 - Flow switch alarm bypass**

ACS heater: see corresponding paragraph

ACS disengage
Once the machine has been "disengaged" to heat the sanitary water for Anti-Legionnaire's disease, it will continue to do so until *at least one* of the following conditions is satisfied:

- tACS accumulator sensor reaches the actual ACS setpoint **- see figure B**
- the Heat control sensor (which typically is not the ACS accumulator sensor) reaches a certain value, equal to the **AS01 -**ACS Setpoint (ACS) plus a specifiable differential, which takes account of the temperature difference that may exist between the ACS accumulator and the position of the Heat control sensor, parameter AS05 **- see figure C**
- the time set using parameter **AS09 - ACS maximum activation time has elapsed**
- an Anti-Legionnaire's Disease period is starting

When normal mode and the actual Heat (or Cool) setpoint are restored, except in the event of request/consent for machine operation in ACS for Anti-Legionnaire's Disease – see corresponding paragraph
All considerations regarding the actions adopted during switchovers apply.
If normal operating mode is restored, *the* ACS valve / pump is switched off with the following actions:

- machine with ACS valve: the ACS valve is switched off, the internal pump will continue to function if required for normal operating mode
- machine with ACS pump: the internal pump is activated at the same time as the ACS pump is deactivated; to prevent flow switch alarms, it is necessary to re-enter the time **AL14 - Flow switch alarm bypass**

Diagram B
sanitary water DISENGAGE
SETPOINT REACHED

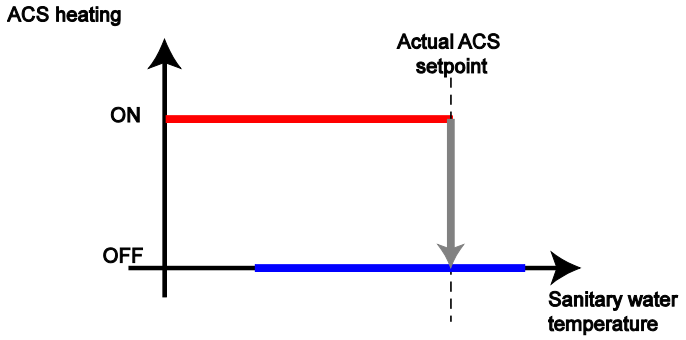


Diagram C
sanitary water DISENGAGE

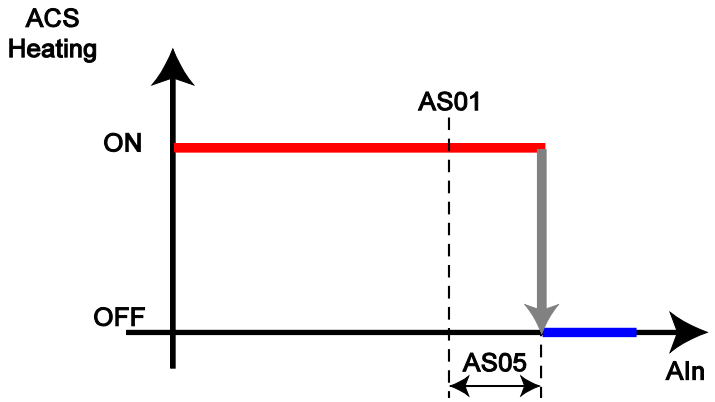


Diagram	Par.	Description
	AS02-AS03	**Note:** using the parameters: **AS02 - ACS minimum setpoint** **AS03 - ACS maximum setpoint** It is possible to limit the maximum and minimum configuration values of **AS01**
B	**Setpoint**	**Actual ACS Setpoint**
B	**Control sensor**	**Sanitary water temperature**
C	**AS01**	**ACS Setpoint**
C	**AS05**	**ACS disengage setpoint differential**
C	**Control sensor AIn**	**HEAT control sensor**

22.1.1 Sanitary water heater in Heat/Cool mode *

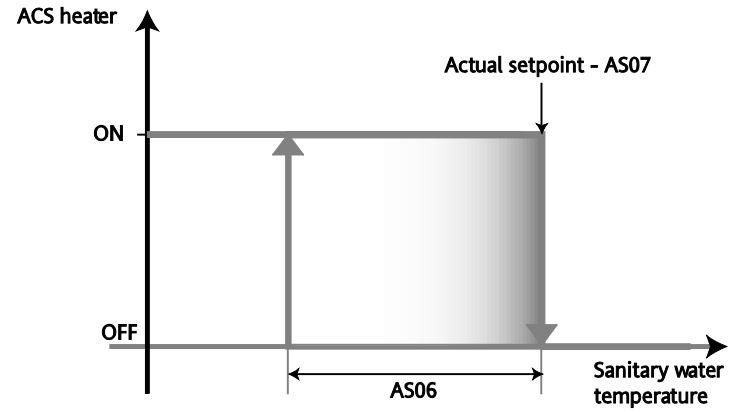
* behaviour independent from mode
Sanitary water heat regulation occurs on the actual ACS setpoint, with

- fixed differential **AS07 - ACS heater differential**
- hysteresis **AS06 - ACS heater hysteresis**, as shown in the figure

The analogue input used for regulation is exclusively the sanitary water temperature
Once enabled, the ACS heater is *independent* (setpoint differential aside, *it does not influence and is not influenced by the machine's other regulators, and the concepts relating to ACS consent do not apply to it*)

Differential AS07 is cancelled if the unit is in Heat Pump Lock

ACS heater



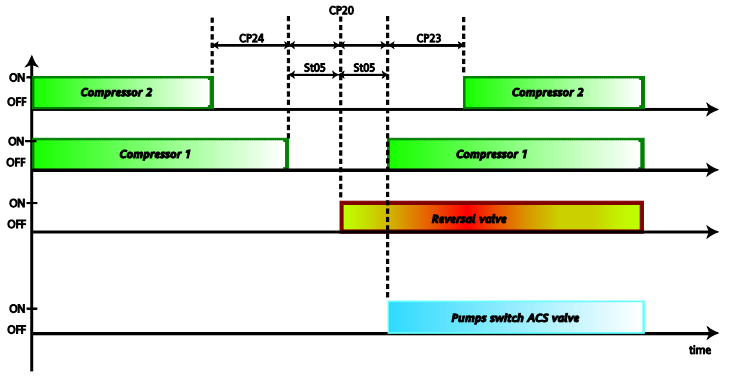
Par.	Description
AS06	ACS heater hysteresis
AS07	ACS heater differential
Setpoint	Actual Setpoint – AS07
Control sensor	Sanitary water temperature

22.2 Sanitary Water, Cool mode

In the event of an **ACS heating** request, the machine switches temporarily from Chiller to Heat Pump (for Heat Pump operation see HEAT Mode), and remains in this mode until it is "disengaged", when normal Cool mode is restored, with actual Cool Setpoint.
In this case, special attention must be paid to the switchovers, since both the reversal valve (already discussed in the corresponding section) and the ACS valve / pump must respect the times indicated below:

Diagram	Par.	Mode Change
A	St05 different from 0	COOL - ACS
B		ACS - COOL
C	St05 = 0	COOL - ACS
D		ACS - COOL

Diagram A



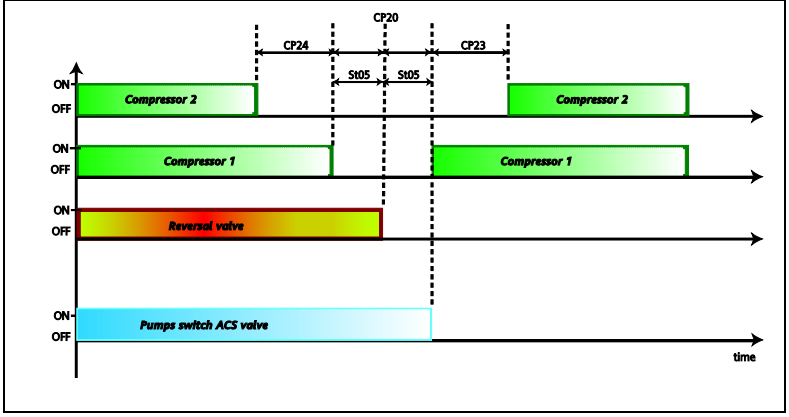
Par.	Description
St05 different from 0	Reversal valve switching delay
CP20	Minimum off/on for same compressor
CP23	Minimum on/on time for same compressor

Par.	Description
CP24	Minimum off/off time for different compressors

The switchover occurs with the following measures:

- **machine with ACS valve**: the ACS valve is activated after the time **St05 - Reversal valve switching delay** from the valve switchover (to switch-on of the first compressor, unless other safety timings further delay said compressor), without switching off the internal pump. If in normal mode the compressors are switched off, the internal exchanger water pump can also be switched off (e.g. operation enabled on request): in this case the pump will switch on at the same time as the ACS mode is activated, resulting in the delayed switch-on of the compressors due to the need for pre-pumping.
- **machine with ACS pump:** the ACS pump is activated after the time **St05 - Reversal valve switching delay** from the valve switchover (to switch-on of the first compressor, unless other safety timings further delay said compressor): the internal pump is switched off at the same time; to prevent flow switch alarms it is necessary to re-enter the time **AL14 - Flow switch alarm bypass**

Diagram B



Par.	Description
St05 different from 0	Reversal valve switching delay
CP20	Minimum off/on for same compressor
CP23	Minimum on/on time for same compressor
CP24	Minimum off/off time for different compressors

The switchover occurs with the following actions:

- **machine with ACS valve**: the ACS valve is deactivated after the time St05 **- Reversal valve switching delay** from the valve switchover (to switch-on of the first compressor, unless other safety timings further delay said compressor), without switching off the internal pump (this water pump may be switched off according to normal mode logic (e.g. operation enabled on request and compressors off).
- **machine with ACS pump:**: the internal exchange pump is activated after the time **St05 - Reversal valve switching delay** from the valve switchover (to switch-on of the first compressor, unless other safety timings further delay said compressor), the ACS is switched off at the same time; to prevent flow switch alarms it is necessary to reset the time **AL14 - Flow switch alarm bypass.**

Diagram C

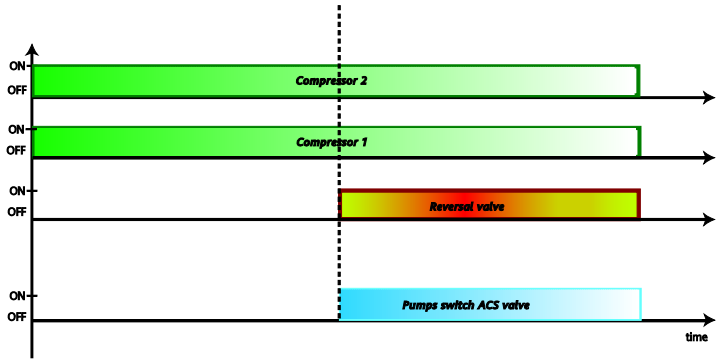
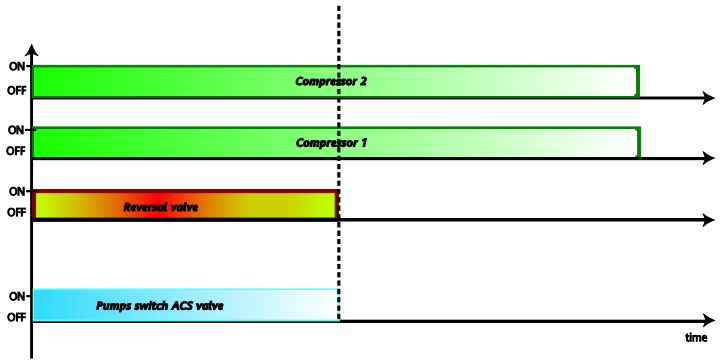


Diagram D



Par.	Description
St05 = 0	Reversal valve switching delay

22.2.1 Dynamic ACS setpoint

The Dynamic ACS Setpoint function consists of modifying the *actual* ACS setpoint according to the system's thermal efficiency.
In fact, it may occur that (e.g. due to incorrect dimensioning of the system) the machine never manages to reach the *actual* ACS setpoint.
Based on previous considerations, in this case the machine would exit ACS mode either due to timeout expired (**AS09 - ACS maximum activation time**) or due to Heat control setpoint reached *(***AS01** + **AS05***)*.

The Dynamic ACS Setpoint function calculates and updates the maximum sanitary water temperature which the system can achieve under those particular conditions. In this way, the system is in any case "guaranteed" to exit from ACS mode due to attainment of the ACS Setpoint.

Enabling
This function is *enabled* by setting parameter **AS11 - ACS setpoint dynamic constant** to a value different from zero.
You must also configure all of the following analogue inputs as:

- water delivery temperature.
- water return temperature.
- ACS temperature

The Dynamic ACS Setpoint function will calculate the new ACS setpoint as the minimum value between

- Actual Setpoint
- (*) ACS maximum water temperature achievable as a function of the system

Where (*) is a function of the parameters
AS11 - ACS setpoint dynamic constant
AS12 - ACS system maximum temperature

22.3 Sanitary water regulation, AS mode

During operation in Heat or Cool mode, the controller/machine (heat pump) meet ACS (or ACS for AL) heating needs if there is a request and provided the necessary conditions are met, otherwise they meet system needs (Heat or Cool).

AS mode is useful in the event that (e.g. due to the current season or the type of system) it is not necessary to meet system needs. In other words in AS mode, the controller/machine (heat pump) are only activated if there is a need for ACS (or ACS for AL) heating, according to the same process as that described previously, otherwise there is no actuation.

The above indications also apply to defrost (must be managed as normal!).

22.4 Anti-Legionnaire's Disease

The Anti-Legionnaire's Disease function eliminates Legionnaire's disease bacteria, which reside in water sources; these bacteria are typically destroyed if the water temperature rises above 60°C for a certain period of time.

Anti-Legionnaire's Disease period
An anti-legionnaire's disease period can be activated on each day of the week with a configurable start time and duration:

Description	Duration of event (0= disabled) Par.	Event (start) hour Par.	Event (start) minutes Par.
day 1 (Monday)	**AS25**	**AS26**	**AS27**
day 2 (Tuesday)	**AS28**	**AS29**	**AS30**
day 3 (Wednesday)	**AS31**	**AS32**	**AS33**
day 4 (Thursday)	**AS34**	**AS35**	**AS36**
day 5 (Friday)	**AS37**	**AS38**	**AS39**
day 6 (Saturday)	**AS40**	**AS41**	**AS42**
day 7 (Sunday)	**AS43**	**AS44**	**AS45**

Note.
The Anti-Legionnaire's disease period (duration of event) must be of suitable length, otherwise there is the risk that **AS20 - ACS setpoint for anti-legionnaire's disease** is never reached. If so an Er48 Anti-legionnaires alarm will raise up. The automatic alarm reset when the setpoint will be reached.

ACS setpoint for anti-legionnaire's disease

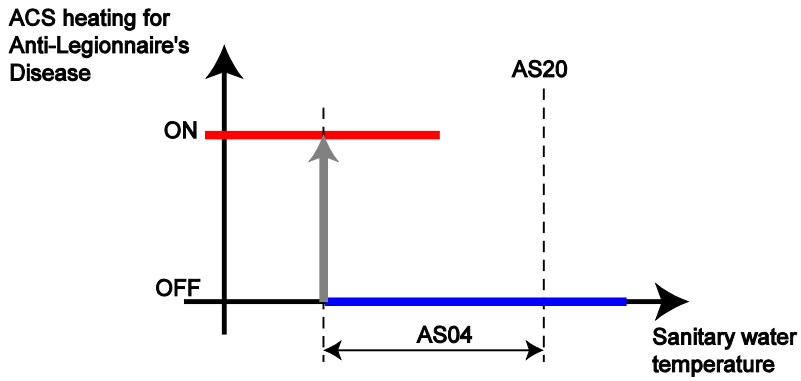
Regulation always occurs on the ACS setpoint **for anti-legionnaire's disease AS20**

ACS consent for anti-legionnaire's disease
In the same way as for the "normal" ACS regulator, the **request/consent** concept applies to **machine operation in ACS for Anti-Legionnaire's Disease**. Consent may be given (with resulting switchover from normal mode, or from ACS mode, to the mode determined by the ACS regulator for Anti-Legionnaire's disease) *if and only if all* of the follow conditions are satisfied:

- Anti-Legionnaire's disease period in progress*
  *example: Saturday 22.30. AS40 different from 0; AS41 = 22, AS42 = 0
- ACS setpoint for Anti-Legionnaire's Disease not reached (a function of the temperature of the ACS accumulator – **See diagram A**
- the time **AS23 - ACS minimum deactivation/activation time for anti-legionnaire's disease has elapsed**

This request, which was described above, takes priority over the "normal" **ACS heating request**.

Diagram A
Anti- Legionnaire's disease CONSENT



Par.	Description
AS04	**ACS hysteresis**
AS20	**ACS setpoint for anti-legionnaire's disease**
AS21-AS22	**Note: with** the parameters :

	AS21 - Minimum ACS setpoint for anti-legionnaire's disease **AS22 - Maximum ACS setpoint for anti-legionnaire's disease** It is possible to limit the maximum and minimum configuration values of **AS20**
Control sensor	**ACS water temperature**

Notes
Consent is not subject to compliance with safety times*, since the aim is to bring the ACS to the temperature specified for Anti-Legionnaire's Disease, with priority over everything else.
*times controlled by defining Anti-Legionnaire's disease periods using parameters AS25...AS45
Typically **AS20 - ACS setpoint for anti-legionnaire's disease** > **AS01 - ACS setpoint** which means that the machine will switch to managing ACS heating for Anti-Legionnaire's Disease as soon as the Anti-Legionnaire's Disease period starts (all the more so if the machine was in Cool mode).

Regulation
HEAT
the machine operates in much the same way as for the ACS case, except that a different setpoint is adopted: in the event of a request for ACS heating for Anti-Legionnaire's disease:

- the machine remains in Heat Pump mode (and maintains the same control sensor that it uses in normal Heat mode) but modifies the control setpoint from Actual Heat Setpoint to **AS20 - ACS setpoint for anti-legionnaire's disease** with the same **AS05 - ACS disengage setpoint differential**
- the ACS valve / pump is activated (or remains active) with the same actions as those indicated in the ACS case.

COOL
the machine operates in a similar way, it must switch from chiller to PdC and vice versa.
All considerations made with regard to actions adopted during switchovers apply.

ACS Disengage for Anti-Legionnaire's Disease
Once the machine has been "engaged" to heat sanitary water for Anti-Legionnaire's disease, it will continue to do so until *at least one* of the following conditions is satisfied:

- the ACS accumulator sensor reaches the ACS setpoint for Anti-Legionnaire's disease, parameter AS20 **- see figure B**
- the Heat control sensor (which typically is not the ACS accumulator sensor) will reach a certain value, equal to the ACS Setpoint for Anti-Legionnaire's Disease plus a specifiable differential, which takes account of the temperature difference that may exist between the ACS accumulator and the position of the Heat control sensor, parameter AS05 **- see figure C**
- the Anti-Legionnaire's Disease period is finished

when normal mode and the actual Heat (or Cool) setpoint are restored, except in the event of request/consent for machine operation in ACS mode, for which the machine's behaviour has already been described in detail.
All considerations made with regard to actions adopted during switchovers apply.

Note. Once the request for ACS heating for Anti-Legionnaire's Disease is exhausted, typically the conditions for having an ACS heating request are not satisfied, but this may occur if the Anti-Legionnaire's Disease period has a limited duration. In which case, normal mode will not be restored but the machine will operate in ACS mode, for which the machine's behaviour has already been described in detail.

Diagram B
Anti-Legionnaire's Disease
DISENGAGE
SETPOINT REACHED

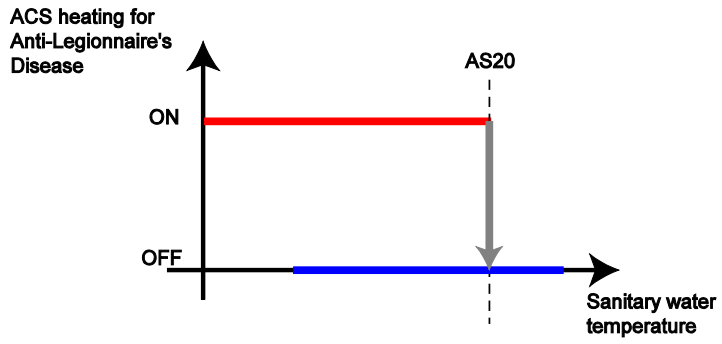


Diagram C
Anti-Legionnaire's Disease
DISENGAGE

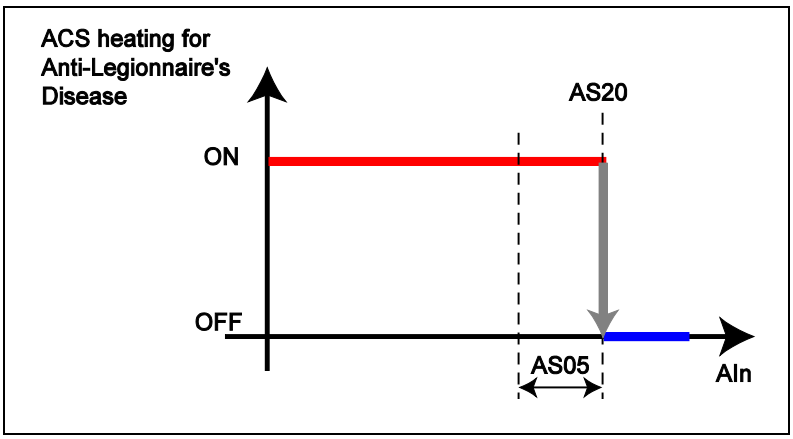


Diagram	Par.	Description
C	AS05	ACS disengage setpoint differential
B-C	AS20	ACS setpoint for anti-legionnaire's disease
B-C	AS21-AS22	Note: with the parameters : **AS21 - Minimum ACS setpoint for anti-legionnaire's disease** **AS22 - Maximum ACS setpoint for anti-legionnaire's disease** it is possible to limit the maximum and minimum configuration values of **AS20**
B	Control sensor	Sanitary water temperature
C	Aln Control sensor	HEAT control sensor

Note
Diagram C Case:: if the Heat control sensor is disengaged (e.g. the sanitary water did not achieve the Anti-Legionnaire's Disease setpoint), the conditions for a new ACS consent for Anti-Legionnaire's Disease may immediately exist.
In order to prevent the machine fluctuating between normal mode and ACS for Anti-Legionnaire's Disease mode, there must be a minimum ACS OFF-ON safety time for Anti-legionnaire's disease defined by parameter **AS23 - ACS minimum deactivation/activation time for anti-legionnaire's disease**

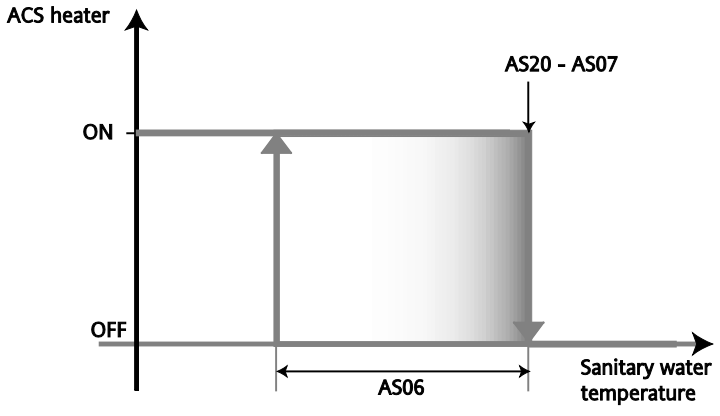
22.4.1 ACS Heater for Anti-Legionnaire's Disease

The ACS heater is regulated in the same way as described for ACS heating, except that:

- the setpoint adopted is **AS20 - ACS setpoint for anti-legionnaire's disease**
-

Differential AS07 is cancelled if the unit is in Heat Pump Lock

ACS Heater for Anti-Legionnaire's Disease



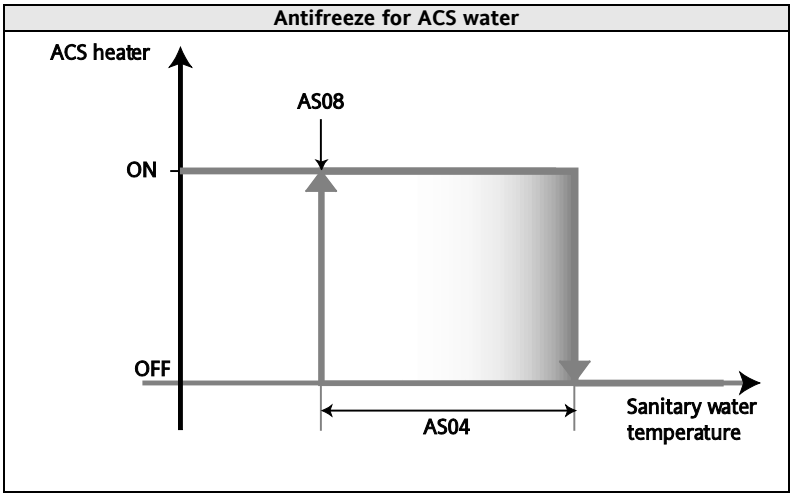
Par.	Description
AS06	ACS heater hysteresis (for anti-legionnaire's disease)
AS07	ACS heater differential
AS20	ACS setpoint for anti-legionnaire's disease
Control sensor	ACS water temperature

22.5 Sanitary Water Antifreeze

In specific situations (e.g. machine in standby) it is necessary to guard against the risk of the ACS water freezing.
For this purpose, only the ACS heater (which must be present*) is used and the machine's operation mode is not modified (e.g. if in Cool, it remains in Cool).

* at least one digital input must be configured as ACS Electrical Heater by means of parameters **CL90...CL97 / CL80-CL81 if digital / CL61...CL63 if digital = ±28.**

The heater is regulated on parameter **AS08 - ACS antifreeze setpoint**, as shown in the figure below. The analogue input used for regulation is exclusively the sanitary water temperature



Par.	Description
AS04	ACS hysteresis
AS08	ACS antifreeze setpoint
Control sensor	Sanitary water temperature

23 BLOCK HEAT PUMP (FOLDER PAR/HP)

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)**

Block heat pump 1 and 2 parameters table

Parameter	Description	External temperature	Differential Setpoint External Temperature	Parameter (analogue input)
	Block 1			
HP00	Select heat pump 1 lock probe	**X (=1)**		**x**
HP01	Block heat pump 1 setpoint	**x**		**x**
HP02	Block heat pump 1 hysteresis	**x**		**x**
HP03	Heat pump 1 lock maximum dynamic differential		**x**	
HP04	Block heat pump 1 dynamic differential setpoint		**x**	
HP05	Block heat pump 1 dynamic differential proportional band		**x**	
	Block 2			
HP10	Select probe for block heat pump 2	**X (=1)**		**x**
HP11	Block heat pump 2 setpoint	**x**		**x**
HP12	Block heat pump 2 hysteresis	**x**		**x**

If the external temperature is too low, heat pump performance will not be acceptable; the following are thus available:

Block heat pump based on external temperature

Block heat pump based on external temperature

- set a set point (**HP01 / HP11**) below which the heat pump will be disabled.
- Set the parameters **HP00 / HP10 Select probe for block heat pump 1 / 2** = 1

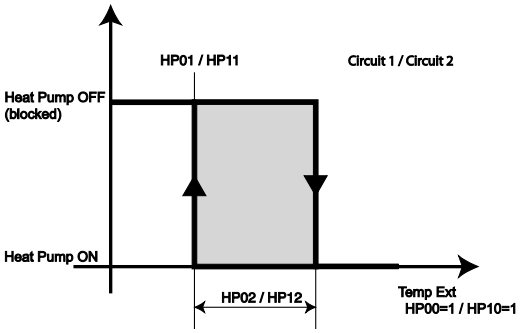
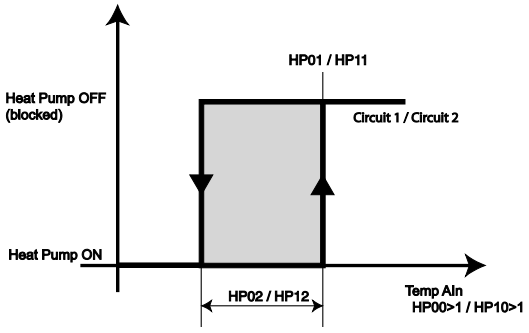
Block heat pump based on regulation temperature

Block heat pump based on regulation temperature

- set a set point (**HP01 / HP11**) above which the heat pump will be disabled.
- Set the parameters **HP00 / HP10 Select probe for block heat pump 1 / 2** > 1

Value	Probe	Mode
0	No probe (block pump disabled)	-
1	**External temperature**	**Heating**
2	Internal exchanger water/air inlet temperature	Cooling
3	Internal exchanger water/air outlet temperature	Cooling
4	Circuit 1 and 2 internal exchanger water outlet average temperature	Cooling
5	Recovery exchanger inlet water temperature (or external exchanger)	Cooling
6	Recovery exchanger water outlet temperature (or external exchanger)	Cooling
7	Circuit 1 and 2 external exchanger average temperature	Cooling

Note: The Economy LED illuminates with a steady light on the display to indicate heat pump lock (set **UI07 - Configuration of Economy LED** = 2)

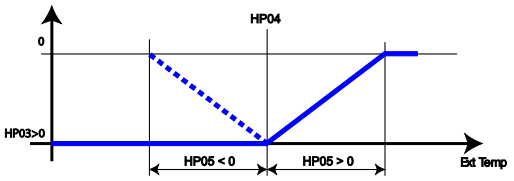
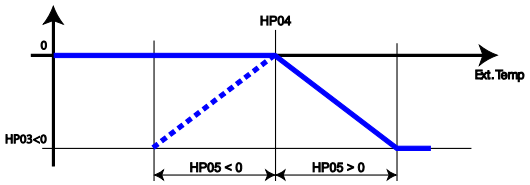
Block heat pump based on external temperature Circuit 1 / Circuit 2	Block heat pump based on regulation temperature Circuit 1 / Circuit 2
	
Heat Pump = pompa di calore	**Heat Pump = pompa di calore**

Heat Pump	Heat pump state
T ext	External temperature
AIn	Probe selected by parameter

23.1.1 Block heat pump 1 - setpoint

It is useful to be able to vary the block heat pump temperature according to the external temperature.
This regulator linearly compensates the setpoint for the block heat pump function with a positive or negative differential value according to the external temperature.
The real setpoint for the block function is calculated by *adding* this dynamic differential to the value of parameter **HP01 - Block heat pump 1 setpoint**

Enabling
The regulator is enabled by setting parameter **HP03 - Heat pump 1 lock maximum dynamic differential** ≠ 0.
Furthermore, an analogue input must be configured as external temperature.

Positive offset HP03>0	Negative offset HP03<0
	
Heat Pump = pompa di calore	**Heat Pump = pompa di calore**

23.1.2 Block heat pump from digital input

If a digital input is configured as “Block heat pump” or C**L40..CL45 / CL50..CL54=±20 ,** then when it is activated, the heat pump will be deactivated.

24 POWER LIMITATION (FOLDER PAR/PL)

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

24.1 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.

Enabling

- Power limitation on **external temperature *** is enabled by parameter (**PL00 -** Proportional band for power limitation on external temperature ≠ **0**)
- Power limitation on **temperature *** is enabled by parameter (**PL10 -** Proportional band for power limitation on water/air temperature ≠ **0**)
- Power limitation on **pressure **** is enabled by parameter (**PL20 -** Proportional band for power limitation on pressure ≠ **0**)

* The external temperature and temperature power limitation act on the power steps independently of the circuits.
** In the case of machines with two circuits, power limitation is controlled on each circuit separately, as a function of their parameters.

General conditions of operation

Function active in Cool/Heat mode.

1. In **Off** the power limitation function is disabled.
2. In **Standby** the power limitation function is disabled.
3. In **On** power limitation acts by switching off the power steps in observance of the set safety timings. The same applies to their turning back on when returning from limitation.
   Note: when limitation is active, no special message indicates this on the display
   Note: if the control input is not configured or in error, the individual power limitation controllers are disabled. Apart from probe errors, in this situation there is no special indication on the display

Parameter	Parameter	Description	See diagram	
COOL	HEAT		COOL	HEAT
PL00		Power limitation on external temperature proportional band External SETPOINT. COOL temperature		
PL01	PL02	External temperature setpoint for power limitation in Cool/Heat. External SETPOINT. HEAT temperature	A A’	B B’
PL11		Select probe for power limitation on water/air temperature	See table, parameter PL11	
PL12		High water temperature setpoint for power limitation PL12 High temperature SETPOINT	C	
PL13		Low water temperature setpoint for power limitation Low temperature SETPOINT	D	
PL20		Power limitation on pressure proportional band		
PL21		High pressure setpoint for power limitation High Pressure SETPOINT	E E’ E’’	
PL22		Low pressure setpoint for power limitation Low Pressure SETPOINT	F F’ F’’	

Table, parameter PL11

Value	Probe
0	No probe (regulator disabled)
1	Internal exchanger water/air inlet temperature
2	Internal exchanger water/air outlet temperature
3	Circuit 1 and 2 internal exchanger water outlet average temperature
4	Recovery (or external) exchanger inlet water temperature
5	Recovery (or external) exchanger water outlet temperature
6	Circuit 1 and 2 external exchanger average temperature

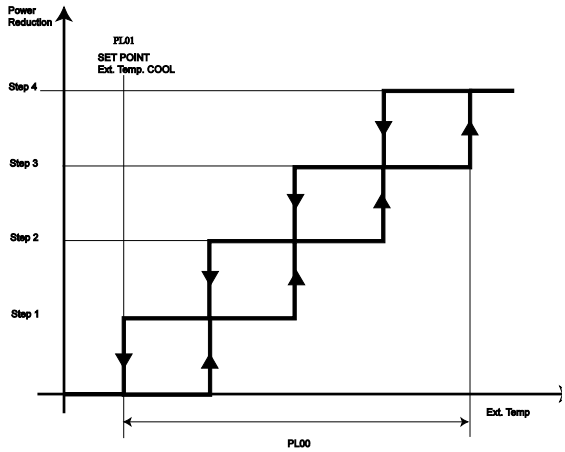
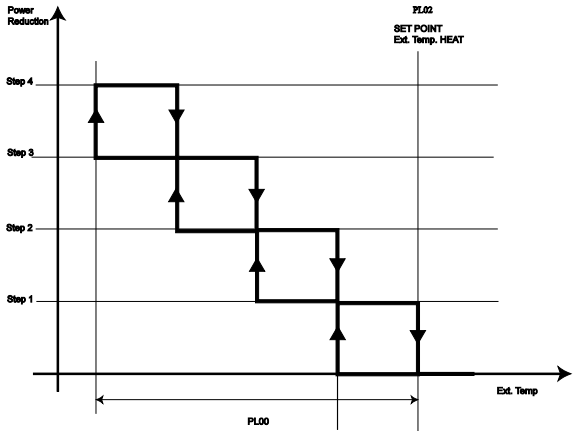
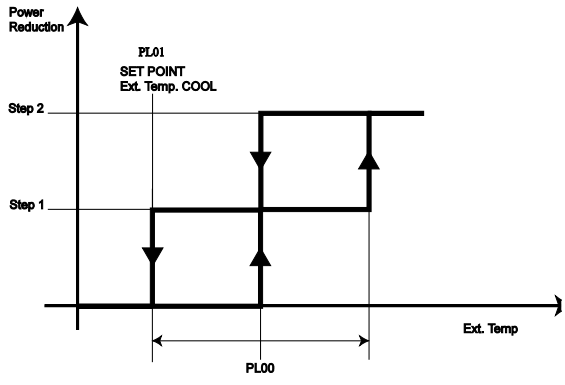
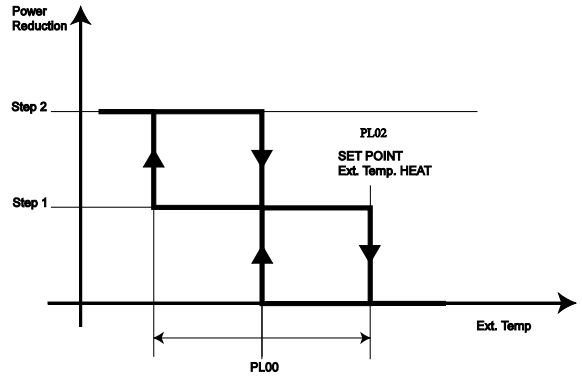
Power limitation - 2 compressors

Diagrams **A' B' E'' F' F''** represent the inhibition/enabling of two power steps (two compressor machine or power stage compressor);
The pressure or temperature interval between inhibition/enabling of one step and the next 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

Power limitation - 4 compressors

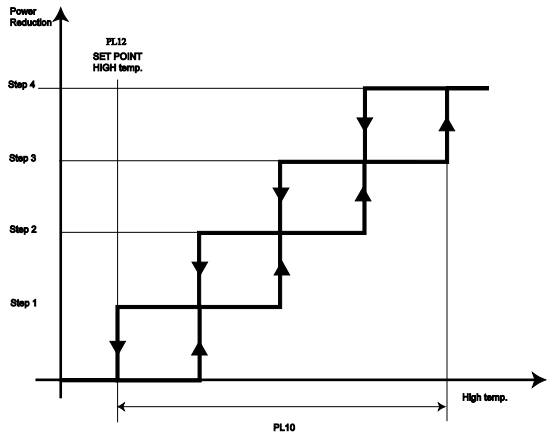
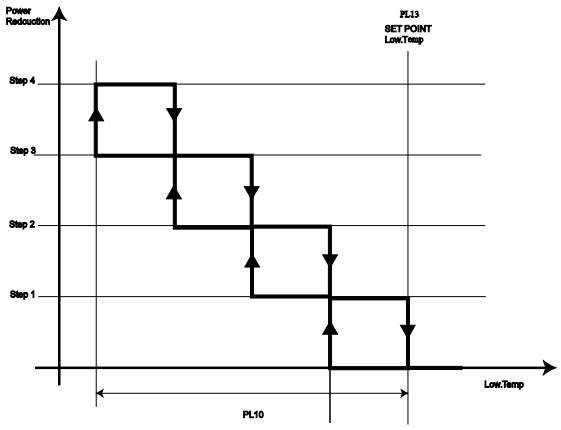
The external temperature and temperature power limitation act on the power steps independently of the circuits.

24.2 Power limitation - by external temperature (Cool and Heat)

COOL	HEAT
Diagram A **for high external temperature** **PL01 = External SET POINT COOL temperature**	**Diagram B** **for low external temperature PL02 = External SET POINT HEAT temperature**
Total of 4 steps	
	
NOTE: "POWER REDUCTION" INDICATES THE POWER STEPS TO BE CUT OUT	
Diagram A	**Diagram B**
Total of 2 steps	
	
NOTE: "POWER REDUCTION" INDICATES THE POWER STEPS TO BE CUT OUT	

24.3 Power limitation - by temperature (Cool and Heat)

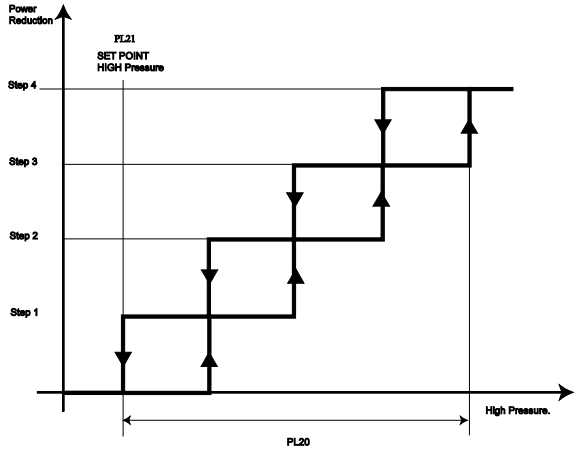
Example of power limitation on temperature in a 4 step machine,

Diagram C for high temperature on the control probe (Cool and Heat) PL12 High temperature SETPOINT	Diagram D for low temperature on the control probe (Cool and Heat) PL13 Low temperature SETPOINT
	
NOTE: "POWER REDUCTION" INDICATES THE POWER STEPS TO BE CUT OUT	

24.4 Power limitation - by high pressure probe (Cool and Heat)

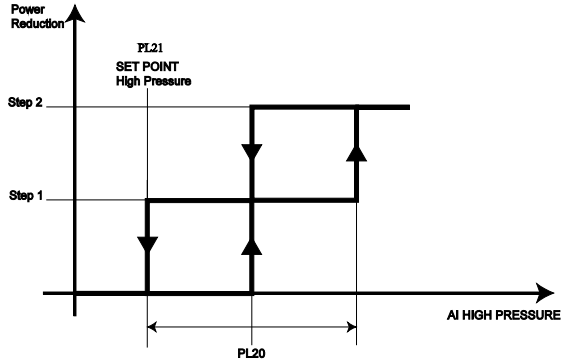
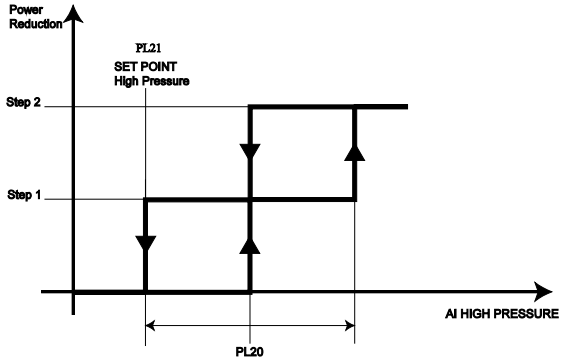
Example of power limitation on high pressure in a 4 step/1 circuit machine

Diagram E
on high pressure probe (Cool and Heat)
PL21 = High Pressure SETPOINT



NOTE: "POWER REDUCTION" INDICATES THE POWER STEPS TO BE CUT OUT

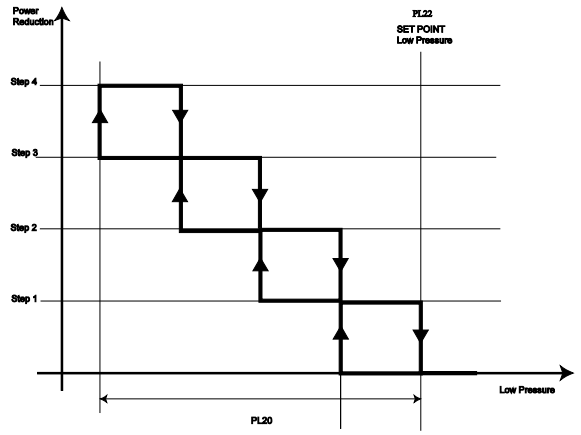
Example of power limitation on high pressure in a 2 step/2 circuit machine

Diagram E' **on high pressure probe (Cool and Heat)** **PL21 = High Pressure SETPOINT**	**Diagram E''** **on high pressure probe (Cool and Heat)** **PL21 = High Pressure SETPOINT**
Steps to cut out on circuit 1	**Steps to cut out on circuit 2**
	
NOTE: "POWER REDUCTION" INDICATES THE POWER STEPS TO BE CUT OUT ON CIRCUIT 1	**NOTE: "POWER REDUCTION" INDICATES THE POWER STEPS TO BE CUT OUT ON CIRCUIT 2**
HIGH PRESSURE = high pressure input circuit 1	**HIGH PRESSURE = high pressure input circuit 2**

24.5 Power limitation - by low pressure probe (Cool and Heat)

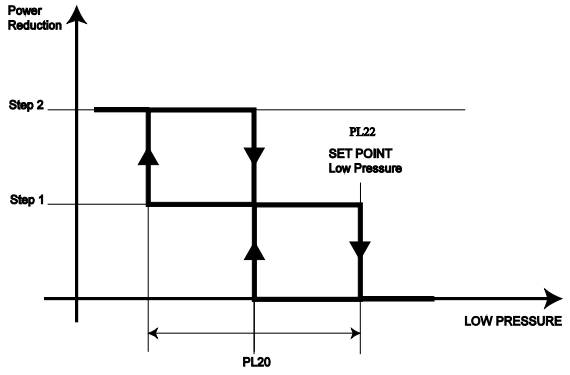
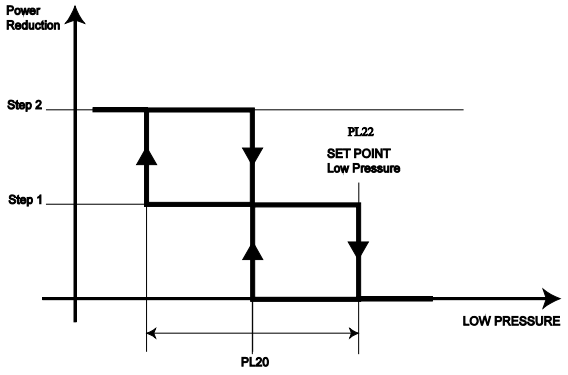
Example of power limitation on low pressure in a 4 step/1 circuit machine

Diagram F
on low pressure probe (Cool and Heat)
PL22 Low Pressure SETPOINT



NOTE: "POWER REDUCTION" INDICATES THE POWER STEPS TO BE CUT OUT

Example of power limitation on low pressure in a 2 step/2 circuit machine

Diagram F' **on low pressure probe (Cool and Heat)** **PL22 Low Pressure SETPOINT**	**Diagram F''** **on low pressure probe (Cool and Heat)** **PL22 Low Pressure SETPOINT**
Steps to cut out on circuit 1	**Steps to cut out on circuit 2**
	
NOTE: "POWER REDUCTION" INDICATES THE POWER STEPS TO BE CUT OUT ON CIRCUIT 1	**NOTE: "POWER REDUCTION" INDICATES THE POWER STEPS TO BE CUT OUT ON CIRCUIT 2**
LOW PRESSURE = low pressure input circuit 1	**LOW PRESSURE = low pressure input circuit 2**

24.6 Power limitation to 50%

Function enabled by configuring:
a digital input as 50% power limitation or by setting one of parameters CL40...CL45 = ±21
or an analogue input when configured as digital input CL46...CL54 = ±21;

Activating the digital input halves the availability of power steps, thus reducing energy consumption.

Power limitation to 50% is independent of the forced power stages described above.
The limitations act in parallel, and the number of steps limited is the maximum of the two limitation functions.

With the SBW600 this results in a large number of possible situations: the first column shows the power steps *normally* available (without alarms or blocks, a value which depends exclusively on how the SBW600 is *configured*, not on the particular situation at any given time), while the second column shows the residual power steps with 50% power limitation active.

Number of power steps *configured*	Number of power steps available with *limitation to 50%* active	Notes
1	**1**	No effect
2	**1**	
3	**2**	
4	**2**	

By step we mean the power equivalent of a compressor power stage; the selection of the step is subordinate to the compressor controller mechanism (e.g. limitation to 50% makes no distinction between the power stages of different circuits).
In other words, the selection of which power step to turn off is made by the power stage on/off logic described in the chapter Compressors.

Example 1
SB device configured with two power steps, one per circuit (= one compressor per circuit): the activation of the input has no effect if only one compressor is running at the time; if the input stays active, it will affect any request for activation of the compressor of the other circuit (it will impede it).

Example 2
SB device configured with four power steps (one power stage compressor per circuit): activation of the input has no effect if only 1 or 2 power stages are active at the time (whether both or only one compressor is running), as for the previous example. It will have an effect if 3 or 4 power stages are active and 1 or 2 steps are turned off according to the compressor controller logic (either both compressors or only one remains active).

As fro other forms of limitation, the step off/on sequence is subordinate to the *safety timings*.

The function has no effect on other resources, and is not indicated on the display in any way.

25 TIME BANDS (FOLDER PAR/TE)

SBW600 allows for differentiated operation based on the time and the days of the week.
In fact, you can "define" time bands (e.g. in order to save energy at night, when less energy is requested by the system), by programming specific "profiles" and "events" throughout the course of the week.
You can define the hour and minute of each event, at which point a new "time band" triggers the activation of a specific mode (ON or STANDBY) and specific Cool / Heat setpoints.

The Time Band control parameters can be viewed and configured in the **tE** folder (see User interface section and Parameters section).

Enabling
The function may be enabled using parameter **tE00 - Enable time band operation**

		Parameter	**Description**	
			0	**1**
Enable	**tE00**	**Enable time band operation**	Time bands disabled	Time bands enabled

General conditions of operation
tE00 - Enable time band operation = 1
The RTC must be present **(models /C)**
The time must first be checked and if necessary adjusted (see paragraph on How to adjust the clock (CL), in the User Interface section (folder PAr/UI)

NOTE: This DOES NOT affect the Heat/Cool mode change or even the system / ACS mode change but only the Cool and Heat setpoint values defined by the indicated parameters, as well as the mode change from ON to STANDBY and vice versa.
The mode change procedure always occurs in accordance with the basic regulation times and rules.

Time Band Operation
Up to 3 profiles are available for each day of the week. They may be selected from the following parameters:

Parameter	**Description**	**1**	**2**	**3**
tE01	Select profile, day 1 (Monday)	Profile 1	Profile 2	Profile 3
tE02	Select profile, day 2 (Tuesday)	Profile 1	Profile 2	Profile 3
tE03	Select profile, day 3 (Wednesday)	Profile 1	Profile 2	Profile 3
tE04	Select profile, day 4 (Thursday)	Profile 1	Profile 2	Profile 3
tE05	Select profile, day 5 (Friday)	Profile 1	Profile 2	Profile 3
tE06	Select profile, day 6 (Saturday)	Profile 1	Profile 2	Profile 3
tE07	Select profile, day 7 (Sunday)	Profile 1	Profile 2	Profile 3

Up to 4 events can be associated with each profile – see the following table:

Description	Description	Profile 1	Profile 2	Profile 3
EVENT 1		**tE10..tE15**	**tE38..tE50**	**tE66..tE71**
	Hour / Minutes	tE10..tE11	tE38..tE39	tE66..tE67
	ON/Standby operating mode	tE12	tE40	tE68
	Cool setpoint	tE13	tE41	tE69
	Heat setpoint	tE14	tE42	tE70
	ACS setpoint	tE15	tE43	tE71
EVENT 2		**tE17..tE22**	**tE45..tE50**	**tE73..tE78**
	Hour / Minutes	tE17...tE18	tE45..tE46	tE73..tE74
	ON/Standby operating mode	tE19	tE47	tE75
	Cool setpoint	tE20	tE48	tE76
	Heat setpoint	tE21	tE49	tE77
	ACS setpoint	tE22	tE50	tE78
EVENT 3		**tE24..tE29**	**tE52..tE57**	**tE80..tE85**
	Hour / Minutes	tE24...tE25	tE52..tE53	tE80..tE81
	ON/Standby operating mode	tE26	tE54	tE82
	Cool setpoint	tE27	tE55	tE83
	Heat setpoint	tE28	tE56	tE84
	ACS setpoint	tE29	tE57	tE85
EVENT 4		**tE31..tE36**	**tE59..tE64**	**tE87..tE92**
	Hour / Minutes	tE31...tE32	tE59..tE60	tE87..tE88
	ON/Standby operating mode	tE33	tE61	tE89
	Cool setpoint	tE34	tE62	tE90
	ACS setpoint	tE36	tE64	tE92

ACS = Domestic hot water
Each event will have
a start time defined by 2 parameters
event start hour
event start minute
operating mode
ON
Standby
SBW600 will enter ON or standby when the time coincides with the start of the time band
Cool mode temperature controller setpoint
Heat mode temperature controller setpoint
Sanitary Water setpoint
The Cool mode setpoint will be active with SBW600 in Cool mode when the time coincides with the predefined event (start of the time band).
Similarly, the Heat mode setpoint will be active with SBW600 in Heat mode when the time coincides with the start of the time band
NOTE: the SBW600 device does NOT change mode but will use the setpoints indicated if in Cool/Heat mode

26 ALARMS AND DIAGNOSTICS (FOLDER PAR/AL)

Alarms

"Energy SBA600" can execute complete diagnostics of the plant and signal a series of alarms.

Parameters for alarm activation and resetting can be viewed and configured in folder
AL (parameters AL00...AL82) (see User Interface and Parameters section).

Automatic reset

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

Manual reset

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 acknowledgment
Alarms can be acknowledged by pressing any key.
NOTE: acknowledging an alarm has no effect on the alarm generated other than on the alarm LED, which goes from fixed to flashing.

An alarm has two effects:

- It blocks the services 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 (folder PAr/AL)

For some alarms, the signal can be excluded for a preset interval, set in the relative parameter.

Number of trips
The number of interventions per sampling period is defined in parameter **AL00 – Time interval in which alarm events are counted**

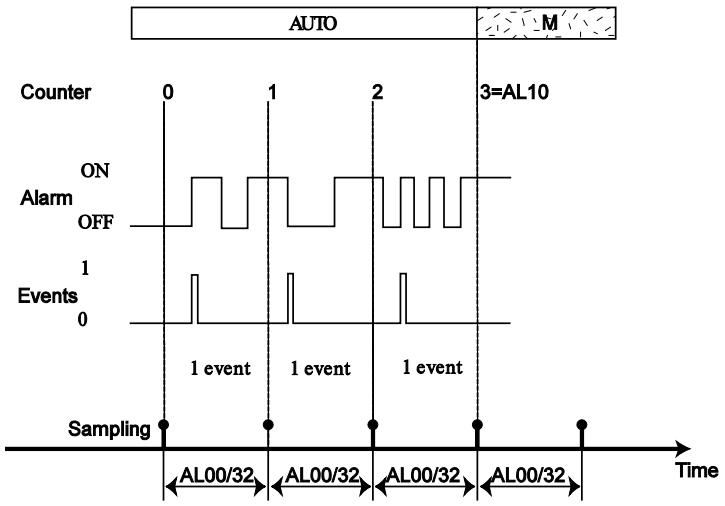
Number of trips

For some alarms, the number of events that occur are counted: if, in a period of time defined in **AL00** a threshold set in a parameter is exceeded, the alarm changes from automatic to manual reset.

Alarms are counted every **AL00**/32 (minutes) = sampling time.
AL00 and hence also **AL00/32** is expressed in minutes.

Example **AL10-Circuit 1 high pressure alarm:** if a number of events equivalent to **AL10** is set, in order for the alarm to switch from automatic reset to manual reset the events must reach the number set by **AL10.**

Example AL10=3



			Event =No. Events
A: automatic reset	Sampling	**AL00**/32 sampling time	**1**
M: manual reset	Time: time		**2**
	Alarm: alarm		**3 (=AL10)**

N.B.:

- if during the sample time **AL10**/32 several alarm events of the same type occur (e.g. **High pressure alarm circuit 1**), only 1 event will be counted
- If the alarm condition is active for several sample times, only 1 event is counted.
- If the alarm event is active for a period greater than **AL00**, **the counter resets to zero**.

26.1.1 Digital alarms

Alarm code	Name of alarm	Bypass activation event	Bypass time	Automatic alarm activation time	Manual alarm activation manual	Exit alarm deactivation time	Number of interventions per sample time
E001	Circuit 1 digital high pressure alarm	None	not present	not present	not present	not present	**AL10**
E002	Circuit 2 digital high pressure alarm	None	not present	not present	not present	not present	**AL10**
E005	Circuit 1 digital low pressure alarm	Circuit compressor activated or reversal of 4-way valve **(NOTE 1)**	**AL11**	not present	not present	not present	**AL12**
E006	Circuit 2 digital low pressure alarm	Circuit compressor activated or reversal of 4-way valve **(NOTE 1)**	**AL11**	not present	not present	not present	**AL12**
E020 (NOTE 2)	Primary circuit flow switch alarm	Internal circuit pump activation (One of the two pumps)	**AL14**	**AL15**	**AL16**	**AL15**	not present
E025 (NOTE 3)	Primary circuit pump thermal switch alarm	External circuit pump activation	**AL17**	**AL18**	**AL19**	**AL18**	not present
E010	Compressor 1 thermal switch	Compressor 1 switched on	**AL20**	not present	not present	not present	**AL21**
E011	Compressor 2 thermal switch	Compressor 2 switched on	**AL20**	not present	not present	not present	**AL21**
E012	Compressor 3 thermal switch	Compressor 3 switched on	**AL20**	not present	not present	not present	**AL21**
E013	Compressor 4 thermal switch	Compressor 4 switched on	**AL20**	not present	not present	not present	**AL21**
E015 (NOTE 2)	Compressor 1 oil pressure switch	Compressor 1 switched on	**AL22**	not present	not present	Not present	**AL23**
E016 (NOTE 2)	Compressor 2 oil pressure switch	Compressor 2 switched on	**AL22**	not present	not present	Not present	**AL23**
E017 (NOTE 2)	Compressor 3 oil pressure switch	Compressor 3 switched on	**AL22**	not present	not present	Not present	**AL23**
E018 (NOTE 2)	Compressor 4 oil pressure switch	Compressor 4 switched on	**AL22**	not present	not present	Not present	**AL23**
Er40	Internal exchanger fan thermal switch	None	not present	not present	not present	Not present	**AL24**
Er41	External exchanger fan thermal switch Circuit 1	None	not present	not present	not present	Not present	**AL25**
Er42	External exchanger fan thermal switch Circuit 2	None	not present	not present	not present	Not present	**AL25**
E021	Primary circuit pump 1 thermal switch	None	not present	Not present	not present	Not present	**AL26**
E022	Primary circuit pump 2 thermal switch	None	not present	Not present	not present	Not present	**AL26**
E026	Disposable circuit pump thermal switch	None	not present	Not present	not present	Not present	**AL27**
E050	Primary exchanger electric heater 1 thermal switch	None	Not present	Not present	not present	Not present	not present
E051	Primary exchanger electric heater 2 thermal switch	None	Not present	Not present	not present	Not present	not present
E056	Auxiliary output alarm	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

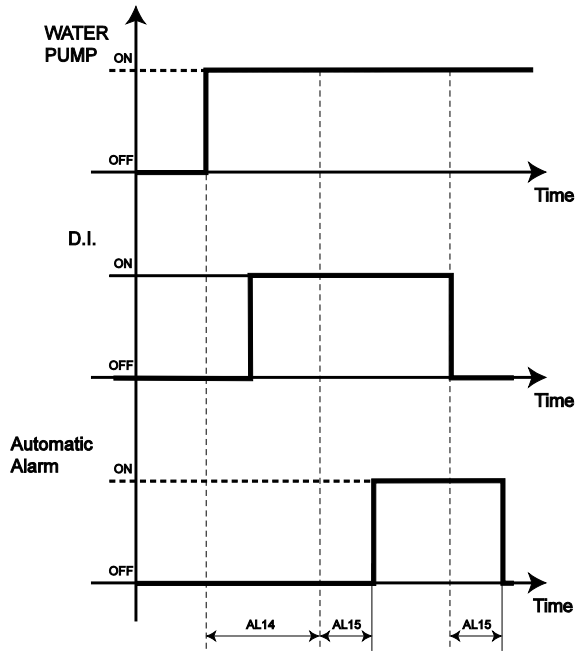
(NOTE 2) The alarm is enabled only if the associated resource (e.g. a given compressor or pump) is active

(NOTE 3) The alarm is enabled only if the associated resource (e.g. specific compressor or specific pump) is active only in heating mode.

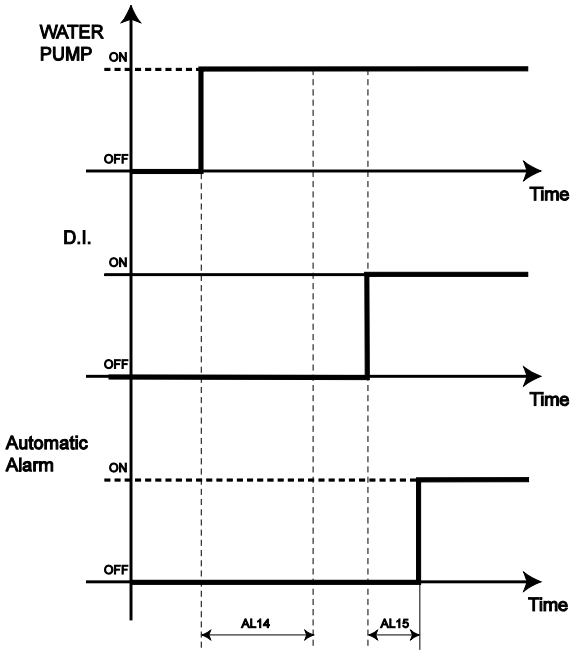
26.1.1.1 Flow switch alarm

Management of the digital flow switch alarms E020 & E025 is different from that of the other digital alarms: the alarm events are not considered, instead, only the activation time of the digital input is taken into account. See the following examples
Note. The external circuit flow switch alarm is not active in Cool.

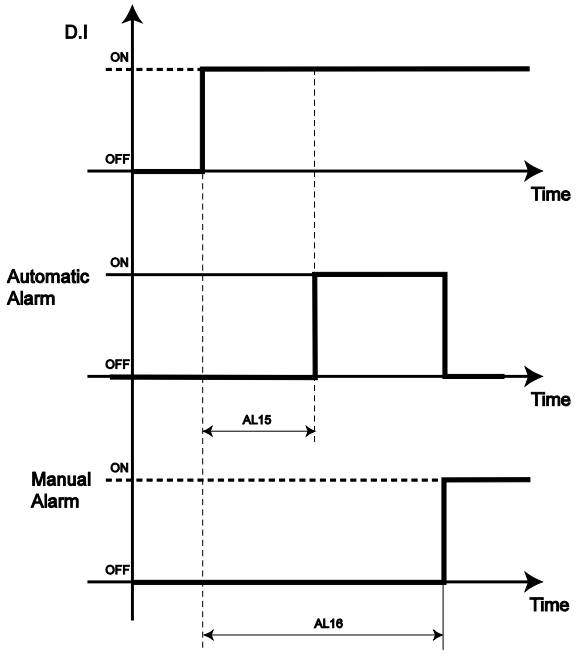
Example of external circuit pump automatic reset flow switch alarm
Alarm generated with activation of digital input D.I. during bypass;
the count **AL15 - Flow switch activation/deactivation time on internal circuit automatic alarm**
only starts when **AL14 - Flow switch bypass time after primary circuit water pump enabled** is decremented to 0.



Example 2 of external circuit pump automatic reset flow switch alarm
Alarm generated with start of next alarm event after the bypass has elapsed



Example of external circuit pump manual reset flow switch alarm
AL15 - Flow switch activation/deactivation time on internal circuit automatic alarm
AL16 – Enable flow switch time for primary circuit manual alarm



26.1.2 Analogue alarms

NOTES

(NOTE 1) If N° trips = 1, the alarm is always manual reset type.
(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)	N° of trips	Regulation probe
E003	Circuit 1 analogue high pressure alarm	None	None	**AL40**	**AL41**	Not present	**AL42**	High pressure probe Circuit 1
E004	Circuit 2 analogue high pressure alarm	None	None	**AL40**	**AL41**	Not present	**AL42**	High pressure probe Circuit 2
E007	Circuit 1 analogue low high pressure alarm	A circuit 1 compressor is switched on or reversal of the 4-way valve	**AL43**	**Al44**	**AL45**	Not present	**AL46**	Low pressure probe Circuit 1
E008	Circuit 2 analogue low pressure alarm	A circuit 1 compressor switched on or reversal of the 4-way valve	**AL43**	**Al44**	**AL45**	Not present	**AL46**	Low pressure probe Circuit 2
E030	Primary circuit antifreeze alarm	On/Off (local or remote), input in heat mode *(NOTE 2)*	**AL50**	**AL51**	**AL52**	Not present	**A53**	Internal exchanger water/air outlet temperature
E031	Disposable circuit antifreeze alarm	On/Off (local or remote), input in heat mode *(NOTE 2)*	**AL54**	**AL55**	**AL56**	Not present	**A57**	External exchanger outlet water temperature
E035	High temperature alarm	None	None	**AL47**	**AL48**	**AL49**	Automatic reset	Internal exchanger water/air outlet temperature

26.1.3 Alarms Table

- The indication is composed of a code type "E0**nn**" (where nn is a 2-digit number identifying the alarm type, e.g.: E000, E025, E039....).
- In the case of multiple simultaneous alarms only the one with the lowest code will be displayed (e.g. simultaneous alarms E000 and E001). The display will show only E000 alternated with the main display page
- 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	**NOTE: the codes are shown in ascending order (E000, E001) but there may be some gaps (there is no E006)**	
Name of alarm		
notes	**CMP 1/2**	Compressor 1/power step 2
	PUMP 1/2	Pump 1/2
alarm	**D**	digital
	A	input
		See digital alarms table
Reset	**AUTO**	automatic
UTILITY	**OFF COMP1**	OFF compressor 1
	OFF COMP2	OFF compressor 2
	OFF COMP3	OFF compressor 3
	OFF COMP4	OFF compressor 4
	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

Alarms Table

Alarms Table

Alarm Code	Name of Alarm	Notes	Digital/Analogue	Alarm type	SANITARY WATER VALVE	SANITARY WATER HEATER	COMPRESSORS	EXTERNAL EXCHANGER FAN	RECIRCULATION FAN	INTERNAL CIRCUIT PUMP	EXTERNAL CIRCUIT PUMP	INTERNAL EXCHANGER HEATERS	EXTERNAL EXCHANGER HEATERS	OUTPUT AUXILIARY	BOILER
E000	General alarm		**D**	AUTO	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
E001	Circuit 1 digital high pressure		**D**	Events			OFF (1)								
E002	Circuit 2 digital high pressure		**D**	Events			OFF (1)								
E003	Circuit 1 analogue high pressure		**A**	Events			OFF (1)								

Alarm Code	Name of Alarm	Notes	Digital/Analogue	Alarm type	SANITARY WATER VALVE	SANITARY WATER HEATER	COMPRESSORS	EXTERNAL EXCHANGER FAN	RECIRCULATION FAN	INTERNAL CIRCUIT PUMP	EXTERNAL CIRCUIT PUMP	INTERNAL EXCHANGER HEATERS	EXTERNAL EXCHANGER HEATERS	OUTPUT AUXILIARY	BOILER
E004	Circuit 2 analogue high pressure		**A**	Events			OFF (1)								
E005	Circuit 1 digital low pressure		**D**	Events			OFF (1)	OFF (2)	OFF						
E007	Circuit 1 analogue low pressure		**A**	Events			OFF (1)	OFF (2)	OFF						
E008	Circuit 2 analogue low pressure		**A**	Events			OFF (1)	OFF (2)	OFF						
E009	Machine low charge		**A**	Events			OFF	OFF (2)	OFF						
E010	Compressor 1 thermal switch	CMP 1	**D**	Events			OFF COMP1								
E011	Compressor 2 thermal switch	CMP 2	**D**	Events			OFF COMP2								
E012	Compressor 3 thermal switch	CMP 3	**D**	Events			OFF COMP3								
E013	Compressor 4 thermal switch	CMP 4	**D**	Events			OFF COMP4								
E015	Compressor 1 oil pressure switch	CMP 1	**D**	Events			OFF COMP1								
E016	Compressor 2 oil pressure switch	CMP 2	**D**	Events			OFF COMP2								
E017	Compressor 3 oil pressure switch	CMP 3	**D**	Events			OFF COMP3								
E018	Compressor 4 oil pressure switch	CMP 4	**D**	Events			OFF COMP4								
E020	Primary circuit flow switch		**D**	Time	OFF for manual reset alarm		OFF	OFF		OFF for manual reset alarm		OFF			OFF
E021	Primary circuit pump 1 thermal switch	Pump 1	**D**	Events			OFF (3)	OFF (3)		OFF Pump 1		OFF (3)			OFF (3)
E022	Primary circuit pump 2 thermal switch	Pump 2	**D**	Events			OFF (3)	OFF (3)		OFF Pump 2		OFF (3)			OFF (3)
E025	Disposable circuit flow switch		**D**	Time			OFF	OFF if alarm with manual reset			OFF for manual reset alarm		OFF		
E026	Disposable circuit pump thermal switch		**D**	Events			OFF				OFF		OFF		
E030	Primary circuit antifreeze		**A**	AUTO			OFF	OFF							
E031	Disposable circuit antifreeze		**A**	AUTO			OFF	OFF							
E035	High temperature		**A**	AUTO			OFF								

Alarm Code	Name of Alarm	Notes	Digital/Analogue	Alarm type	SANITARY WATER VALVE	SANITARY WATER HEATER	COMPRESSORS	EXTERNAL EXCHANGER FAN	RECIRCULATION FAN	INTERNAL CIRCUIT PUMP	EXTERNAL CIRCUIT PUMP	INTERNAL EXCHANGER HEATERS	EXTERNAL EXCHANGER HEATERS	OUTPUT AUXILIARY	BOILER
E040	Primary exchanger fan thermal switch		**D**	Events			OFF		OFF			OFF			
E041	Circuit 1 external exchanger fan thermal switch		**D**	Events			OFF (2)	OFF (1)					OFF (2)		
E042	Circuit 2 external exchanger fan thermal switch		**D**	Events			OFF (2)	OFF (1)					OFF (2)		
E045	Faulty clock			AUTO											
E046	Time lost			AUTO											
E047	LAN communication absent			AUTO											
E048	Anti-legionnaires alarm			AUTO											
E050	Primary exchanger electric heater 1 thermal switch		**D**	AUTO								OFF RES.1			
E051	Primary exchanger electric heater 2 thermal switch		**D**	AUTO								OFF RES.2			
E056	Auxiliary output alarm		**D**	AUTO										OFF	
E060	Primary exchanger water or air input temperature probe faulty			AUTO	See Probe Errors Table										
E061	Primary exchanger water or air output temperature probe faulty, or Circuit 1 internal exchanger water outlet temperature probe faulty, or Circuit 2 internal exchanger water outlet temperature probe faulty			AUTO	See Probe Errors Table										
E062	Circuit 1 disposable exchanger faulty temperature probe, or Circuit 2 disposable exchanger faulty temperature probe			AUTO	See Probe Errors Table										
E063	Faulty disposable exchanger inlet water temperature probe			AUTO	See Probe Errors Table										
E064	Faulty disposable exchanger outlet water temperature probe			AUTO	See Probe Errors Table										
E065	Internal room temperature probe faulty			AUTO	See Probe Errors Table										

Alarm Code	Name of Alarm	Notes	Digital/Analogue	Alarm type	SANITARY WATER VALVE	SANITARY WATER HEATER	COMPRESSORS	EXTERNAL EXCHANGER FAN	RECIRCULATION FAN	INTERNAL CIRCUIT PUMP	EXTERNAL CIRCUIT PUMP	INTERNAL EXCHANGER HEATERS	EXTERNAL EXCHANGER HEATERS	OUTPUT AUXILIARY	BOILER
E066	Sanitary water temperature probe faulty			AUTO	See Probe Errors Table										
E067	Faulty display probe (temperature / pressure)			AUTO	See Probe Errors Table										
E068	Faulty external temperature probe			AUTO											
E069	Faulty circuit 1 high pressure transducer, or Faulty circuit 2 high pressure transducer			AUTO	See Probe Errors Table										
E070	Faulty circuit 1 low pressure transducer, and/or Faulty circuit 2 low pressure transducer			AUTO											
E071	Faulty compressor 1 discharge temperature probe			AUTO											
E073	Faulty dynamic setpoint input			AUTO											
E074	Faulty primary exchanger transducer circuit 1, and/or Faulty primary exchanger transducer circuit 2			AUTO	See Probe Errors Table										
E075	Faulty disposable exchanger transducer circuit 1, and/or Faulty disposable exchanger transducer circuit 2 faulty			AUTO	See Probe Errors Table										
E080	Configuration error			AUTO	OFF	OFF									
E081	Compressors operating hours exceeded (*)	CMP		Manual											
E085	Primary circuit pump operating hours exceeded (*)	PUMP		Manual											
E086	External circuit pump operating hours exceeded (*)	PUMP		Manual											
E090	Alarm log full warning			Manual											

(*)It will be possible to configure a digital output as Operating hours exceeded (value = ±29), which will be activated when at least one of these alarms trips

(1) the resources of the associated circuit are switched off
(2) the resources of the associated circuit are switched off if separate condensation, all resources if single condensation. In digital and analogue low pressure alarms, the external exchanger fans are switched off only if the alarm is of the manual reset type
(3) if the device is configured for two internal water pumps, the resources are switched off only if both thermal switch alarms (pump 1 and pump 2) are active

26.1.4 XVD driver alarms

The XVD alarms are managed locally by each driver and they are signalled and recorded by the master SBA controller
The alarm codes are divided as follows

.

Alarm Code SBA	
E1xx	XVD1
E2xx	XVD2

Alarm Code	Name of Alarm	Type alarm	COMPRESSORS CIRCUIT 1		Code Preheat	Name of Alarm	Type alarm	COMPRESSORS CIRCUIT 2
E101	Input error dA/1 EEV1	AUTO			**E201**	Input error dA/1 EEV2	AUTO	
E102	Input error dA/2 EEV1	AUTO			**E202**	Input error dA/2 EEV2	AUTO	
E103	Input error dA/3 EEV1	AUTO			**E203**	Input error dA/3 EEV2	AUTO	
E104	Input error dA/4 EEV1	AUTO			**E204**	Input error dA/4 EEV2	AUTO	
E105	Valve EEV1 overheating probe (1rE1)	AUTO			**E205**	Valve EEV2 overheating probe (2rE1)	AUTO	
E106	Valve EEV1 saturation probe (1rE2)	AUTO			**E206**	Valve EEV2 saturation probe (2rE2)	AUTO	
E107	Alarm MOP XVD1	AUTO			**E207**	Alarm MOP XVD2	AUTO	
E108	XVD1 maximum valve opening alarm	AUTO			**E208**	XVD2 maximum valve opening alarm	AUTO	
E109	External alarm XVD1	AUTO			**E209**	External alarm XVD2	AUTO	
E110	NOLINK alarm XVD1	AUTO			**E210**	NOLINK alarm XVD2	AUTO	
E111	Motor protection alarm XVD1: current consumption too high	MANUAL	**OFF**		**E211**	Motor protection alarm XVD2: current consumption too high	MANUAL	**OFF**
E112	Motor protection alarm XVD1: winding 1 not connected	MANUAL	**OFF**		**E212**	Motor protection alarm XVD2: winding 1 not connected	MANUAL	**OFF**
E113	Motor protection alarm XVD1: winding 1 short-circuited	MANUAL	**OFF**		**E213**	Motor protection alarm XVD2: winding 1 short-circuited	MANUAL	**OFF**
E114	Motor protection alarm XVD1: winding 2 not connected	MANUAL	**OFF**		**E214**	Motor protection alarm XVD2: winding 2 not connected	MANUAL	**OFF**
E115	Motor protection alarm XVD1: winding 2 short-circuited	MANUAL	**OFF**		**E215**	Motor protection alarm XVD2: winding 2 short-circuited	MANUAL	**OFF**

NOTE switch off driver XVD and switch it on again for a manual reset

26.1.4.2 XVD driver probe errors

Label		Cause	Effect	Solution
E101 **E201**	Probe AI1 faulty	Measured values are outside the nominal range Regulating probe faulty/short-circuited/open	Signal only if the relative backup probe is configured AI2 - - - If this is not done see E106	Check the probe wiring. - - - Replace probe. - - - when the error condition ceases, regulation continues normally
E102 **E202**	Probe AI2 faulty	Same as E101	Same as E101 (probe dAi1)	Same as E101
E103 **E203**	Probe AI3 faulty		Signal only if the relative backup probe is configured AI4 - - - If this is not done see E105	
E104 **E204**	Probe 1AI4 faulty		Same as E101 (probe Ai3)	
E105 **E205**	Evaporator outlet probe error (1rE1) Evaporator outlet probe error (2rE1)	Probes AI3 AI4 are both in error	%valve opening =dE16	
E106 **E206**	Gas saturation probe error (1rE2) Gas saturation probe error (2rE2)	Probes AI1, AI2 are both in error	Example dE50= 0 %valve opening =dE16 - - - Example dE50= 1 Valve closed	

26.1.4.3 XVD driver alarms

Label		Cause	Effect	Solution
E107	Alarm MOP XVD1	Saturation temperature > MOP setpoint (dE52) for time greater than dE53	Only if dE50=1 Valve closed	Wait for return Saturation temperature < dE52
E108	XVD1 maximum valve opening alarm	% maximum opening of valve drE7 ≥ dE10 for time greater than dE13	Signal only	Wait for return % maximum opening of valve drE7 < dE10
E109	External alarm XVD1	Activation of digital input set as external alarm. See paragraph dL40/dL41=±3	Valve closed	Deactivation of digital input set as external alarm
E110	NOLINK alarm XVD1	Serial communication failure	Valve closed	Communication restore
E111	Motor protection alarm XVD1: current consumption too high	Excess current consumption	Valve closed	Check motor phases - - - Check motor connection - - - Check correct setting parameters dE01..dE09, dE80
E112	Motor protection alarm XVD1: winding 1 disconnected	Winding 1 disconnection	Valve closed	Check winding 1 connection (terminals 6-7) - - - Check correct setting parameters dE01..dE09, dE80
E113	Motor protection alarm XVD1: winding 1 short-circuited	Winding 1 short-circuited	Valve closed	Check winding 1 connection (terminals 6-7) - - - Check correct setting parameters dE01..dE09, dE80
E114	Motor protection alarm XVD1: winding 2 disconnected	Winding 2 disconnection	Valve closed	Check winding 2 connection (terminals 4-5) - - - Check correct setting parameters dE01..dE09, dE80
E115	Motor protection alarm XVD1: winding 2 short-circuited	Winding 2 short-circuited	Valve closed	Check winding 2 connection (terminals 4-5) - - - Check correct setting parameters dE01..dE09, dE80

Probe errors table

Temperature probe error	Use	Lock machine	Notes
Water/air inlet temperature Internal exchanger	Cool / Heat temperature controllers (proportional and differential)	YES	
	Change over	YES	
	Recirculation fan	NO	The fan switches ON/OFF depending on the compressor state
	Internal circuit water pump, antifreeze and/or Internal circuit heater, antifreeze	YES	
	Antifreeze with heat pump	YES	
	Heat pump lock	YES	
	Power limitation	NO	
	Low refrigerant alarm	NO	The alarm is disabled
Water/air outlet temperature Internal exchanger		YES	
Water outlet temperature probe Internal exchanger circuit 1		YES	
Water outlet temperature probe Internal exchanger circuit 2		YES	
External exchanger temperature circuit 1 and/or External exchanger temperature circuit 2	Cool / Heat temperature controllers (proportional and differential)	YES	
	External exchanger fans	NO	
	Antifreeze with external circuit heater	YES	
	Auxiliary output	NO	
	Defrost, input and output	NO	
	Heat pump lock and/or Power limitation	YES	
Water inlet temperature external exchanger	Cool / Heat temperature controllers (proportional and differential)	YES	
	Antifreeze with external circuit heater	YES	
	Auxiliary output	NO	
	Heat pump lock	YES	
	Power limitation	NO	
Water outlet temperature external exchanger		YES	
External temperature	Cool / Heat temperature regulators (differential)	YES	
	Change over	NO	
	Dynamic setpoint	NO	
	Internal circuit water pump, antifreeze	YES	
	Internal integrated heater, differential	NO	
	Auxiliary output	NO	
	External antifreeze heater	YES	
	Boiler, differential	NO	
	Heat pump lock	YES	
	Power limitation	NO	

Temperature probe error	Use	Lock machine	Notes
	Defrost, compensation	NO	
Input for dynamic setpoint	Dynamic setpoint	NO	
Temperature display	Display	NO	
Sanitary water temperature	Sanitary water	NO	
Pressure probe error	**Use**	**Lock machine**	**Notes**
High pressure input circuit 1 and/or High pressure input circuit 2	External exchanger fans	YES	
	Defrost, input and output		
	Power limitation		
Low pressure input circuit 1 and/or Low pressure input circuit 2	External exchanger fans	YES	
	Defrost, input and output		
	Power limitation		
Input for dynamic setpoint	Dynamic setpoint	NO	
Internal exchanger pressure circuit 1 and/or Internal exchanger pressure circuit 2	External exchanger fans	YES	
External exchanger pressure circuit 1 and/or External exchanger pressure circuit 2	External exchanger fans	YES	
	Defrost, input and output		
Pressure display	Display	NO	

26.2 Alarm log

The alarm log saved with the Device Manager software is a TXT format file; it can be read with any text editor and it can also be imported into Microsoft Excel® for clearer comprehension.

Guidelines for correct interpretation are provided below:

- Line 1: heading with name of model of Device Manager utilised to download data from the device or from MFK.
- Line 2: date and time of data download procedure.
- Line 3: column headings.

“Number” column:
incremental and circular index (FIFO); the alarm with index Eu00 is the most recent, while the Euxx index (max. xx: 98) indicates the oldest.

“Code” column:
lists the device alarm codes (as shown on the device display).

“Type” column:
indicates whether the alarm is reset automatically or manually.
The example below shows the recording of an alarm which changes from automatic reset to manual reset. The manual alarm reset was carried out from the functions menu, not by switching the device off and on again, because the alarm end date and time is also shown.

```
Eu56   E020   Reset Manual          State Closed   21.52  07-feb 21.52  07-feb
Eu57   E020   Reset Automatic       State Closed   21.52  07-feb 21.52  07-feb
```

“State” column:
indicates whether the alarm is still present (Open) or has been reset (Closed).

“Time Start” and “Date Start” columns:
indicate the alarm start time and date.

“Time End” and “Date End” columns:
indicate the alarm end time and date.
A lack of data (as shown below) indicates that the alarm is still ongoing.
If the device is switched off with a manual reset alarm, the log will not record this alarm reset procedure.

```
Number  Code   Type                 State          Time   Date          Time   Date
                                                   Start  Start         End    End
Eu00    Er68   Reset Automatic      State Open     20.20  04-mar        --:--  --/--
Eu01    Er62   Reset Automatic      State Open     20.20  04-mar        --:--  --/--
Eu02    Er61   Reset Automatic      State Open     20.20  04-mar        --:--  --/--
```

For manual reset alarms, the reset date and time correspond to the alarm reset and not to the change in the status of the digital input.

```
Eu56   E020   Reset Manual          State Closed   21.52  07-feb 21.52  07-feb
Eu57   E020   Reset Automatic       State Closed   21.52  07-feb 21.52  07-feb
Eu58   E020   Reset Manual          State Closed   21.51  07-feb 21.51  07-feb
```

27 PARAMETERS (PAR)

Parameter setting allows full configurability of Energy SBA600 and the drivers for XVD Open stepper valves;
Parameters can be edited using:

- Multi Function key (MFK)
- Keys on the SBA600 front panel / SKW22(L) terminal
- PC and DeviceManager software

The following sections provide a detailed analysis of each parameter, divided into categories (folders).

Each folder is designated with a label showing 2 characters (example: CF, UI, etc.).

All parameters are described in the Parameters / visibility table
The parameters for management of XVD Open drivers (folders **1L/1r/1F/1E**, **2L/2r/2F/2E**) are described in a specific table

UI parameters are also described in the paragraph User interface (UI) parameters

Visibility and Parameter Values
Energy SBA600 denotes a family of controllers.
There are 4+1 hardware models (see Appendix, Models section) with varying numbers of inputs and outputs.
The 4+1 hardware models are grouped into 3 DeviceManager models (version with 1 or 2 TRIACs 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.
Refer also to the following table:

			TCL1 **TCE1**	**TCL2** **TCE2**	**DOL6** **DOE6**
	Device Manager	**Hardware**			
Model	**636**	**636**	**CL73-CL76-CL79** **CE73-CE76-CE79**	**CL75-CL78-CL81 (AOL2)** **CE75-CE78-CE81** **(AOE2)**	
	646	**646/C** **646/C/S**	**CL73-CL76-CL79** **CE73-CE76-CE79**		//
	655	**655/C** **655/C/S**	//	//	**CL95** **CE95**

When not indicated otherwise, the parameter is always visible and editable, unless customized settings have been configured via serial.
N.B.: both parameters and folder visibility can be controlled (See Folder table).
If folder visibility is modified, the new setting will apply to all parameters in the folder.

27.1.1 Local I/O configuration parameters (CL) - Configuration Local

Table A Analogue Inputs Configuration

0	Input disabled	16	Temperature display
1	Water/air inlet temperature internal exchanger	17	NOT USED
2	Water/air outlet temperature internal exchanger	18	NOT USED
3	Water outlet temperature internal exchanger circuit 1	19	NOT USED
4	Water outlet temperature internal exchanger circuit 2	20	NOT USED
5	External exchanger temperature circuit 1	21	High pressure input circuit 1
6	External exchanger temperature circuit 2	22	High pressure input circuit 2
7	Water inlet temperature recovery (or external) exchanger	23	Low pressure input circuit 1
8	Water outlet temperature recovery (or external) exchanger	24	Low pressure input circuit 2
9	External temperature	25	Input for dynamic setpoint
10	Internal ambient temperature	26	Internal exchanger pressure circuit 1
11	Domestic hot water temperature	27	Internal exchanger pressure circuit 2
12	Compressor 1 discharge temperature	28	External exchanger pressure circuit 1
13	NOT USED	29	External exchanger pressure circuit 2
14	NOT USED	30	Pressure display
15	NOT USED		

Table B Digital Inputs Configuration
Polarity is defined as indicated below:

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

0	Input disabled	±31	High pressure pressure switch C2
±1	Remote STD-BY	±32	Low pressure pressure switch C1
±2	Remote off	±33	Low pressure pressure switch C2
±3	Remote Summer/Winter	±34	Compressor 1 oil pressure switch
±4	Capacity step 1 request	±35	Compressor 2 oil pressure switch
±5	Capacity step 2 request	±36	Compressor 3 oil pressure switch
±6	Capacity step 3 request	±37	Compressor 4 oil pressure switch
±7	Capacity step 4 request	±38	NOT USED
±8	Digital input heat step 1 request	±39	External exchanger fan thermal switch C1
±9	Digital input heat step 2 request	±40	External exchanger fan thermal switch C2
±10	Digital input heat step 3 request	±41	Internal exchanger fan thermal switch
±11	Digital input heat step 4 request	±42	NOT USED
±12	Digital input cool step 1 request	±43	Compressor 1 thermal witch
±13	Digital input cool step 2 request	±44	Compressor 2 thermal switch
±14	Digital input cool step 3 request	±45	Compressor 3 thermal switch
±15	Digital input cool step 4 request	±46	Compressor 4 thermal switch
±16	Block compressor 1	±47	Internal circuit pump 1 thermal switch
±17	Block compressor 2	±48	Internal circuit pump 2 thermal switch
±18	Block compressor 3	±49	External circuit pump thermal switch
±19	Block compressor 4	±50	Internal exchanger electric heater 1 thermal switch
±20	Heat pump lock	±51	Internal exchanger electric heater 2 thermal switch
±21	Power restricted to 50%	±52	Auxiliary output alarm
±22	Economy input	±53	NOT USED
±23	NOT USED	±54	NOT USED
±24	General alarm	±55	Primary circuit flow switch
±25	End of defrost C1	±56	External circuit flow switch (Recovery)
±26	End of defrost C2	±57	NOT USED
±27	NOT USED	±58	Display
±28	Remote AS		
±29	NOT USED		
±30	High pressure pressure switch C1		

NOTE: If more than one digital input in the table is configured with the same value, the function is activated when the input with the highest index is piloted.

Table C Digital Outputs Configuration
Polarity is defined as indicated below:

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

Value	Description	Type
0	Output disabled	Digital
±1	Compressor 1	Digital
±2	Compressor 2	Digital
±3	Compressor 3	Digital
±4	Compressor 4	Digital
±5	Reversal valve circuit 1	Digital
±6	Reversal valve circuit 2	Digital
±7	NOT USED	Digital
±8	NOT USED	Digital
±9	Domestic hot water valve	Digital
±10	NOT USED	Digital
±11	NOT USED	Digital
±12	NOT USED	Digital
±13	NOT USED	Digital
±14	Internal circuit water pump 1	Digital
±15	Internal circuit water pump 2	Digital
±16	External circuit water pump	Digital
±17	NOT USED	Digital
±18	Recirculation fan	Digital
±19	Fan external exchanger circuit 1	Digital
±20	Fan external exchanger circuit 2	Digital
±21	NOT USED	Digital
±22	Auxiliary output conditional on defrosting	Digital
±23	Electric heater 1 internal exchanger	Digital
±24	Electric heater 2 internal exchanger	Digital
±25	Electric heater external exchanger 1	Digital
±26	Electric heater external exchanger 2	Digital
±27	Auxiliary output	Digital
±28	Domestic Hot Water Electric Heater	Digital
±29	Running hours exceeded	Digital
±30	Water heater	Digital

Value	Description	Type
±31	Preheat	Digital
±32	EEV 1 ON command	Digital
±33	EEV 2 ON command	Digital
±34	Compressor 1 Inverter	Digital
±35	NOT USED	Digital
±36	NOT USED	Digital
±37	NOT USED	Digital
±38	NOT USED	Digital
±39	NOT USED	Digital
±40	NOT USED	Digital
±41	NOT USED	Digital
±42	NOT USED	Digital
±43	NOT USED	Digital
±44	NOT USED	Digital
±45	NOT USED	Digital
±46	NOT USED	Digital
±47	NOT USED	Digital
±48	NOT USED	Digital
±49	NOT USED	Digital
±50	NOT USED	Digital
±51	NOT USED	Digital
±52	NOT USED	Digital
±53	NOT USED	Digital
±54	NOT USED	Digital
±55	NOT USED	Digital
±56	Fan external exchanger circuit 1	Analogue
±57	Fan external exchanger circuit 2	Analogue
±58	Water heater	Analogue
±59	Modulating internal circuit water pump 1	Analogue
±60	Modulating internal circuit water pump 2	Analogue
±61	Analogue stage 1 for Compressor with Envelope control	Analogue
±62	Analogue stage 1 for compressor	Analogue
±63	Analogue stage 2 for Compressor	Analogue

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

27.1.2 Configuration parameters for XVD driver 1 (1r / 1F / 1L / 1E)

27.1.3 Configuration parameters for XVD driver 2 (2r / 2F / 2L / 2E)

Parameters with prefix 1 are relative to driver XVD1 while those with prefix 2 concern XVD2.
Exclusively parameters with prefix 1 are shown below; parameters with prefix 2 are identical. The table shows both parameters.
The resources of the 2 XVD drivers can be configured for use by the base in the same way as an expansion.

27.1.4 User interface parameters (UI) – User Interface

Service LEDs table

LED symbol on display	LED SBW600 / LED SKW22 22L	Parameter SB600 / LED SKW22 22L	Default SBW600 / SKW22 22L	Default SBW600	Default icon on front panel SBA600
	LED 1 / 11 (first from left)	UI00 / UI30	50 / 50	Capacity step 1	
	LED 2 / 12	UI01 / UI31	51 / 51	Capacity step 2	
	LED 3 / 13	UI02 / UI32	14 / 0	Internal circuit water pump	
	LED 4 / 14	UI03 / UI33	16 / 0	External circuit water pump	
	LED 5 / 15	UI04 /UI34	23 / 23	Internal exchanger electric heater 1	
	LED 6 / 16	UI05 /UI35	9 / 0	Valve or DHW pump	
	LED 7 / 17	UI06 /UI36	30 / 14	Water heater	
LED symbol on display	**LED SBW600**	**Parameter SBA600**			
	Economy LED	UI07=0 dS00=0	UI07=0 dS00=1	UI07=1 dS00=0	NOT enabled (LED off)
	Economy LED			UI07=1 dS00=1	Enabled (dynamic setpoint)

* the LED is permanently on when in AS mode and with heating in progress, blinking when in AS mode and with heating not active

See **Outputs: configuration table with the following exceptions:**

Value	Description	
±50	Capacity step 1 output	values used only for configuring the user interface LEDs, and associated with the capacity steps requested by the main temperature regulator
±51	Capacity step 2 output	
±52	Capacity step 3 output	
±53	Capacity step 4 output	
...		
±70	internal pump 1 output or internal pump 2 output or both	
±71	external exchanger fan circuit 1 output or external exchanger fan circuit 2 output or both	Digital values used only for configuring the user interface LEDs
±72	internal exchanger electric heater 1 output or internal exchanger electric heater 2 output or both	
±73	external exchanger heater 1 output or external exchanger heater 2 output or both	
±74	circuit 1 heat pump lock status or circuit 2 heat pump lock status or both	

UI10 **Select main display**
To select to view the main display

0	AiL analogue input 1	**XVD1**	**20**	Input 1rE1 (evaporator outlet temperature) XVD1
1	Analogue input AiL2		**21**	Input 1rE2 (saturation temperature) XVD1
2	Analogue input AiL3		**22**	Input 1rE3 (backup probe evaporator outlet temperature) XVD1
3	Analogue Input AiL4		**23**	Input 1rE4 (backup probe evaporator temperature) XVD1
4	Analogue input AiL5		**24**	Input 1rE5 (superheating) XVD1
5	Analogue Input 1 Terminal AIR1		**25**	Input 1rE6 (refrigerant pressure) XVD1
6	Analogue Input 2 Terminal AIR2		**26**	Input 1rE7 (valve opening percentage) XVD1
7	AiE Analogue input 1		**27**	Input 1SP4 (superheating current setpoint) XVD1
8	AiE Analogue input 2	**XVD2**	**28**	Input 2rE1 (evaporator outlet temperature) XVD2
9	AiE Analogue input 3		**29**	Input 2rE1 (saturation temperature) XVD2
10	AiE analogue input 4		**30**	Input 2rE3 (backup probe evaporator outlet temperature) XVD2
11	AiE analogue input 5		**31**	Input 2rE4 (backup probe evaporator outlet temperature) XVD2
12	Clock		**32**	Input 2rE5 (superheating) XVD2
13	Programmed setpoint		**33**	Input 2rE6 (refrigerant pressure) XVD2
14	Real Setpoint		**34**	Input 2rE7 (valve opening percentage) XVD2
15	Input 1AI1		**35**	Input 2SP4 (superheating current setpoint) XVD2
16	Input 1AI2		**36**	Clock
17	Input 1AI3		**37**	Programmed setpoint
18	Input 1AI4		**38**	Real Setpoint
19	Input 2AI1			

UI11 **Select main display (terminal) SKW1**
Selects the terminal main display* mode
*Note: display with 2 and a half digits + sign
Same as UI10
For convenience we will designate:

Display	**Display A**	**Display B***
	4-figure read-out For displaying time	Read-out with 2 and a half digits and +/- sign See parameter UI11

UI25 **Setpoint edit function enable from main screen**
Parameter allows you to enable Setpoint modification on the main display with the UP and DOWN keys
- 0 = Key not enabled for the function
- 1 = Key enabled for the function

Parameter	**Key [press and hold]**	**Default icon on front panel**	**Parameter**	**Key [press and hold]**	**Default icon on front panel**
UI20=1	[UP] = Domestic Hot Water / Manual defrost depending on model		UI24=1	[Set] = edit SetPoint	**No (set key)**
UI21=1	[esc] = changeover	**mode**	**Parameter**	**key (press and release)**	**Default icon on front panel**
UI22=1	[set] = display	**disp**	UI25=1	UP / DOWN	**No (UP and DOWN keys)**
UI23=1	[DOWN] = Standby / Local ON/OFF according to model				

27.2 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 lists all controller configuration parameters saved in the non-volatile memory, including visibility.
- The **folders** table lists all parameter folder visibility details.
- The **client** table includes all I/O and alarm status resources available in the volatile memory of the instrument.

Description of columns:

FOLDER This indicates the label of the folder containing the parameter in question.

LABEL This indicates the label used to display the **parameters** in the menu of the controller.

ADDR **VAL PAR ADDRESS**
The whole part represents the address of the MODBUS register containing the value of the resource to be read or written in the instrument. The value after the point indicates the position of the most significant data bit inside 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 column DATA SIZE is also taken into consideration).
Given that the modbus registers have 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	(0000010101000110)
8806.8	Byte	5	1350	(0000010101000110)
8806.14	1 bits	0	1350	(0000010101000110)
8806.7	4 bits	10	1350	(0000010101000110)

Important: when the register contains more than one piece of data, the write procedure is as follows:
- Read current value of register
- Modify bits for the resource concerned
- Write register

VIS ADDR **VAL PAR ADDRESS**
The same as above. In this case, the MODBUS register address contains the visibility value of the parameter. By default all parameters have:
- Data size bit
- Range 0...3
- **Visibility 3
- U.M. num.

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

1. Parameters and/or folders with a level of visibility <>3 (password-protected) will be visible only if the correct password is entered (installer or manufacturer) following this procedure:
2. Parameters and/or folders with a level of visibility = 3 are always visible even without a password: in this case, the following procedure is not necessary.

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	----------(1111111111111111)
49482	2 bits	3	65535	(1111111111111111)
49482.2	2 bits	3	65535	(1111111111111111)
49482.4	2 bits	3	65535	(1111111111111111)
49482.6	2 bits	3	65535	(1111111111111111)

Let's modify the visibility of parameter CL04 (address 49482,6) from 3 to 0:

Visibility modified

VAL PAR ADDRESS	DATA SIZE	Value	Content of register	
49481.6	2 bits	0	16383	(0011111111111111)

RESET (Y/N) Indicates whether the device **MUST** be rebooted after the parameter has been changed.

- Y=YES the device **MUST** be rebooted to save the change.
- N=NO the device **DOES NOT need** to be rebooted after changing the parameter

Example ALL configuration parameters (folder **CF**) equal Y or the controller, meaning the controller **MUST ALWAYS BE SWITCHED OFF THEN BACK ON AGAIN AFTER THEY HAVE BEEN CHANGED.**

R/W Indicates if resources are read/write, read-only or write-only:

R The resource is read-only
W The resource is write-only
RW The resource can be both read and written to

DATA SIZE Indicates the size of the data in bits.

WORD = 16 bit
Byte = 8 bit
"n" bit = 0...15 bit based on the value of "n"

CPL When the field indicates "Y", the value read by the register needs to be converted because the value represents a number with a sign. In other cases the value is always positive or null.
To carry out the 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 instrument parameters (indicated in the parameter label).
N.B. If the real value is outside the permitted limits for the parameter (for example, because other parameters defining the limits have been changed), the limit that has been passed and not the real value will be displayed.

DEFAULT Indicates the factory setting for the standard model of the instrument. Hardware model **SBW646/C** with 4 relays + TRIAC + 2 analogue outputs A01 AO2 PWM + 1 low voltage analogue output A03 is considered in this table.

EXP If = -1 the value read by the register is divided by 10 (value/10) to convert it to the values indicated in the RANGE and DEFAULT columns using the unit of measurement in the **UM** column,
Example: parameter CL04 = 50.0. Column EXP = -1:

- The value read by the device /DeviceManager is 50.0
- The value read from the register is 500 --> 500/10 = 50.0

U.M. Measurement unit for values converted according to the rules indicated in the CPL and EXP columns.

27.2.1 Parameters / visibility table

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
CF	**CF01**	**49169**	**49468.6**	BYTE			RW	• **Select COM1 protocol** • Selection of COM1 (TTL) communication channel protocol: • 0 = Eliwell; 1 = Modbus • NOTE: • If CF01=0, parameters CF20/CF21 should be configured • If CF01=1, parameters CF30/CF31/CF32 should be configured	0 ... 1	1	num.
CF	**CF20**	**49176**	**49470.4**	BYTE			RW	**Eliwell protocol controller address** CF20= address of the controller within the family (values valid from 0 to. 14) CF21 = controller family (values from 0 to 14). The two values CF20 and CF21 represent the network address of the controller and the pair are indicated in the following format "FF.DD" (where FF=CF21 and DD=CF20).	0 ... 14	0	num.
CF	**CF21**	**49177**	**49470.6**	BYTE			RW	**Eliwell protocol controller family** See CF21	0 ... 14	0	num.
CF	**CF30**	**49178**	**49471**	BYTE			RW	**Modbus protocol controller address** NOTE: 0 (zero) is not included	1 ... 255	1	num.
CF	**CF31**	**49179**	**49471.2**	BYTE			RW	• **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 that can be set using **Device**Manager software) • 6=57600 baud • 7=115200 baud	0 ... 7	3	num.
CF	**CF32**	**49180**	**49471.4**	BYTE			RW	• **Modbus protocol parity** • 1= EVEN • 2 = NONE • 3= ODD	1 ... 3	1	num.
CF	**CF43**	**NA**	**NA**	BYTE			R	Firmware screen	0 ... 999	0	num.
CF	**CF44**	**NA**	**NA**	BYTE			R	Firmware version	0 ... 999	0	num.
CF	**CF50**	**49360**	**49473.2**	BYTE			RW	**RTC present** 0 = RTC not present; 1 = RTC present	0 ... 1	1	num.
CF	**CF60**	**16430**	**49473.4**	WORD			RW	**Client code 1** Parameter for the exclusive use of customers/users. The user can assign these parameters values that e.g. identify the type and/or model of the system, and its configuration etc.	0 ... 999	0	num.
CF	**CF61**	**16432**	**49473.6**	WORD			RW	**Client code 2** See CF60	0 ... 999	0	num.
CL	**CL00**	**49208**	**49438.6**	BYTE			RW	• **AiL1 analogue input type** • 0= Probe not configured • 1= DI • 2= NTC	0 ... 2	0	num.
CL	**CL01**	**49209**	**49439**	BYTE			RW	**AiL2 analogue input type** See CL00	0 ... 2	0	num.
CL	**CL02**	**49210**	**49439.2**	BYTE			RW	• **AiL3 analogue input type**	0 ... 6	0	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
								• 0= Probe not configured • 1= DI • 2= NTC • 3=4...20mA • 4=0-10V • 5=0-5V • 6=0-1V			
CL	**CL03**	**49211**	**49439.4**	BYTE			RW	**AiL4 analogue input type** See CL02	0 ... 6	0	num.
CL	**CL04**	**49212**	**49439.6**	BYTE			RW	**AiL5 analogue input type** See CL00	0 ... 2	0	num.
CL	**CL10**	**16450**	**49440**	WORD	Y	-1	RW	**AiL3 analogue input full scale value**	CL11 ... 999	500	°C/Bar
CL	**CL11**	**16462**	**49440.2**	WORD	Y	-1	RW	**AiL3 analogue input start of scale value**	-500...CL10	0	°C/Bar
CL	**CL12**	**16452**	**49440.4**	WORD	Y	-1	RW	**AiL4 analogue input full scale value**	CL13 ... 999	500	°C/Bar
CL	**CL13**	**16464**	**49440.6**	WORD	Y	-1	RW	**AiL4 analogue input start of scale value**	-500 ... CL12	0	°C/Bar
CL	**CL20**	**49238**	**49441**	BYTE	Y	-1	RW	**AiL1 analogue input differential**	-120 ... 120	0	°C
CL	**CL21**	**49239**	**49441.2**	BYTE	Y	-1	RW	**AiL2 analogue input differential**	-120 ... 120	0	°C
CL	**CL22**	**49240**	**49441.4**	BYTE	Y	-1	RW	**AiL3 analogue input differential**	-120 ... 120	0	°C/Bar
CL	**CL23**	**49241**	**49441.6**	BYTE	Y	-1	RW	**AiL4 analogue input differential**	-120 ... 120	0	°C/Bar
CL	**CL24**	**49242**	**49442**	BYTE	Y	-1	RW	**AiL5 analogue input differential5**	-120 ... 120	0	°C
CL	**CL30**	**49286**	**49442.2**	BYTE			RW	**AIL1 analogue input configuration**	0 ... 16	0	num.
CL	**CL31**	**49287**	**49442.4**	BYTE			RW	**AIL2 analogue input configuration**	0 ... 16	0	num.
CL	**CL32**	**49288**	**49442.6**	BYTE			RW	**AIL3 analogue input configuration**	0 ... 30	0	num.
CL	**CL33**	**49289**	**49443**	BYTE			RW	**AIL4 analogue input configuration**	0 ... 30	0	num.
CL	**CL34**	**49290**	**49443.2**	BYTE			RW	**AIL5 analogue input configuration**	0 ... 16	0	num.
CL	**CL40**	**49292**	**49443.4**	BYTE	Y		RW	**DIL1 digital input configuration**	-58 ... 58	0	num.
CL	**CL41**	**49293**	**49443.6**	BYTE	Y		RW	**DIL2 digital input configuration**	-58 ... 58	0	num.
CL	**CL42**	**49294**	**49444**	BYTE	Y		RW	**DIL3 digital input configuration**	-58 ... 58	0	num.
CL	**CL43**	**49295**	**49444.2**	BYTE	Y		RW	**DIL4 digital input configuration**	-58 ... 58	0	num.
CL	**CL44**	**49296**	**49444.4**	BYTE	Y		RW	**DIL5 digital input configuration**	-58 ... 58	0	num.
CL	**CL45**	**49297**	**49444.6**	BYTE	Y		RW	**DIL6 digital input configuration**	-58 ... 58	0	num.
CL	**CL50**	**49302**	**49445.2**	BYTE	Y		RW	**AIL1 analogue input configuration** **if configured as a digital input** NOTE: Set to 0 if AiL1 is NOT configured as a DI	-58 ... 58	0	num.
CL	**CL51**	**49303**	**49445.4**	BYTE	Y		RW	**AIL2 analogue input configuration** **if configured as a digital input** NOTE: Set to 0 if AiL2 is NOT configured as a DI	-58 ... 58	0	num.
CL	**CL52**	**49304**	**49445.6**	BYTE	Y		RW	**AIL3 analogue input configuration** **if configured as a digital input** NOTE: Set to 0 if AiL3 is NOT configured as a DI	-58 ... 58	0	num.
CL	**CL53**	**49305**	**49446**	BYTE	Y		RW	**AIL4 analogue input configuration** **if configured as a digital input** NOTE: Set to 0 if AiL4 is NOT configured as a DI	-58 ... 58	0	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
CL	**CL54**	**49306**	**49446.2**	BYTE	Y		RW	**AIL5 analogue input configuration** **if configured as a digital input** NOTE: Set to 0 if AiL5 is NOT configured as a DI	-58 … 58	0	num.
CL	**CL60**	**49248**	**49446.4**	BYTE			RW	• **AOL5 analogue output type** • 0 = 4-20mA • 1 = 0-20mA	0 … 1	0	num.
CL	**CL61**	**49310**	**49446.6**	BYTE	Y		RW	**AOL3 analogue output configuration**	-53 … 66	66	num.
CL	**CL62**	**49311**	**49447**	BYTE	Y		RW	**AOL4 analogue output configuration**	-53 … 66	59	num.
CL	**CL63**	**49312**	**49447.2**	BYTE	Y		RW	**AOL5 analogue output configuration**	-53 … 66	0	num.
CL	**CL71**	**49251**	**49447.6**	BYTE			RW	• **Enable AOL1 analogue output 1** • 0 = Output configured as digital – see CL96 • 1 = Output configured as TRIAC – see CL74 – CL77 – CL80 • 2 = PWM – see CL82	0 … 1	1	num.
CL	**CL72**	**49252**	**49448**	BYTE			RW	• **Enable AOL2 analogue output** • 0 = Output configured as digital – see CL97 • 1 = Output configured as TRIAC – see CL75 – CL78 – CL81	0 … 1	1	num.
CL	**CL73**	**49253**	**49448.2**	BYTE			RW	**Phase shift TCL1 analogue output**	0 … 90	1	deg
CL	**CL74**	**49254**	**49448.4**	BYTE			RW	**Phase shift AOL1 analogue output**	0 … 90	27	deg
CL	**CL75**	**49255**	**49448.6**	BYTE			RW	**Phase shift AOL2 analogue output**	0 … 90	27	deg
CL	**CL76**	**49256**	**49449**	BYTE			RW	**TCL1 analogue output pulse length**	5 … 40	27	69 µsec
CL	**CL77**	**49257**	**49449.2**	BYTE			RW	**AOL1 analogue output pulse length**	5 … 40	10	69 µsec
CL	**CL78**	**49258**	**49449.4**	BYTE			RW	**AOL2 analogue output pulse length**	5 … 40	10	69 µsec
CL	**CL79**	**49314**	**49449.6**	BYTE	Y		RW	**TCL1 analogue output configuration**	-53 … 66	10	num.
CL	**CL80**	**49315**	**49450**	BYTE	Y		RW	**AOL1 analogue output configuration**	-53 … 66	59	num.
CL	**CL81**	**49316**	**49450.2**	BYTE	Y		RW	**AOL2 analogue output configuration**	-53 … 66	56	num.
CL	**CL90**	**49322**	**49450.4**	BYTE	Y		RW	**DOL1 digital output configuration**	-53 … 53	0	num.
CL	**CL91**	**49323**	**49450.6**	BYTE	Y		RW	**DOL2 digital output configuration**	-53 … 53	-5	num.
CL	**CL92**	**49324**	**49451**	BYTE	Y		RW	**DOL3 digital output configuration**	-53 … 53	24	num.
CL	**CL93**	**49325**	**49451.2**	BYTE	Y		RW	**DOL4 digital output configuration**	-53 … 53	23	num.
CL	**CL94**	**49326**	**49451.4**	BYTE	Y		RW	**DOL5 digital output configuration (Open Collector)**	-53 … 53	34	num.
CL	**CL95**	**49327**	**49451.6**	BYTE	Y		RW	**Visible only in models 655** **DOL6 digital output configuration (655 models)**	-53 … 53	31	num.
CL	**CL96**	**49328**	**49452**	BYTE	Y		RW	**AOL1 digital output configuration**	-53 … 53	0	num.
CL	**CL97**	**49329**	**49452.2**	BYTE	Y		RW	**AOL2 digital output configuration**	-53 … 53	0	num.
Ui	**Ui00**	**49388**	**49474**	BYTE			RW	**Configuration of LED1**	0 … 74	50	num.
Ui	**Ui01**	**49389**	**49474.2**	BYTE			RW	**Configuration of LED2**	0 … 74	51	num.
Ui	**Ui02**	**49390**	**49474.4**	BYTE			RW	**Configuration of LED3**	0 … 74	14	num.
Ui	**Ui03**	**49391**	**49474.6**	BYTE			RW	**Configuration of LED4**	0 … 74	16	num.
Ui	**Ui04**	**49392**	**49475**	BYTE			RW	**Configuration of LED5**	0 … 74	23	num.
Ui	**Ui05**	**49393**	**49475.2**	BYTE			RW	**Configuration of LED6**	0 … 74	9	num.
Ui	**Ui06**	**49394**	**49475.4**	BYTE			RW	**Configuration of LED7**	0 … 74	30	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
Ui	**Ui07**	**49402**	**49475.6**	BYTE			RW	• **Configuration of Economy LED** • Allows you to configure the Economy LED. • (if=1 the economy LED on the display will be permanently on) • 0 = LED disabled • 1 = dynamic setpoint	0 ... 2	1	num.
Ui	**Ui10**	**49366**	**49476.2**	BYTE			RW	**Select main display**	0 ... 38	0	num.
Ui	**Ui11**	**49367**	**49476.4**	BYTE			RW	**Select main display SKW1**	0 ... 38	5	num.
Ui	**Ui20**	**49382**	**49477**	BYTE			RW	• **Enable DHW in standby / Manual defrost function from key [UP]** • Makes it possible to enable or disable the domestic hot water function in standby from the **[UP]** button, or manual defrost, depending on the model • 0 = Key not enabled for the function • 1 = Key enabled for the function	0 ... 1	1	num.
Ui	**Ui21**	**49383**	**49477.2**	BYTE			RW	• **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	0 ... 1	1	num.
Ui	**Ui22**	**49384**	**49477.4**	BYTE			RW	• **Enable DISP function from key** • To enable or disable access the button [set] (disp function) • for configuration of the main display mode • 0 = Key not enabled for the function • 1 = Key enabled for the function	0 ... 1	1	num.
Ui	**Ui23**	**49385**	**49477.6**	BYTE			RW	• **Enable ON/OFF function from key** • To enable or disable the [DOWN] key • (ON/OFF function) to switch the instrument on or off • 0 = Key not enabled for the function • 1 = Key enabled for the function	0 ... 1	1	num.
Ui	**Ui24**	**49386**	**49478**	BYTE			RW	• **Enable SET function from key** • To enable or disable access via the “set” • key to the machine state menu and relative subfolders • 0 = Key not enabled for the function • 1 = Key enabled for the function	0 ... 1	1	num.
Ui	**Ui25**	**49387**	**49478.2**	BYTE			RW	• **Setpoint edit function enable from main screen** • To enable or disable Setpoint modification • on the main display with the UP and DOWN keys • 0 = Key not enabled for the function • 1 = Key enabled for the function	0 ... 1	0	num.
Ui	**Ui27**	**16640**	**49478.6**	WORD			RW	**Installation password** When enabled (value other than 0) it constitutes the access key for parameters	0 ... 255	1	num.
Ui	**Ui28**	**16642**	**49479**	WORD			RW	**Manufacturer password** When enabled (value other than zero), constitutes the password for access to parameters	0 ... 255	2	num.
Ui	**Ui30**	**49395**	**49479.2**	BYTE			RW	**SKW utility LED configuration** **Configuration of led11** See LED table (parameters **UI00..UI06**)	0 ... 74	50	num.
Ui	**Ui31**	**49396**	**49479.4**	BYTE			RW	**Configuration of LED12**	0 ... 74	51	num.
Ui	**Ui32**	**49397**	**49479.6**	BYTE			RW	**Configuration of LED13**	0 ... 74	0	num.
Ui	**Ui33**	**49398**	**49480**	BYTE			RW	**Configuration of LED14**	0 ... 74	0	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
Ui	**Ui34**	**49399**	**49480.2**	BYTE			RW	**Configuration of LED15**	0 ... 74	23	num.
Ui	**Ui35**	**49400**	**49480.4**	BYTE			RW	**Configuration of LED16**	0 ... 74	0	num.
Ui	**Ui36**	**49401**	**49480.6**	BYTE			RW	**Configuration of LED17**	0 ... 74	14	num.
Cr	**CR00**	**49664**	**49452.4**	BYTE			RW	• **AIR1 local analogue input type** • 0= Probe not configured • 1 = not used • 2= NTC	0 ... 2	0	num.
Cr	**CR01**	**49665**	**49452.6**	BYTE			RW	• **AIR2 local analogue input type** • 0= Probe not configured • 1= DI • 2= NTC • 3 = 4..20mA	0 ... 3	0	num.
Cr	**CR10**	**16900**	**49453**	WORD	Y	-1	RW	**AIR2 analogue input full scale value**	Cr11 ... 999	500	C/Bar
Cr	**CR11**	**16904**	**49453.2**	WORD	Y	-1	RW	**AIR2 analogue input start of scale value**	-500 ... Cr10	0	C/Bar
Cr	**CR20**	**49674**	**49453.4**	BYTE	Y	-1	RW	**AIR1 analogue input differential**	-120 ... 120	0	°C
Cr	**CR21**	**49675**	**49453.6**	BYTE	Y	-1	RW	**AIR2 analogue input differential**	-120 ... 120	0	C/Bar
Cr	**CR30**	**49676**	**49454**	BYTE			RW	**AIR1 analogue input configuration**	0 ... 16	0	num.
Cr	**CR31**	**49677**	**49454.2**	BYTE			RW	**AIR2 analogue input configuration**	0 ... 30	0	num.
Cr	**CR50**	**49683**	**49454.4**	BYTE	Y		RW	**AIR2 analogue input configuration** **if configured as a digital input** NOTE: Set to 0 if Air2 is NOT configured as a DI	-58 ... 58	0	num.
CE	**CE00**	**49696**	**49454.6**	BYTE			RW	• **AIE1 analogue input type** • 0= Probe not configured • 1= DI • 2= NTC	0 ... 2	0	num.
CE	**CE01**	**49697**	**49455**	BYTE			RW	**AIE2 analogue input type** See CE00	0 ... 2	0	num.
CE	**CE02**	**49698**	**49455.2**	BYTE			RW	• **AIE3 analogue input type** • 0= Probe not configured • 1= DI • 2= NTC • 3 = 4...20mA • 4=0-10V • 5=0-5V • 6=0-1V	0 ... 6	0	num.
CE	**CE03**	**49699**	**49455.4**	BYTE			RW	**AIE4 analogue input type** See CE02	0 ... 6	0	num.
CE	**CE04**	**49700**	**49455.6**	BYTE			RW	**AIE5 analogue input type** See CE00	0 ... 2	0	num.
CE	**CE10**	**16938**	**49456**	WORD	Y	-1	RW	**AIE3 analogue input fullscale value**	CE11 ... 999	500	°C/Bar
CE	**CE11**	**16950**	**49456.2**	WORD	Y	-1	RW	**AIE3 analogue input start of scale value**	-500 ... CE10	0	°C/Bar
CE	**CE12**	**16940**	**49456.4**	WORD	Y	-1	RW	**AIE4 analogue input fullscale value**	CE13 ... 999	500	°C/Bar
CE	**CE13**	**16952**	**49456.6**	WORD	Y	-1	RW	**AIE4 analogue input start of scale value**	-500 ... CE12	0	°C/Bar
CE	**CE20**	**49726**	**49457**	BYTE	Y	-1	RW	**AIE1 analogue input differential**	-120 ... 120	0	°C
CE	**CE21**	**49727**	**49457.2**	BYTE	Y	-1	RW	**AIE2 analogue input differential**	-120 ... 120	0	°C

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
CE	**CE22**	**49728**	**49457.4**	BYTE	Y	-1	RW	**AIE3 analogue input differential**	-120 ... 120	0	°C/Bar
CE	**CE23**	**49729**	**49457.6**	BYTE	Y	-1	RW	**AIE4 analogue input differential**	-120 ... 120	0	°C/Bar
CE	**CE24**	**49730**	**49458**	BYTE	Y	-1	RW	**AIE5 analogue input differential**	-120 ... 120	0	°C
CE	**CE30**	**49748**	**49458.2**	BYTE			RW	**AIE1 analogue input configuration**	0 ... 16	0	num.
CE	**CE31**	**49749**	**49458.4**	BYTE			RW	**AIE2 analogue input configuration**	0 ... 16	0	num.
CE	**CE32**	**49750**	**49458.6**	BYTE			RW	**AIE3 analogue input configuration**	0 ... 30	0	num.
CE	**CE33**	**49751**	**49459**	BYTE			RW	**AIE4 analogue input configuration**	0 ... 30	0	num.
CE	**CE34**	**49752**	**49459.2**	BYTE			RW	**AIE5 analogue input configuration**	0 ... 16	0	num.
CE	**CE40**	**49754**	**49459.4**	BYTE	Y		RW	**DIE1 digital input configuration**	-58 ... 58	0	num.
CE	**CE41**	**49755**	**49459.6**	BYTE	Y		RW	**DIE2 digital input configuration**	-58 ... 58	0	num.
CE	**CE42**	**49756**	**49460**	BYTE	Y		RW	**DIE3 digital input configuration**	-58 ... 58	0	num.
CE	**CE43**	**49757**	**49460.2**	BYTE	Y		RW	**DIE4 digital input configuration**	-58 ... 58	0	num.
CE	**CE44**	**49758**	**49460.4**	BYTE	Y		RW	**DIE5 digital input configuration**	-58 ... 58	0	num.
CE	**CE45**	**49759**	**49460.6**	BYTE	Y		RW	**DIE6 digital input configuration**	-58 ... 58	0	num.
CE	**CE50**	**49762**	**49461.2**	BYTE	Y		RW	**AIE1 analogue input configuration if configured as a digital input** NOTE: Set = 0 if AiE1 is NOT configured as DI	-58 ... 58	0	num.
CE	**CE51**	**49763**	**49461.4**	BYTE	Y		RW	**AIE2 analogue input configuration if configured as a digital input** NOTE: Set = 0 if AiE2 is NOT configured as DI	-58 ... 58	0	num.
CE	**CE52**	**49764**	**49461.6**	BYTE	Y		RW	**AIE3 analogue input configuration if configured as a digital input** NOTE: Set = 0 if AiE3 is NOT configured as DI	-58 ... 58	0	num.
CE	**CE53**	**49765**	**49462**	BYTE	Y		RW	**AIE4 analogue input configuration if configured as a digital input** NOTE: Set to 0 if AE4 is NOT configured as a DI	-58 ... 58	0	num.
CE	**CE54**	**49766**	**49462.2**	BYTE	Y		RW	**AIE5 analogue input configuration if configured as a digital input** NOTE: Set = 0 if AiE5 is NOT configured as DI	-58 ... 58	0	num.
CE	**CE60**	**49736**	**49462.4**	BYTE			RW	• **AOE5 analogue output type** • 0 = 4-20mA • 1 = 0-20mA	0 ... 1	0	num.
CE	**CE61**	**49768**	**49462.6**	BYTE	Y		RW	**AOE3 analogue output configuration**	-53 ... 66	0	num.
CE	**CE62**	**49769**	**49463**	BYTE	Y		RW	**AOE4 analogue output configuration**	-53 ... 66	0	num.
CE	**CE63**	**49770**	**49463.2**	BYTE	Y		RW	**AOE5 analogue output configuration**	-53 ... 66	0	num.
CE	**CE70**	**49738**	**49463.4**	BYTE			RW	• **Enable TCE1 analogue output** • 0 = SE65x models – see CE95 • 1 = SE64x models – see CE73 – CE76 – CE79	0 ... 1	1	num.
CE	**CE71**	**49739**	**49463.6**	BYTE			RW	• **Enable AOE1 analogue output** • 0 = Output configured as digital – see CE96 • 1 = Output configured as triac – see CE74 – CE77 – CE80	0 ... 1	0	num.
CE	**CE72**	**49740**	**49464**	BYTE			RW	• **Enable AOE2 analogue output** • 0 = Output configured as digital – see CE97 • 1 = Output configured as TRIAC – see CE75 – CE78 – CE81	0 ... 1	0	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
CE	**CE73**	**49741**	**49464.2**	BYTE			RW	**Phase shift TCE1 analogue output**	0 ... 90	27	deg
CE	**CE74**	**49742**	**49464.4**	BYTE			RW	**Phase shift AOE1 analogue output**	0 ... 90	27	deg
CE	**CE75**	**49743**	**49464.6**	BYTE			RW	**Phase shift AOE2 analogue output**	0 ... 90	27	deg
CE	**CE76**	**49744**	**49465**	BYTE			RW	**TCE1 analogue output pulse length**	5 ... 40	10	69 µsec
CE	**CE77**	**49745**	**49465.2**	BYTE			RW	**AOE1 analogue output pulse length**	5 ... 40	10	69 µsec
CE	**CE78**	**49746**	**49465.4**	BYTE			RW	**AOE2 analogue output pulse length**	5 ... 40	10	69 µsec
CE	**CE79**	**49772**	**49465.6**	BYTE	Y		RW	**TCE1 analogue output configuration**	-53 ... 66	0	num.
CE	**CE80**	**49773**	**49466**	BYTE	Y		RW	**AOE1 analogue output configuration**	-53 ... 66	0	num.
CE	**CE81**	**49774**	**49466.2**	BYTE	Y		RW	**AOE2 analogue output configuration**	-53 ... 66	0	num.
CE	**CE90**	**49776**	**49466.4**	BYTE	Y		RW	**DOE1 digital output configuration**	-53 ... 53	0	num.
CE	**CE91**	**49777**	**49466.6**	BYTE	Y		RW	**DOE2 digital output configuration**	-53 ... 53	0	num.
CE	**CE92**	**49778**	**49467**	BYTE	Y		RW	**DOE3 digital output configuration**	-53 ... 53	0	num.
CE	**CE93**	**49779**	**49467.2**	BYTE	Y		RW	**DOE4 digital output configuration**	-53 ... 53	0	num.
CE	**CE94**	**49780**	**49467.4**	BYTE	Y		RW	**DOE5 digital output configuration**	-53 ... 53	0	num.
CE	**CE95**	**49781**	**49467.6**	BYTE	Y		RW	**Visible only in models 655** **DOE6 digital output configuration (models 655)**	-53 ... 53	0	num.
CE	**CE96**	**49782**	**49468**	BYTE	Y		RW	**AOE1 digital output configuration**	-53 ... 53	0	num.
CE	**CE97**	**49783**	**49468.2**	BYTE	Y		RW	**AOE2 digital output configuration**	-53 ... 53	0	num.

The parameters relative to the XVD Open drivers are listed at the end of the table
The folders are shown after parameters CE and before parameters St

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
St	**ST00**	**49808**	**49520**	BYTE			RW	• **Operating mode** • **Select function modes** • 0 = cool only. Only OFF, STAND-BY and COOL allowed (local and remote). • 1 = heat only. Only OFF, STAND-BY and COOL allowed (local and remote). • 2 = Heat pump heat/cool All modes allowed.	0 ... 2	2	num.
St	**ST01**	**49809**	**49520.2**	BYTE			RW	• **Enable change-over from analogue input** • 0 = not enabled • 1 = enabled	0 ... 1	0	num.
St	**ST02**	**49810**	**49520.4**	BYTE			RW	• **Select probe for automatic change-over of operating mode** • 0 = external temperature • 1 = internal exchanger inlet water temperature • 2 = external exchanger water outlet temperature	0 ... 2	0	num.
St	**ST03**	**17044**	**49520.6**	WORD	Y	-1	RW	**Differential for automatic changeover in Heat**	-255 ... 255	-100	°C
St	**ST04**	**17046**	**49521**	WORD	Y	-1	RW	**Differential for automatic changeover in Cool**	-255 ... 255	100	°C
St	**ST05**	**49816**	**49521.2**	BYTE			RW	**Reversal valve** **Reversal valve switching delay**	0 ... 255	3	sec
St	**ST06**	**49817**	**49521.4**	BYTE			RW	**Reversal valve switching from Heat to Defrost delay**	0 ... 255	15	sec
St	**ST07**	**49818**	**49521.6**	BYTE			RW	**Reversal valve switching from Defrost to Heat delay**	0 ... 255	1	sec
St	**ST08**	**49819**	**49522**	BYTE			RW	**Reversal valve activation time for pressure release** Each time the compressors are completely switched off, the reversal valve is temporarily inverted. If = 0 the valve will not be temporarily inverted with a complete compressors shut down	0 ... 255	0	sec
tr	**TR00**	**49824**	**49513**	BYTE			RW	• **Type of temperature controller** • 0 = Proportional • 1 = Differential • 2 = Digital • **3 = INVERTER Proportional** • **4 = INVERTER Differential**	0 ... 4	3	num.
tr	**TR01**	**49825**	**49513.2**	BYTE			RW	• **Enable heat pump** • 0 = Heat pump absent • 1 = Heat pump present	0 ... 1	1	num.
tr	**TR02**	**49826**	**49513.4**	BYTE			RW	**Select temperature control probe in Cool** • 0=Internal exchanger water/air inlet temperature **(CL30...CL34=0)** • 1=Internal exchanger water/air outlet temperature **(CL30...CL34=1)** • 2= Circuit 1 and 2 internal exchanger water outlet average temperature **Average ((CL30...CL34=2), (CL30...CL34=3))** • 3= External exchanger water inlet temperature **(CL30...CL34=6)** • 4= External exchanger water outlet temperature **(CL30...CL34=7)** • 5= Circuit 1 and 2 external exchanger average temperature **Average ((CL30...CL34=4), (CL30...CL34=5))**	0 ... 5	0	num.
tr	**TR03**	**49827**	**49513.6**	BYTE			RW	**Select temperature control probe in Heat** **See tr02**	0 ... 5	0	num.
tr	**TR04**	**49828**	**49514**	BYTE			RW	• **Select probe for temperature control differential in Cool** • **Probe 1 – see tr02** • **Probe 2** External temperature NTC input **(CL30...CL34=8)**	0 ... 5	0	num.
tr	**TR05**	**49829**	**49514.2**	BYTE			RW	**Select probe for temperature control differential in Heat** **See tr04**	0 ... 5	0	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
tr	**TR10**	**17062**	**49514.4**	WORD	Y	-1	RW	**Cool mode setpoint, hysteresis, differentials** **Temperature control setpoint in Cool**	tr11 ... tr12	150	°C
tr	**TR11**	**17064**	**49514.6**	WORD	Y	-1	RW	**Minimum temperature control setpoint in Cool**	-500 ... tr12	110	°C
tr	**TR12**	**17066**	**49515**	WORD	Y	-1	RW	**Maximum temperature control setpoint in Cool**	tr11... 999	200	°C
tr	**TR13**	**17068**	**49515.2**	WORD		-1	RW	**Temperature control hysteresis in Cool**	1 ... 255	30	°C
tr	**TR14**	**17070**	**49515.4**	WORD		-1	RW	**Steps/compressors insertion differential in Cool**	1 ... 255	30	°C
tr	**TR15**	**17072**	**49515.6**	WORD	Y	-1	RW	**Setpoint differential in Cool from start of Economy**	-255 ... 255	50	°C
tr	**TR20**	**17074**	**49516**	WORD	Y	-1	RW	**Heat mode setpoint, hysteresis, differentials** **Temperature control setpoint in Heat**	tr21 ...tr22	310	°C
tr	**TR21**	**17076**	**49516.2**	WORD	Y	-1	RW	**Minimum temperature control setpoint in Heat**	-500 ... tr22	300	°C
tr	**TR22**	**17078**	**49516.4**	WORD	Y	-1	RW	**Maximum temperature control setpoint in Heat**	tr21 ... 999	450	°C
tr	**TR23**	**17080**	**49516.6**	WORD		-1	RW	**Temperature control hysteresis in Heat**	1 ... 255	30	°C
tr	**TR24**	**17082**	**49517**	WORD		-1	RW	**Steps/compressors insertion differential in Heat**	1 ... 255	30	°C
tr	**TR25**	**17084**	**49517.2**	WORD	Y	-1	RW	**Setpoint differential in Heat from start of Economy**	-255 ... 255	-50	°C
tr	**TR30**	**17712**	**49517.4**	WORD		-1	RW	**Temperature controller hysteresis with inverter in Cool** To modify temperature control hysteresis with INVERTER in Cool mode	0 ... 255	20	°C
tr	**TR31**	**17714**	**49517.6**	WORD		-1	RW	**Temperature controller band with inverter in Cool** To modify the proportional band of the temperature controller with INVERTER in Cool mode	0 ... 255	30	°C
tr	**TR32**	**50484**	**49518**	BYTE			RW	**Minimum speed with inverter in Cool** To modify the maximum speed of the compressor with INVERTER in Cool mode	0 ...tr33	30	num.
tr	**TR33**	**50485**	**49518.2**	BYTE			RW	**Maximum speed with inverter in Cool** To modify the maximum speed of the compressor with INVERTER in Cool mode	tr32 ... 100	70	num.
tr	**TR34**	**17718**	**49518.4**	WORD		-1	RW	**Inverter/compressors insertion differential in Cool** Makes it possible to change the compressor / INVERTER starting differential in Cooling mode	0 ... 255	60	°C
tr	**TR40**	**17726**	**49518.6**	WORD		-1	RW	**Temperature controller hysteresis with inverter in Heat** To modify temperature control hysteresis with INVERTER in Heat mode	0 ... 255	20	°C
tr	**TR41**	**17728**	**49519**	WORD		-1	RW	**Temperature controller band with inverter in Heat** To modify the proportional band of the temperature controller with INVERTER in Heat mode	0 ... 255	30	°C
tr	**TR42**	**50498**	**49519.2**	BYTE			RW	**Minimum speed with inverter in Heat** To modify the minimum speed of the compressor with INVERTER in Heat mode	0 ... Tr43	30	num.
tr	**TR43**	**50499**	**49519.4**	BYTE			RW	**Maximum speed with inverter in Heat** To modify the maximum speed of the compressor with INVERTER in Heat mode	tr42 ... 100	70	num.
tr	**TR44**	**17732**	**49519.6**	WORD		-1	RW	**Inverter/compressors insertion differential in Heat** Makes it possible to change the compressor / INVERTER starting differential in Heating mode	0 ... 255	60	°C
ri	**ri00**	**50864**	**49522.2**	BYTE			RW	**Enable discharge temperature limitation control** 0= disabled; 1= enabled	0 ... 1	0	num.
ri	**ri01**	**50865**	**49522.4**	BYTE			RW	**Compression ratio control mode selection** 0= Compression ratio control disabled 1=Compression ratio control enabled, minimum and maximum values 2=Compression ratio control enabled, minimum value 3=Compression ratio control enabled, maximum value	0 ... 3	1	num.
ri	**ri10**	**50868**	**49523.2**	BYTE			RW	**Compressor safety speed for oil recovery**	0 ... 100	40	%

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
ri	**ri11**	**50869**	**49523.4**	BYTE			RW	**Compressor safety speed**	0 ... 100	50	%
ri	**ri12**	**50870**	**49523.6**	BYTE			RW	**Compressor safety operation time** If different from zero enables oil recovery function	0 ... 255	3	min
ri	**ri13**	**50871**	**49524**	BYTE			RW	**Compressor running time for oil recovery**	0 ... 255	30	min
ri	**ri14**	**50872**	**49524.2**	BYTE			RW	**Initial transient for compression ratio control**	0 ... 255	2	min
ri	**ri16**	**50874**	**49524.6**	BYTE			RW	**Compressor speed correction**	1 ... 20	5	%
ri	**ri20**	**50875**	**49525**	BYTE			RW	**Zone 1b discharge temperature limit**	0 ... 255	110	°C
ri	**ri21**	**50876**	**49525.2**	BYTE			RW	**Zone 1a - 2 discharge temperature limit**	0 ... 255	120	°C
ri	**ri22**	**50877**	**49525.4**	BYTE			RW	**Zone 1c - 3 discharge temperature limit** ri20/ri21/ri22: discharge temperature reference values	0 ... 255	120	°C
ri	**ri30**	**50879**	**49526**	BYTE		-1	RW	**Minimum compression ratio**	0 ... 255	10	num.
ri	**ri31**	**50880**	**49526.2**	BYTE		-1	RW	**Maximum compression ratio**	0 ... 255	100	num.
ri	**ri32**	**50881**	**49526.4**	BYTE		-1	RW	**Minimum compression ratio band**	0 ... 255	10	num.
ri	**ri33**	**50882**	**49526.6**	BYTE		-1	RW	**Maximum compression ratio band**	0 ... 255	20	num.
ri	**ri34**	**50883**	**49527**	BYTE			RW	**Discharge temperature correction period**	5 ... 255	60	sec
ri	**ri55**	**50894**	**49529.6**	BYTE			RW	**Superheating setpoint correction period**	1 ...60	1	min
ri	**ri63**	**50901**	**49531.4**	BYTE		-1	RW	**Zone 1a/1b evaporation pressure**	0 ... 255	34	bar
ri	**ri64**	**50902**	**49531.6**	BYTE		-1	RW	**Evaporation pressure differential 2**	0 ... 255	20	bar
ri	**ri65**	**50903**	**49532**	BYTE		-1	RW	**Zone 1b/1c evaporation pressure**	0 ... 255	60	bar
dS	**dS00**	**49876**	**49573.6**	BYTE			RW	• **Ambient or external temperature regulator dynamic differential selection** • 0 = disabled • 1 = proportional • 2 = by steps	0 ... 2	0	num.
dS	**dS01**	**17096**	**49574**	WORD	Y	-1	RW	**Temperature controller dynamic differential proportional band in Cool**	-500 ... 999	50	°C
dS	**dS02**	**17098**	**49574.2**	WORD	Y	-1	RW	**Temperature controller dynamic differential proportional band in Heat**	-500 ... 999	50	°C
dS	**dS03**	**17100**	**49574.4**	WORD	Y	-1	RW	**Maximum temperature controller dynamic differential in Cool**	-500 ... 999	50	°C
dS	**dS04**	**17102**	**49574.6**	WORD	Y	-1	RW	**Maximum temperature controller dynamic differential in Heat**	-500 ... 999	50	°C
dS	**dS05**	**17104**	**49575**	WORD	Y	-1	RW	**Temperature controller dynamic differential setpoint in Cool**	-500 ... 999	150	°C
dS	**dS06**	**17106**	**49575.2**	WORD	Y	-1	RW	**Temperature controller dynamic differential setpoint in Heat**	-500 ... 999	220	°C
CP	**CP00**	**49694**	**49532.2**	BYTE			RW	• **Type of System** • **Type of compressor** • 0 = simple (non-power stage) • 1 = alternate power stage • 2 = screw power stage	0 ... 2	0	num.
CP	**CP01**	**49887**	**49532.4**	BYTE			RW	• **Number of circuits** • 1 = 1 circuit • 2 = 2 circuits	1 ... 2	1	num.
CP	**CP02**	**49888**	**49532.6**	BYTE			RW	• **Number of compressors per circuit** • 1 = 1 compressor • 2= 2 compressors • 3 = 3 compressors	1 ... 4	1	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
								• 4 = 4 compressors			
CP	**CP03**	**49889**	**49533**	BYTE			RW	• **Number of capacity steps of compressor** • 1 = 1 capacity steps • 2= 2 capacity steps • 3 = 3 capacity steps	0 ... 3	0	num.
CP	**CP10**	**49896**	**49533.6**	BYTE			RW	• **Plant resource management** • **Enable circuit balancing** • Establishes circuit management • 0 = saturation (circuits) • 1 = balancing (circuits)	0 ... 1	0	num.
CP	**CP11**	**49897**	**49534**	BYTE			RW	• **Enable compressor balancing** • Establishes circuit management • 0 = saturation (compressors) • 1 = balancing (compressors) • 2 = NOT USED	0 ... 1	0	num.
CP	**CP12**	**49898**	**49534.2**	BYTE			RW	• **Circuit selection criterion** • 0 = hours balancing • 1 = on sequence 1-->2; off sequence 2-->1	0 ... 1	0	num.
CP	**CP13**	**49899**	**49534.4**	BYTE			RW	• **Compressor selection criterion** • Establishes the selection of compressors on each circuit • 0 = hours balancing • 1 = on sequence 1-->2-->3-->4; off sequence 4-->3-->2-->1 • 2 = operating time	0 ... 2	0	num.
CP	**CP14**	**17132**	**49534.6**	WORD			RW	**Compressor running time for switch on sequence**	0 ... 255	3	sec*10
CP	**CP20**	**17136**	**49535**	WORD			RW	**Compressor Protection** **Minimum off/on for same compressor**	0 ... 255	3	sec*10
CP	**CP21**	**17138**	**49535.2**	WORD			RW	**Minimum time between the switching on of the same compressor**	0 ... 255	3	sec*10
CP	**CP22**	**17140**	**49535.4**	WORD			RW	**Minimum compressor on time**	0 ... 255	3	sec*10
CP	**CP23**	**17142**	**49535.6**	WORD			RW	**Minimum on/on time for same compressor**	1 ... 255	10	sec
CP	**CP24**	**17144**	**49536**	WORD			RW	**Minimum off/off time for different compressors**	1 ... 255	10	sec
CP	**CP25**	**17146**	**49536.2**	WORD			RW	**Minimum compressor switch on time per splitting increment**	1 ... 255	10	sec
CP	**CP26**	**17148**	**49536.4**	WORD			RW	**Minimum compressor switch on time per splitting decrease**	1 ... 255	5	sec
CP	**CP27**	**17150**	**49536.6**	WORD			RW	**Defrost compressor/step delay minimum**	1 ... 255	3	sec
Fi	**FI00**	**49956**	**49546.4**	BYTE			RW	• **Select recirculation fan operation** • 0 = recirculation fan disabled • 1 = Always on • 2 = On request	0 ... 2	0	num.
Fi	**FI01**	**17190**	**49546.6**	WORD		-1	RW	**Recirculating fan regulator hysteresis in Cool mode**	1 ... 255	20	°C
Fi	**FI02**	**17192**	**49547**	WORD		-1	RW	**Recirculating fan regulator hysteresis in Heat mode**	1 ... 255	20	°C
Fi	**FI03**	**17194**	**49547.2**	WORD			RW	**Postventilation time in Heat mode**	0 ... 255	10	sec
Pi	**PI00**	**49984**	**49540**	BYTE			RW	• **Select primary circuit water pump operating mode** • 0=Pump disabled • 1=Continuous (always on) • 2=On request (pump on when compressor on)	0 ... 2	2	num.
Pi	**PI01**	**49985**	**49540.2**	BYTE			RW	**Time primary circuit water pump not active for anti-lock**	0 ... 255	1	hours

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
Pi	**PI02**	**49986**	**49540.4**	BYTE			RW	**Internal circuit water pump pick-up time**	0 ... 255	2	sec
Pi	**PI03**	**49987**	**49540.6**	BYTE			RW	**Minimum internal circuit water pump start time**	0 ... 255	10	Sec x 10
Pi	**PI05**	**49989**	**49541.2**	BYTE			RW	**Maximum internal circuit water pump changeover start time** Pump operation time, after which the active pump is switched off and replaced by the second pump if available. If = 0 the second pump is not called	0 ... 255	0	hours
Pi	**PI10**	**49992**	**49541.4**	BYTE			RW	• **Enable primary circuit water pump on when antifreeze heaters on** • 0 = Pump disabled • 1 = Pump enabled	0 ... 1	0	num.
Pi	**PI11**	**49993**	**49541.6**	BYTE			RW	• **Enable internal circuit water pump start when boiler active** • 0 = Pump disabled • 1 = Pump enabled	0 ... 2	1	num.
Pi	**PI20**	**49996**	**49542**	BYTE			RW	**Operation in response to request** **Delay internal circuit water pump on and compressor on**	0 ... 255	60	sec
Pi	**PI21**	**49997**	**49542.2**	BYTE			RW	**Delay compressor off - internal circuit water pump off**	0 ... 255	60	sec
Pi	**PI22**	**49998**	**49542.4**	BYTE			RW	**Internal circuit pump periodic activation interval** Modifies the maximum pump off time after which the pump is forced on If modulating, it will be switched on a maximum speed	0 ... 255	30	min
Pi	**PI30**	**50002**	**49542.6**	BYTE			RW	**Modulating function in Cool mode** **Minimum internal circuit water pump speed in Cool**	1 ... 100	50	%
Pi	**PI31**	**50003**	**49543**	BYTE			RW	**Maximum internal circuit water pump speed in Cool**	1 ... 100	100	%
Pi	**PI32**	**17236**	**49543.2**	WORD	Y	-1	RW	**Minimum internal circuit water pump speed setpoint in Cool**	-500 ... 999	200	°C
Pi	**PI33**	**17238**	**49543.4**	WORD	Y	-1	RW	**Internal circuit water pump proportional band in Cool**	-255 ... 255	80	°C
Pi	**PI34**	**50008**	**49543.6**	BYTE			RW	**Fan speed setpoint to modulate internal circuit water pump in Cool**	0 ... 100	80	%
Pi	**PI35**	**50009**	**49544**	BYTE			RW	**Fan speed hysteresis to modulate internal circuit water pump in Cool**	1 ... 100	10	%
Pi	**PI40**	**50012**	**49544.2**	BYTE			RW	**Modulating function in Heat mode** **Minimum internal circuit water pump speed in Heat**	1 ... 100	30	%
Pi	**PI41**	**50013**	**49544.4**	BYTE			RW	**Maximum internal circuit water pump speed in Heat**	1 ... 100	100	%
Pi	**PI42**	**17246**	**49544.6**	WORD	Y	-1	RW	**Minimum internal circuit water pump speed setpoint in Heat**	-500 ... 999	200	°C
Pi	**PI43**	**17248**	**49545**	WORD	Y	-1	RW	**Internal circuit water pump proportional band in Heat**	-255 ... 255	180	°C
Pi	**PI44**	**50018**	**49545.2**	BYTE			RW	**Fan speed setpoint to modulate internal circuit water pump in Heat**	0 ... 100	80	%
Pi	**PI45**	**50019**	**49545.4**	BYTE			RW	**Fan speed hysteresis to modulate internal circuit water pump in Heat**	1 ... 100	10	%
Pi	**PI50**	**50022**	**49545.6**	BYTE			RW	• **ANTIFREEZE with PUMP** • **Select probe for internal circuit + water pump antifreeze** • 0=No probe (pump in antifreeze disabled) • 1=Internal exchanger water/air inlet temperature • 2=Internal exchanger water/air outlet temperature • 3=Circuit 1 internal exchanger water outlet temperature • 4=Circuit 2 internal exchanger water outlet temperature • 5=Circuit 1 and 2 internal exchanger water outlet minimum temperature • 6=External temperature	0 ... 6	0	num.
Pi	**PI51**	**17256**	**49546**	WORD	Y	-1	RW	**Internal circuit water pump regulator setpoint for antifreeze**	-500 ... 999	80	°C
Pi	**PI52**	**17258**	**49546.2**	WORD		-1	RW	**Internal circuit water pump regulator hysteresis for antifreeze**	1 ... 255	20	°C

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
FE	**FE00**	**50038**	**49548.4**	BYTE			RW	• **External exchanger fan mode selection** • 0 = Fan disabled • 1 = Continuous operation (Always ON) • 2 = Operation on call (ON when compressor ON)	0 … 2	1	num.
FE	**FE01**	**50039**	**49548.6**	BYTE			RW	**External exchanger fan pick-up time**	0 … 60	2	sec
FE	**FE10**	**50046**	**49549**	BYTE			RW	• **FAN CONTROL IN DEFROST** • **Enable single condensation** • Configures 2 circuit machines with a single condenser • 0 = separate condensation / independent fans • 1 = single condensation / in parallel	0 … 1	0	num.
FE	**FE11**	**50047**	**49549.2**	BYTE			RW	• **Enable external exchanger fan on in defrost** • 0 = Fan disabled • 1 = Fan enabled	0 … 2	0	num.
FE	**FE12**	**17280**	**49549.4**	WORD	Y	-1	RW	**External exchanger fan on setpoint in defrost**	-500 … 999	190	°C/Bar
FE	**FE13**	**17282**	**49549.6**	WORD		-1	RW	**External exchanger fan on hysteresis in defrost**	1 … 255	10	°C/Bar
FE	**FE14**	**50052**	**49550**	BYTE			RW	• **Select probe for external exchanger fan regulation in defrost** • 0 = Probe absent • 1 = External exchanger temperature probe (circuit 1 and 2) • 2 = High Pressure probe (circuit 1 and 2) • 3 = External exchanger pressure probe (circuit 1 and 2)	0 … 3	1	num.
FE	**FE20**	**17290**	**49550.2**	WORD			RW	**Bypass time for external exchanger fan cut-off**	0 … 255	2	sec
FE	**FE21**	**17292**	**49550.4**	WORD			RW	**External exchanger fan preventilation time**	0 … 255	0	sec
FE	**FE30**	**50062**	**49550.6**	BYTE			RW	**FAN CONTROL IN COOLING** **Minimum speed external exchanger fan in Cool**	0 … 100	35	%
FE	**FE31**	**50063**	**49551**	BYTE			RW	**Average speed external exchanger fan in Cool**	0 … 100	100	%
FE	**FE32**	**50064**	**49551.2**	BYTE			RW	**Maximum speed external exchanger fan in Cool**	0 … 100	100	%
FE	**FE33**	**50065**	**49551.4**	BYTE			RW	• **Select probe for external exchanger fan regulation in Cool** • 0=No probe • 1=External exchanger temperature (circuit 1 and 2) • 2=High pressure input (circuit 1 and 2) • 3=Low pressure input (circuit 1 and 2) • 4=External exchanger pressure (circuit 1 and 2) • 5=Internal exchanger pressure (circuit 1 and 2)	0 … 7	4	num.
FE	**FE34**	**17298**	**49551.6**	WORD	Y	-1	RW	**External exchanger fan minimum speed setpoint in Cool**	-500 … 999	180	°C/Bar
FE	**FE35**	**17300**	**49552**	WORD	Y	-1	RW	**External exchanger maximum speed differential in Cool**	1 … 999	55	°C/Bar
FE	**FE36**	**17302**	**49552.2**	WORD		-1	RW	**External exchanger fan speed proportional band in Cool**	0 … 999	25	°C/Bar
FE	**FE37**	**17304**	**49552.4**	WORD		-1	RW	**Maximum external exchanger fan hysteresis in Cool mode**	1 … 255	10	°C/Bar
FE	**FE38**	**17306**	**49552.6**	WORD		-1	RW	**External exchanger fan cut-off hysteresis in Cool**	1 … 255	10	°C/Bar
FE	**FE39**	**17308**	**49553**	WORD		-1	RW	**External exchanger fan cut-off differential in Cool**	0 … 255	20	°C/Bar
FE	**FE50**	**50082**	**49553.2**	BYTE			RW	**FAN CONTROL IN HEATING** **Minimum speed external exchanger fan in Heat**	0 … 100	35	%
FE	**FE51**	**50083**	**49553.4**	BYTE			RW	**Average speed external exchanger fan in Heat**	0 … 100	100	%
FE	**FE52**	**50084**	**49553.6**	BYTE			RW	**Maximum speed external exchanger fan in Heat**	0 … 100	100	%
FE	**FE53**	**50085**	**49554**	BYTE			RW	• **Select probe for external exchanger fan regulation in Heat** • 0=No probe	0 … 7	4	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
								• 1=External exchanger temperature (circuit 1 and 2) • 2=High pressure input (circuit 1 and 2) • 3=Low pressure input (circuit 1 and 2) • 4=External exchanger pressure (circuit 1 and 2) • 5=Internal exchanger pressure (circuit 1 and 2)			
FE	**FE54**	**17318**	**49554.2**	WORD	Y	-1	RW	**Minimum external exchanger fan speed setpoint in Heat**	-500 ... 999	120	°C/Bar
FE	**FE55**	**17320**	**49554.4**	WORD	Y	-1	RW	**Maximum external exchanger speed differential in Heat**	1 ... 999	17	°C/Bar
FE	**FE56**	**17322**	**49554.6**	WORD		-1	RW	**External exchanger fan speed proportional band in Heat**	0 ... 999	10	°C/Bar
FE	**FE57**	**17324**	**49555**	WORD		-1	RW	**Maximum external exchanger fan speed hysteresis in Heat**	1 ... 255	5	°C/Bar
FE	**FE58**	**17326**	**49555.2**	WORD		-1	RW	**External exchanger fan cut-off hysteresis in Heat**	1 ... 255	5	°C/Bar
FE	**FE59**	**17328**	**49555.4**	WORD		-1	RW	**External exchanger fan cut-off differential in Heat**	0 ... 255	10	°C/Bar
PE	**PE00**	**50110**	**49555.6**	BYTE			RW	• **External circuit water pump mode selection** • Defines the operation of the external circuit water pump • 0 = Pump disabled • 1 = Continuous operation (Always ON) • 2 = NOT USED • 3 = Operation synchronised with external exchanger fans	0 ... 3	0	num.
PE	**PE02**	**50111**	**49556**	BYTE			RW	**External circuit pump switch-on - compressor switch-on delay**	0 ... 255	0	sec
PE	**PE03**	**50112**	**49556.2**	BYTE			RW	**Compressor switch-off - external circuit pump switch-off delay**	0 ... 255	60	sec
PE	**PE04**	**50113**	**49556.4**	BYTE			RW	**External circuit water pump antilock function enabling** 0= function disabled; 1= function enabled	0 ... 1	0	num.
PE	**PE05**	**50114**	**49556.6**	BYTE			RW	**External circuit water pump OFF time for antilock**	0 ... 255	50	hours
PE	**PE06**	**50115**	**49557**	BYTE			RW	**External circuit water pump ON time for antilock**	1 ... 255	10	sec
PE	**PE07**	**50116**	**49557.2**	BYTE			RW	**Antifreeze function enabling with external circuit water pump** 0= function disabled; 1= function enabled	0 ... 1	0	num.
PE	**PE08**	**17350**	**49557.4**	WORD	Y	-1	RW	**External circuit water pump set point control for antifreeze**	-500 ... 999	100	°C
PE	**PE09**	**17352**	**49557.6**	WORD		-1	RW	**External circuit water pump hysteresis control for antifreeze**	0 ... 255	20	°C
Hi	**HI00**	**50126**	**49558**	BYTE			RW	• **Enable internal exchanger antifreeze heaters in standby** • 0 = Heaters disabled • 1 = Heaters enabled	0 ... 1	0	num.
Hi	**HI01**	**50127**	**49558.2**	BYTE			RW	• **Enable 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	0 ... 3	0	num.
Hi	**HI10**	**50130**	**49558.4**	BYTE			RW	• **Select probe for antifreeze internal exchanger + heater 1** • 0=No probe (antifreeze heater disabled) • 1=Internal exchanger water/air inlet temperature • 2=Internal exchanger water/air outlet temperature • 3=Circuit 1 internal exchanger water outlet temperature • 4=Circuit 2 internal exchanger water outlet temperature • 5=Circuit 1 and 2 internal exchanger water outlet average temperature	0 ... 5	2	num.
Hi	**HI11**	**50131**	**49558.6**	BYTE			RW	**Select probe for antifreeze internal exchanger + heater 2** See HI11	0 ... 5	2	num.
Hi	**HI12**	**17364**	**49559**	WORD	Y	-1	RW	**Internal exchanger heater regulator setpoint for antifreeze**	HI14 ...HI13	40	°C
Hi	**HI13**	**17366**	**49559.2**	WORD	Y	-1	RW	**Maximum internal exchanger heater regulator setpoint for antifreeze**	HI14 ... 999	70	°C

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
Hi	**HI14**	**17368**	**49559.4**	WORD	Y	-1	RW	**Minimum internal exchanger heater regulator setpoint for antifreeze**	-500 ... HI13	-100	°C
Hi	**HI15**	**17370**	**49559.6**	WORD		-1	RW	**Internal exchanger heater regulator hysteresis for antifreeze**	1 ... 255	5	°C
Hi	**HI20**	**50146**	**49560**	BYTE			RW	• **Select heater mode for internal exchanger in integration mode** • 0=Integration heaters disabled • 1=Integration heaters with differential setpoint proportional to external temperature • 2=Integration heaters with differential setpoint in steps to external temperature • 3=Integration heaters with differential setpoint fixed	0 ... 3	3	num.
Hi	**HI21**	**17380**	**49560.2**	WORD	Y	-1	RW	**Internal exchanger heater dynamic differential setpoint in integrated use**	-500 ... 999	100	°C
Hi	**HI22**	**17382**	**49560.4**	WORD		-1	RW	**Maximum dynamic differential internal exchanger heaters in integrated use**	0 ... 999	60	°C
Hi	**HI23**	**17384**	**49560.6**	WORD		-1	RW	**Heater differential in integration mode with heat pump lock**	0 ... 999	0	°C
Hi	**HI24**	**17386**	**49561**	WORD		-1	RW	**Internal exchanger heater dynamic differential proportional band in integrated use**	0 ... 999	50	°C
Hi	**HI25**	**17388**	**49561.2**	WORD		-1	RW	**Internal exchanger heater regulator hysteresis in integrated use**	1 ... 255	10	°C
Hi	**HI26**	**17390**	**49561.4**	WORD		-1	RW	**Differential setpoint internal exchanger heater 2 on in integrated use**	0 ... 999	200	°C
HE	**HE00**	**50166**	**49561.6**	BYTE			RW	• **Enable external exchanger antifreeze heaters in standby** • 0 = Heaters disabled • 1 = Heaters enabled	0 ... 1	0	num.
HE	**HE10**	**50168**	**49562**	BYTE			RW	• **Select probe for antifreeze external exchanger + heater 1** • 0=No probe (antifreeze heater disabled) • 1=Circuit 1 and 2 external exchanger average temperature • 2=Recovery (or external) exchanger inlet water temperature • 3=Recovery (or external) exchanger outlet water temperature • 4=External temperature	0 ... 4	0	num.
HE	**HE11**	**50169**	**49562.2**	BYTE			RW	**Select probe for antifreeze external exchanger + heater 2** See HE10	0 ... 4	0	num.
HE	**HE12**	**17402**	**49562.4**	WORD	Y	-1	RW	**External exchanger heater switch on setpoint for antifreeze**	HE14 ... HE13	40	°C
HE	**HE13**	**17404**	**49562.6**	WORD	Y	-1	RW	**Maximum external exchanger heater regulator setpoint for antifreeze**	HE14... 999	70	°C
HE	**HE14**	**17406**	**49563**	WORD	Y	-1	RW	**Minimum external exchanger heater regulator setpoint for antifreeze**	-500 ... HE13	-100	°C
HE	**HE15**	**17408**	**49563.2**	WORD		-1	RW	**External exchanger heater regulator hysteresis for antifreeze**	1 ... 255	10	°C
HA	**HA00**	**50186**	**49563.4**	BYTE			RW	• **Select probe for auxiliary output regulator** • 0=No probe (auxiliary output disabled) • 1=External temperature • 2=External exchanger temperature circuit 1 • 3=External exchanger temperature circuit 2 • 4=Recovery (or external) exchanger inlet water temperature • 5=Recovery (or external) exchanger outlet water temperature • 6=NOT USED	0 ... 6	0	num.
HA	**HA01**	**17420**	**49563.6**	WORD	Y	-1	RW	**Auxiliary output regulator setpoint**	-500 ... 999	20	°C
HA	**HA02**	**17422**	**49564**	WORD	Y	-1	RW	**Auxiliary output regulator hysteresis**	-500 ... 999	10	°C
br	**BR00**	**50200**	**49564.2**	BYTE			RW	• **Select boiler (water heater) mode** • 0=Water heater disabled • 1=Water heater with differential setpoint proportional to external temperature • 2=Water heater with differential setpoint in steps as a function of external	0 ... 3	0	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
								temperature • 3=Water heater with differential setpoint fixed			
br	**BR01**	**17434**	**49564.4**	WORD	Y	-1	RW	**Boiler dynamic differential setpoint**	-500 ... 999	100	°C
br	**BR02**	**17436**	**49564.6**	WORD		-1	RW	**Maximum boiler dynamic differential**	0 ... 999	255	°C
br	**BR03**	**17438**	**49565**	WORD		-1	RW	**Boiler dynamic differential with heat pump lock** In case of heat pump block, the Water heater differential assumes the fixed value of this parameter	0 ... 999	0	°C
br	**BR04**	**17440**	**49565.2**	WORD		-1	RW	**Boiler proportional band dynamic differential**	0 ... 999	50	°C
br	**BR05**	**17442**	**49565.4**	WORD		-1	RW	**Boiler regulator hysteresis**	1 ... 255	20	°C
dF	**dF00**	**50262**	**49570.2**	BYTE			RW	• **Select defrost mode** • 0= Defrost disabled • 1 = Simultaneous defrost (only for dual-circuit systems) • 2 = Independent defrost (for single-circuit systems and dual-circuit systems with separate condensation)	0 ... 2	2	num.
dF	**dF01**	**50263**	**49570.4**	BYTE			RW	**Enable maximum power for non-defrost circuit** 0= force maximum power NOT enabled 1= force maximum power enabled	0 ... 1	0	num.
dF	**dF10**	**50266**	**49570.6**	BYTE			RW	• **Select probe to enable interval count between defrost cycles** • 0 = External exchanger temperature • 1 = High pressure input • 2 = Low pressure input • 3= Internal exchanger pressure • 4 = External exchanger pressure	0 ... 4	4	Num.
dF	**dF11**	**17500**	**49571**	WORD	Y	-1	RW	**Setpoint for enable interval count between defrost cycles**	-500 ... 999	27	°C/Bar
dF	**dF12**	**17502**	**49571.2**	WORD	Y	-1	RW	**Setpoint to clear cumulative time between defrost cycles**	-500 ... 999	130	°C/Bar
dF	**dF13**	**17504**	**49571.4**	WORD			RW	**Cumulative time between defrost cycles**	1 ... 255	20	Min
dF	**dF14**	**17506**	**49571.6**	WORD			RW	**Minimum interval between defrost cycles**	1 ... 255	60	Min
dF	**dF20**	**50280**	**49572**	BYTE			RW	• **Select probe to disable defrost** • 0 = External exchanger temperature • 1 = High pressure input • 2 = Low pressure input • 3= Internal exchanger pressure • 4 = External exchanger pressure	0 ... 4	1	Num.
dF	**dF21**	**17514**	**49572.2**	WORD	Y	-1	RW	Disable defrost setpoint	-500 ... 999	130	°C/Bar
dF	**dF22**	**17516**	**49572.4**	WORD			RW	Maximum defrost time	1 ... 255	5	Minutes
dF	**dF23**	**17518**	**49572.6**	WORD			RW	Drip time	0 ... 255	40	sec
dF	**dF30**	**17524**	**49573**	WORD	Y	-1	RW	Maximum dynamic defrost differential	-500 ... 999	0	°C/Bar
dF	**dF31**	**17526**	**49573.2**	WORD	Y	-1	RW	Dynamic defrost differential setpoint	-500 ... 999	100	°C
dF	**dF32**	**17528**	**49573.4**	WORD	Y	-1	RW	Defrost proportional band dynamic differential	-500 ... 999	-50	°C
Ad	**Ad00**	**50308**	**49575.4**	BYTE			RW	• **Select no accumulation mode** • 0 = Accumulation disabled • 1 = Setpoint • 2 = Hysteresis • 3 = Setpoint and hysteresis	0 ... 3	0	Num.
Ad	**Ad01**	**17542**	**49575.6**	WORD		-1	RW	**Constant accumulation compensation**	0 ... 255	20	Num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
Ad	**Ad02**	**17544**	**49576**	WORD		-1	RW	**Accumulator compensation differential**	0 ... 255	5	°C
Ad	**Ad03**	**17546**	**49576.2**	WORD	Y	-1	RW	**Accumulation compensation block setpoint in Cool**	-500 ... 999	40	°C
Ad	**Ad04**	**17548**	**49576.4**	WORD	Y	-1	RW	**Accumulation compensation block setpoint in Heat**	-500 ... 999	500	°C
Ad	**Ad05**	**17550**	**49576.6**	WORD			RW	**Time compressor on for accumulation compensation regression**	0 ... 255	24	sec x 10
Ad	**Ad06**	**17552**	**49577**	WORD			RW	**Compressor on reference time for accumulation compensation**	0 ... 255	18	sec x 10
AF	**AF00**	**50332**	**49577.2**	BYTE			RW	Select antifreeze probe with circuit 1 heat pump	0 ... 5	0	num.
AF	**AF01**	**50333**	**49577.4**	BYTE			RW	Select antifreeze probe with circuit 2 heat pump	0 ... 5	0	num.
AF	**AF02**	**17566**	**49577.6**	WORD	Y	-1	RW	Setpoint for anti-freeze regulator with heat pump	-500 ... 999	50	°C
AF	**AF03**	**17568**	**49578**	WORD		-1	RW	Anti-freeze regulator hysteresis with heat pump	1 ... 125	30	°C
AS	**AS00**	**50344**	**49578.2**	BYTE			RW	Select ACS mode	0 ... 6	0	num.
AS	**AS01**	**17578**	**49578.4**	WORD	Y	-1	RW	ACS setpoint	AS2 ... AS03	500	°C
AS	**AS02**	**17580**	**49578.6**	WORD	Y	-1	RW	ACS minimum setpoint	-500 ... AS03	400	°C
AS	**AS03**	**17582**	**49579**	WORD	Y	-1	RW	ACS maximum setpoint	AS02 ... 999	600	°C
AS	**AS04**	**17584**	**49579.2**	WORD		-1	RW	ACS hysteresis	1 ... 255	30	°C
AS	**AS05**	**17586**	**49579.4**	WORD	Y	-1	RW	ACS disengage setpoint differential	-500 ... 999	30	°C
AS	**AS06**	**17588**	**49579.6**	WORD		-1	RW	ACS heater hysteresis	1 ... 255	20	°C
AS	**AS07**	**17590**	**49580**	WORD		-1	RW	ACS heater differential	0 ... 999	0	°C
AS	**AS08**	**17592**	**49580.2**	WORD	Y	-1	RW	ACS antifreeze setpoint	-500 ... AS03	30	°C
AS	**AS09**	**17594**	**49580.4**	WORD			RW	ACS maximum activation time	1 ... 999	60	min
AS	**AS10**	**17596**	**49580.6**	WORD			RW	ACS minimum deactivation/activation time	1 ... 999	60	min
AS	**AS11**	**17598**	**49581**	WORD		-1	RW	Sanitary water setpoint dynamic constant	0 ... 255	0	°C
AS	**AS12**	**17600**	**49581.2**	WORD	Y	-1	RW	Sanitary water system maximum temperature setpoint	-500 ... 999	650	°C
AS	**AS20**	**17602**	**49581.4**	WORD	Y	-1	RW	ACS setpoint for anti-legionnaire's disease	AS21... AS22	650	°C
AS	**AS21**	**17604**	**49581.6**	WORD	Y	-1	RW	Minimum ACS setpoint for anti-legionnaire's disease	-500 ... AS22	600	°C
AS	**AS22**	**17606**	**49582**	WORD	Y	-1	RW	Maximum ACS setpoint for anti-legionnaire's disease	AS21... 999	700	°C
AS	**AS23**	**17608**	**49582.2**	WORD			RW	ACS minimum deactivation/activation time for anti-legionnaire's disease	1 ... 999	15	min
AS	**AS25**	**50382**	**49582.4**	BYTE			RW	Anti-legionnaire's disease period duration, day 1	0 ... 24	0	Hours
AS	**AS26**	**50383**	**49582.6**	BYTE			RW	Event hour, day 1	0 ... 23	0	Hours
AS	**AS27**	**50384**	**49583**	BYTE			RW	Event minutes, day 1	0 ... 59	0	Minutes
AS	**AS28**	**50385**	**49583.2**	BYTE			RW	Anti-legionnaire's disease period duration, day 2	0 ... 24	0	Hours
AS	**AS29**	**50386**	**49583.4**	BYTE			RW	Event hour, day 2	0 ... 23	0	Hours
AS	**AS30**	**50387**	**49583.6**	BYTE			RW	Event minutes, day 2	0 ... 59	0	Minutes
AS	**AS31**	**50388**	**49584**	BYTE			RW	Anti-legionnaire's disease period duration, day 3	0 ... 24	0	Hours
AS	**AS32**	**50389**	**49584.2**	BYTE			RW	Event hour, day 3	0 ... 23	0	Hours
AS	**AS33**	**50390**	**49584.4**	BYTE			RW	Event minutes, day 3	0 ... 59	0	Minutes
AS	**AS34**	**50391**	**49584.6**	BYTE			RW	Anti-legionnaire's disease period duration, day 4	0 ... 24	0	Hours
AS	**AS35**	**50392**	**49585**	BYTE			RW	Event hour, day 4	0 ... 23	0	Hours

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
AS	**AS36**	**50393**	**49585.2**	BYTE			RW	Event minutes, day 4	0 ... 59	0	Minutes
AS	**AS37**	**50394**	**49585.4**	BYTE			RW	Anti-legionnaire's disease period duration, day 5	0 ... 24	0	Hours
AS	**AS38**	**50395**	**49585.6**	BYTE			RW	Event hour, day 5	0 ... 23	0	Hours
AS	**AS39**	**50396**	**49586**	BYTE			RW	Event minutes, day 5	0 ... 59	0	Minutes
AS	**AS40**	**50397**	**49586.2**	BYTE			RW	Anti-legionnaire's disease period duration, day 6	0 ... 24	0	Hours
AS	**AS41**	**50206**	**49586.4**	BYTE			RW	Event hour, day 6	0 ... 23	0	Hours
AS	**AS42**	**50399**	**49586.6**	BYTE			RW	Event minutes, day 6	0 ... 59	0	Minutes
AS	**AS43**	**50400**	**49587**	BYTE			RW	Anti-legionnaire's disease period duration, day 7	0 ... 24	0	Hours
AS	**AS44**	**50401**	**49587.2**	BYTE			RW	Event hour, day 7	0 ... 23	0	Hours
AS	**AS45**	**50402**	**49587.4**	BYTE			RW	Event minutes, day 7	0 ... 59	0	Minutes
HP	**HP00**	**50408**	**49587.6**	BYTE			RW	• **Select heat pump lock probe 1** • 0=No probe (pump block disabled) • 1=External temperature - Heating • 2=Internal exchanger water/air inlet temperature - Cooling • 3=Internal exchanger water/air outlet temperature - Cooling • 4=Circuit 1 and 2 internal exchanger water outlet average temperature - Cooling • 5=Recovery (or external) exchanger inlet water temperature - Cooling • 6=Recovery (or external) exchanger inlet water temperature - Cooling • 7=Circuit 1 and 2 external exchanger average temperature - Cooling	0 ... 7	0	num.
HP	**HP01**	**17642**	**49588**	WORD	Y	-1	RW	**Heat pump 1 lock setpoint**	-500 ... 999	0	°C
HP	**HP02**	**17644**	**49588.2**	WORD		-1	RW	**Heat pump 1 lock hysteresis**	1 ... 255	20	°C
HP	**HP03**	**17646**	**49588.4**	WORD	Y	-1	RW	**Heat pump 1 lock maximum dynamic differential**	-500 ... 999	0	°C
HP	**HP04**	**17648**	**49588.6**	WORD	Y	-1	RW	**Heat pump 1 lock dynamic differential setpoint**	-500 ... 999	0	°C
HP	**HP05**	**17650**	**49589**	WORD	Y	-1	RW	**Heat pump 1 lock dynamic differential proportional band**	-500 ... 999	0	°C
HP	**HP10**	**50424**	**49589.2**	BYTE			RW	**Select heat pump lock probe 2**	0 ... 7	0	num.
HP	**HP11**	**17658**	**49589.4**	WORD	Y	-1	RW	**Heat pump 2 lock setpoint**	-500 ... 999	450	°C
HP	**HP12**	**17660**	**49589.6**	WORD		-1	RW	**Heat pump 2 lock hysteresis**	1 ... 255	20	°C
PL	**PL00**	**17676**	**49590**	WORD		-1	RW	**Power limitation on external temperature** **Power limitation proportional band on external temperature**	0 ... 255	0	°C
PL	**PL01**	**17678**	**49590.2**	WORD	Y	-1	RW	**External temperature setpoint for power limitation in Cool**	-500 ... 999	500	°C
PL	**PL02**	**17680**	**49590.4**	WORD	Y	-1	RW	**External temperature setpoint for power limitation in Heat**	-500 ... 999	-50	°C
PL	**PL10**	**17686**	**49590.6**	WORD		-1	RW	**Power limitation on temperature** **Power limitation proportional band on water/air temperature**	0 ... 255	0	°C
PL	**PL11**	**50456**	**49591**	BYTE			RW	• **Power limitation probe selection on water/air temperature** • 0=No probe (Controller disabled) • 1=Internal exchanger water/air inlet temperature • 2=Internal exchanger water/air outlet temperature • 3=Circuit 1 and 2 internal exchanger water outlet average temperature • 4=Recovery (or external) exchanger inlet water temperature • 5=Recovery (or external) exchanger outlet water temperature • 6=Circuit 1 and 2 external exchanger average temperature	0 ... 6	2	Num.
PL	**PL12**	**17690**	**49591.2**	WORD	Y	-1	RW	**High temperature setpoint for power limitation**	-500 ... 999	500	°C

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
PL	**PL13**	**17692**	**49591.4**	WORD	Y	-1	RW	**Low temperature setpoint for power limitation**	-500 … 999	50	°C
PL	**PL20**	**17694**	**49591.6**	WORD		-1	RW	**Power limitation on pressure** **Power limitation proportional band on pressure**	0 … 255	0	Bar
PL	**PL21**	**17696**	**49592**	WORD	Y	-1	RW	**High pressure setpoint for power limitation**	-500 … 999	400	Bar
PL	**PL22**	**17698**	**49592.2**	WORD	Y	-1	RW	**Low pressure setpoint for power limitation**	-500 … 999	30	Bar
tE	**tE00**	**50688**	**49592.4**	BYTE			RW	• **Enable time band operation** • 0= time bands disabled • 1= time bands enabled	0 … 1	0	Num.
tE	**tE01**	**50689**	**49592.6**	BYTE			RW	• **Select profile, day 1** • To select the profile of the first day of the week **MONDAY** • 1= Profile 1 • 2= Profile 2 • 3= Profile 3	1 … 3	1	Num.
tE	**tE02**	**50690**	**49593**	BYTE			RW	**Select profile, day 2** **TUESDAY – See tE01**	1 … 3	1	Num.
tE	**tE03**	**50691**	**49593.2**	BYTE			RW	**Select profile, day 3** **WEDNESDAY – See tE01**	1 … 3	1	Num.
tE	**tE04**	**50692**	**49593.4**	BYTE			RW	**Select profile, day 4** **THURSDAY – See tE01**	1 … 3	1	Num.
tE	**tE05**	**50693**	**49593.6**	BYTE			RW	**Select profile, day 5** **FRIDAY – See tE01**	1 … 3	1	Num.
tE	**tE06**	**50694**	**49594**	BYTE			RW	**Select profile, day 6** **SATURDAY – See tE01**	1 … 3	2	Num.
tE	**tE07**	**50695**	**49594.2**	BYTE			RW	**Select profile, day 7** **SUNDAY – See tE01**	1 … 3	3	Num.
tE	**tE10**	**50700**	**49594.4**	BYTE			RW	**PROFILE 1** **EVENT 1 / PROFILE 1** **Event start time hour 1, profile 1**	0 … 23	7	Hours
tE	**tE11**	**50701**	**49594.6**	BYTE			RW	**Event start time minutes 1, profile 1**	0 … 59	0	Minutes
tE	**tE12**	**50702**	**49595**	BYTE			RW	• **Operating mode from event 1, profile 1** • Determines the operating mode of Energy Flex during the event • 0= ON • 1 = Standby	0 … 1	0	Num.
tE	**tE13**	**17936**	**49595.2**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 1, profile 1** Determines the Cool setpoint to use during the event (with Energy Flex in Cool mode)	tr11 … tr12	120	°C
tE	**tE14**	**17938**	**49595.4**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 1, profile 1** Determines the Heat setpoint to use during the event (with Energy Flex in Heat mode)	tr21 …tr22	400	°C
tE	**tE15**	**17940**	**49595.6**	WORD	Y	-1	RW	**DHW setpoint from event 1, profile 1** Determines the sanitary water setpoint to use during the event	AS02 … AS03	450	°C
tE	**tE17**	**50712**	**49596**	BYTE			RW	**EVENT 2 / PROFILE 1 (see tE10…tE14)** **Event start time hour 2, profile 1**	0 … 23	12	Hours
tE	**tE18**	**50713**	**49596.2**	BYTE			RW	**Event start time minutes 2, profile 1**	0 … 59	0	Minutes
tE	**tE19**	**50714**	**49596.4**	BYTE			RW	**Operating mode from event 2, profile 1**	0 … 1	0	Num.
tE	**tE20**	**17948**	**49596.6**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 2, profile 1**	tr11 … tr12	120	°C
tE	**tE21**	**17950**	**49597**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 2, profile 1**	tr21 …tr22	400	°C
tE	**tE22**	**17952**	**49597.2**	WORD	Y	-1	RW	**DHW setpoint from event 2, profile 1**	AS02 … AS03	450	°C

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
tE	**tE24**	**50724**	**49597.4**	BYTE			RW	**EVENT 3 / PROFILE 1 (see tE10...tE14) Event start time hour 3, profile 1**	0 ... 23	15	Hours
tE	**tE25**	**50725**	**49597.6**	BYTE			RW	**Event start time minutes 3, profile 1**	0 ... 59	0	Minutes
tE	**tE26**	**50726**	**49598**	BYTE			RW	**Operating mode from event 3, profile 1**	0 ... 1	0	Num.
tE	**tE27**	**17960**	**49598.2**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 3, profile 1**	tr11 ... tr12	120	°C
tE	**tE28**	**17962**	**49598.4**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 3, profile 1**	tr21 ...tr22	400	°C
tE	**tE29**	**17964**	**49598.6**	WORD	Y	-1	RW	**Sanitary water setpoint from event 3, profile 1**	AS02 ... AS03	450	°C
tE	**tE31**	**50736**	**49599**	BYTE			RW	**EVENT 4 / PROFILE 1 (see tE10...tE14) Event start time hour 4, profile 1**	0 ... 23	22	Hours
tE	**tE32**	**50737**	**49599.2**	BYTE			RW	**Event start time minutes 4, profile 1**	0 ... 59	0	Minutes
tE	**tE33**	**50738**	**49599.4**	BYTE			RW	**Operating mode from event 4, profile 1**	0 ... 1	0	Num.
tE	**tE34**	**17972**	**49599.6**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 4, profile 1**	tr11 ... tr12	120	°C
tE	**tE35**	**17974**	**49600**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 4, profile 1**	tr21 ...tr22	400	°C
tE	**tE36**	**17976**	**49600.2**	WORD	Y	-1	RW	**Sanitary water setpoint from event 4, profile 1**	AS02 ... AS03	450	°C
tE	**tE38**	**50748**	**49600.4**	BYTE			RW	**PROFILE 2 EVENT 1 / PROFILE 2 (see tE10...tE14) Event start time hour 1, profile 2**	0 ... 23	7	Hours
tE	**tE39**	**50749**	**49600.6**	BYTE			RW	**Event start time minutes 1, profile 2**	0 ... 59	0	Minutes
tE	**tE40**	**50750**	**49601**	BYTE			RW	**Operating mode from event 1, profile 2**	0 ... 1	0	Num.
tE	**tE41**	**17984**	**49601.2**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 1, profile 2**	tr11 ... tr12	120	°C
tE	**tE42**	**17986**	**49601.4**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 1, profile 2**	tr21 ...tr22	400	°C
tE	**tE43**	**17988**	**49601.6**	WORD	Y	-1	RW	**Sanitary setpoint from event 1, profile 2**	AS02 ... AS03	450	°C
tE	**tE45**	**50760**	**49602**	BYTE			RW	**EVENT 2 / PROFILE 2 (see tE10...tE14) Event start time hour 2, profile 2**	0 ... 23	12	Hours
tE	**tE46**	**50761**	**49602.2**	BYTE			RW	**Event start time minutes 2, profile 2**	0 ... 59	0	Minutes
tE	**tE47**	**50762**	**49602.4**	BYTE			RW	**Operating mode from event 2, profile 2**	0 ... 1	0	Num.
tE	**tE48**	**17996**	**49602.6**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 2, profile 2**	tr11 ... tr12	120	°C
tE	**tE49**	**17998**	**49603**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 2, profile 2**	tr21 ...tr22	400	°C
tE	**tE50**	**18000**	**49603.2**	WORD	Y	-1	RW	**Sanitary water setpoint from event 2, profile 2**	AS02 ... AS03	450	°C
tE	**tE52**	**50772**	**49603.4**	BYTE			RW	**EVENT 3 / PROFILE 2 (see tE10...tE14) Event start time hour 3, profile 2**	0 ... 23	15	Hours
tE	**tE53**	**50773**	**49603.6**	BYTE			RW	**Event start time minutes 3, profile 2**	0 ... 59	0	Minutes
tE	**tE54**	**50774**	**49604**	BYTE			RW	**Operating mode from event 3, profile 2**	0 ... 1	0	Num.
tE	**tE55**	**18008**	**49604.2**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 3, profile 2**	tr11 ... tr12	120	°C
tE	**tE56**	**18010**	**49604.4**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 3, profile 2**	tr21 ...tr22	400	°C
tE	**tE57**	**18012**	**49604.6**	WORD	Y	-1	RW	**Sanitary water setpoint from event 3, profile 2**	AS02 ... AS03	450	°C
tE	**tE59**	**50784**	**49605**	BYTE			RW	**EVENT 4 / PROFILE 2 (see tE10...tE14) Event start time hour 4, profile 2**	0 ... 23	22	Hours
tE	**tE60**	**50785**	**49605.2**	BYTE			RW	**Event start time minutes 4, profile 2**	0 ... 59	0	Minutes
tE	**tE61**	**50786**	**49605.4**	BYTE			RW	**Operating mode from event 4, profile 2**	0 ... 1	0	Num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
tE	**tE62**	**18020**	**49605.6**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 4, profile 2**	tr11 ... tr12	120	°C
tE	**tE63**	**18022**	**49606**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 4, profile 2**	tr21 ...tr22	400	°C
tE	**tE64**	**18024**	**49606.2**	WORD	Y	-1	RW	**Sanitary water setpoint from event 4, profile 2**	AS02 ... AS03	450	°C
tE	**tE66**	**50796**	**49606.4**	BYTE			RW	**PROFILE 3** **EVENT 1 / PROFILE 3 (see tE10...tE14)** **Event start time hour 3, profile 3**	0 ... 23	7	Hours
tE	**tE67**	**50797**	**49606.6**	BYTE			RW	**Event start time minutes 1, profile 3**	0 ... 59	0	Minutes
tE	**tE68**	**50798**	**49607**	BYTE			RW	**Operating mode from event 1, profile 3**	0 ... 1	0	Num.
tE	**tE69**	**18032**	**49607.2**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 1, profile 3**	tr11 ... tr12	120	°C
tE	**tE70**	**18034**	**49607.4**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 1, profile 3**	tr21 ...tr22	400	°C
tE	**tE71**	**18036**	**49607.6**	WORD	Y	-1	RW	**Sanitary water setpoint from event 1, profile 3**	AS02 ... AS03	450	°C
tE	**tE73**	**50808**	**49608**	BYTE			RW	**EVENT 2 / PROFILE 3 (see tE10...tE14)** **Event start time hour 2, profile 3**	0 ... 23	12	Hours
tE	**tE74**	**50809**	**49608.2**	BYTE			RW	**Event start time minutes 2, profile 3**	0 ... 59	0	Minutes
tE	**tE75**	**50810**	**49608.4**	BYTE			RW	**Operating mode from event 2, profile 3**	0 ... 1	0	Num.
tE	**tE76**	**18044**	**49608.6**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 2, profile 3**	tr11 ... tr12	120	°C
tE	**tE77**	**18046**	**49609**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 2, profile 3**	tr21 ...tr22	400	°C
tE	**tE78**	**18048**	**49609.2**	WORD	Y	-1	RW	**Sanitary water setpoint from event 2, profile 3**	AS02 ... AS03	450	°C
tE	**tE80**	**50820**	**49609.4**	BYTE			RW	**EVENT 3 / PROFILE 3 (see tE10...tE14)** **Event start time hour 3, profile 3**	0 ... 23	15	Hours
tE	**tE81**	**50821**	**49609.6**	BYTE			RW	**Event start time minutes 3, profile 3**	0 ... 59	0	Minutes
tE	**tE82**	**50822**	**49610**	BYTE			RW	**Operating mode from event 3, profile 3**	0 ... 1	0	Num.
tE	**tE83**	**18056**	**49610.2**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 3, profile 3**	tr11 ... tr12	120	°C
tE	**tE84**	**18058**	**49610.4**	WORD	Y	-1	RW	**Heat mode temperature regulator setpoint, from event 3, profile 3**	tr21 ...tr22	400	°C
tE	**tE85**	**18060**	**49610.6**	WORD	Y	-1	RW	**Sanitary water setpoint from event 3, profile 3**	AS02 ... AS03	450	°C
tE	**tE87**	**50832**	**49611**	BYTE			RW	**EVENT 4 / PROFILE 3 (see tE10...tE14)** **Event start time hour 4, profile 3**	0 ... 23	22	Hours
tE	**tE88**	**50833**	**49611.2**	BYTE			RW	**Event start time minutes 4, profile 3**	0 ... 59	0	Minutes
tE	**tE89**	**50834**	**49611.4**	BYTE			RW	**Operating mode from event 4, profile 3**	0 ... 1	0	Num.
tE	**tE90**	**18068**	**49611.6**	WORD	Y	-1	RW	**Cool mode temperature regulator setpoint, from event 4, profile 3**	tr11 ... tr12	120	°C
tE	**tE91**	**18070**	**49612**	WORD	Y	-1	RW	**Heat mode temperature regulator, from event 4, profile 3**	tr21 ...tr22	400	°C
tE	**tE92**	**18072**	**49612.2**	WORD	Y	-1	RW	**Sanitary water setpoint from event 4, profile 3**	AS02 ... AS03	450	°C
AL	**AL00**	**50572**	**49612.4**	BYTE			RW	**Time interval for alarm event count** To modify the interval in which alarm events are counted Alarms are sampled every AL00/32 = sampling time	1 ... 99	60	Min
AL	**AL01**	**50573**	**49612.6**	BYTE			RW	**Maximum number of events in alarm log for alarm signal**	0 ... 99	0	num.
AL	**AL10**	**50580**	**49613**	BYTE			RW	**DIGITAL ALARMS** **Number of high pressure alarm events**	1 ... 255	1	num.
AL	**AL11**	**50581**	**49613.2**	BYTE			RW	**Low pressure alarm bypass time**	0 ... 255	120	sec
AL	**AL12**	**50582**	**49613.4**	BYTE			RW	**Number of low pressure alarms**	1 ... 255	3	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
AL	**AL13**	**50583**	**49613.6**	BYTE			RW	**Enable low pressure alarm during defrost** 0 = Alarm disabled 1 = Alarm enabled	0 ... 1	0	num.
AL	**AL14**	**50584**	**49614**	BYTE			RW	**Bypass flow switch time from activation of the internal circuit water pump**	0 ... 255	40	sec
AL	**AL15**	**50585**	**49614.2**	BYTE			RW	**Flow switch activation/deactivation time on internal circuit automatic alarm**	0 ... 255	5	sec
AL	**AL16**	**50586**	**49614.4**	BYTE			RW	**Flow switch activation time for internal circuit manual alarm**	0 ... 255	2	Sec x 10
AL	**AL17**	**50587**	**49614.6**	BYTE			RW	**Bypass flow switch time from activation of the external circuit water pump**	0 ... 255	15	sec
AL	**AL18**	**50588**	**49615**	BYTE			RW	**Flow switch activation/deactivation time on external circuit automatic alarm**	0 ... 255	5	sec
AL	**AL19**	**50589**	**49615.2**	BYTE			RW	**Flow switch activation time for external circuit manual alarm**	0 ... 255	2	sec x 10
AL	**AL20**	**50590**	**49615.4**	BYTE			RW	**Compressor thermoswitch alarm bypass time**	0 ... 255	1	sec
AL	**AL21**	**50591**	**49615.6**	BYTE			RW	**Number of compressor thermoswitch alarms**	1 ... 255	1	num.
AL	**AL22**	**50592**	**49616**	BYTE			RW	**Compressor oil pressure switch alarm bypass time**	0 ... 255	1	sec
AL	**AL23**	**50593**	**49616.2**	BYTE			RW	**Number of compressor oil pressure switch alarms**	1 ... 255	1	num.
AL	**AL24**	**50594**	**49616.4**	BYTE			RW	**Number of internal exchanger fan thermal switch alarms**	1 ... 255	1	num.
AL	**AL25**	**50595**	**49616.6**	BYTE			RW	**Number of external exchanger fan thermal switch alarms**	1 ... 255	1	num.
AL	**AL26**	**50596**	**49617**	BYTE			RW	**Number of internal circuit pump thermal switch alarms**	1 ... 255	2	num.
AL	**AL27**	**50597**	**49617.2**	BYTE			RW	**Number of external circuit pump thermal switch alarms**	1 ... 255	2	num.
AL	**AL40**	**17840**	**49617.4**	WORD	Y	-1	RW	**ANALOGUE ALARMS** **High pressure alarm regulator setpoint from analogue input**	-500 ... 999	420	Bar
AL	**AL41**	**17842**	**49617.6**	WORD		-1	RW	**High pressure alarm regulator hysteresis from analogue input**	1 ... 255	20	Bar
AL	**AL42**	**50612**	**49618**	BYTE			RW	**Number of high pressure alarms from analogue input**	1 ... 255	1	num.
AL	**AL43**	**50613**	**49618.2**	BYTE			RW	**Low pressure alarm bypass time from analogue input**	0 ... 255	10	sec
AL	**AL44**	**17846**	**49618.4**	WORD	Y	-1	RW	**Low pressure alarm regulator setpoint from analogue input**	-500 ... 999	20	Bar
AL	**AL45**	**17848**	**49618.6**	WORD		-1	RW	**Low pressure alarm regulator hysteresis from analogue input**	1 ... 255	20	Bar
AL	**AL46**	**50618**	**49619**	BYTE			RW	**Number of low pressure alarms from analogue input**	1 ... 255	2	num.
AL	**AL47**	**17852**	**49619.2**	WORD	Y	-1	RW	**High temperature alarm regulator setpoint from analogue input**	-500 ... 999	800	°C
AL	**AL48**	**17854**	**49619.4**	WORD		-1	RW	**High temperature alarm regulator hysteresis from analogue input**	1 ... 255	20	°C
AL	**AL49**	**50624**	**49619.6**	BYTE			RW	**Time high temperature before alarm**	0 ... 255	30	sec x 10
AL	**AL50**	**50625**	**49620**	BYTE			RW	**Internal circuit antifreeze alarm bypass time**	0 ... 255	1	min
AL	**AL51**	**17858**	**49620.2**	WORD	Y	-1	RW	**Internal circuit antifreeze alarm regulator setpoint**	-500 ... 999	40	°C
AL	**AL52**	**17860**	**49620.4**	WORD		-1	RW	**Internal circuit antifreeze alarm regulator hysteresis**	1 ... 255	20	°C
AL	**AL53**	**50630**	**49620.6**	BYTE			RW	**Number of internal circuit antifreeze alarms**	1 ... 255	1	num.
AL	**AL54**	**50631**	**49621**	BYTE			RW	**External circuit antifreeze alarm bypass time**	0 ... 255	1	min
AL	**AL55**	**17864**	**49621.2**	WORD	Y	-1	RW	**External circuit antifreeze alarm regulator setpoint**	-500 ... 999	40	°C
AL	**AL56**	**17866**	**49621.4**	WORD		-1	RW	**External circuit antifreeze alarm regulator hysteresis**	1 ... 255	20	°C
AL	**AL57**	**50636**	**49621.6**	BYTE			RW	**NO REFRIGERANT** **Number of external circuit antifreeze alarms**	1 ... 255	1	num.
AL	**AL70**	**50640**	**49622**	BYTE			RW	**Enable low refrigerant alarm**	0 ... 1	0	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
AL	**AL71**	**50641**	**49622.2**	BYTE			RW	**Low refrigerant alarm bypass time**	0 ... 255	5	min
AL	**AL72**	**17874**	**49622.4**	WORD		-1	RW	**Low refrigerant alarm differential**	0 ... 255	20	°C
AL	**AL73**	**50644**	**49622.6**	BYTE			RW	**Time low refrigerant before alarm**	0 ... 255	30	min
AL	**AL80**	**50652**	**49623**	BYTE			RW	**MAINTENANCE** **Compressor start time for maintenance signal**	0 ... 255	0	hoursx100
AL	**AL81**	**50653**	**49623.2**	BYTE			RW	**Internal pump start time on maintenance signal**	0 ... 255	0	hoursx100
AL	**AL82**	**50462**	**49623.4**	BYTE			RW	**Internal pump start time on maintenance signal**	0 ... 255	0	hoursx100

Parameters AL80/AL81/AL82 see Alarms E081/E085/EO86

27.3 Configuration parameters for XVD driver 1 (1r / 1F / 1L / 1E)

27.3.1 Configuration parameters for XVD driver 2 (2r / 2F / 2L / 2E)

Parameters with prefix 1 are relative to driver XVD1 while those with prefix 2 concern XVD2.
Exclusively parameters with prefix 1 are described below; parameters with prefix 2 are identical.
The table shows both parameters.
The resources of the 2 XVD drivers can be configured for use by the base in the same way as an expansion.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
1R	**1R00**	**50992**	**49481**	BYTE			RW	**Driver EEV1 enabling** 0 = driver disabled; 1 = driver enabled	0 ... 1	1	flag
1R	**1R30**	**50997**	**49481.2**	BYTE			RW	**1Ai1 analogue input configuration** See Table A Analogue Inputs Configuration Note. Values 0...30	0 ... 30	0	num.
1R	**1R31**	**50998**	**49481.4**	BYTE			RW	**1Ai2 analogue input configuration** See Table A Analogue Inputs Configuration Note. Values 0...16	0 ... 16	0	num.
1R	**1R32**	**50999**	**49481.6**	BYTE			RW	**1Ai3 analogue input configuration** See 1R31	0 ... 16	0	num.
1R	**1R33**	**51000**	**49482**	BYTE			RW	**1Ai4 analogue input configuration** See 1R31	0 ... 16	0	num.
1R	**1R40**	**50993**	**49482.2**	BYTE	Y		RW	**1Ai3 digital input configuration** Configures analogue input Ai3 if configured as a digital input See Table B Digital Inputs Configuration	-58 ... 58	0	num.
1R	**1R41**	**50994**	**49482.4**	BYTE	Y		RW	**1Ai4 digital input configuration** Configures analogue input Ai4 if configured as a digital input See 1R40	-58 ... 58	0	num.
1R	**1R91**	**51004**	**49483**	BYTE	Y		RW	**1dO digital output configuration** See Table C Digital Outputs Configuration	-53 ... 53	0	num.
1F	**1F02**	**51025**	**49483.2**	BYTE			RW	**Control from digital inputs or serial port** • 0 = DI (digital input) • 1 = LAN • 2 = LAN + shared probe • 3 = DI (digital input) + shared probe	0 ... 3	1	num.
1F	**1F10**	**51024**	**49483.4**	BYTE			RW	**Lincus protocol controller address COM0** • 2= XVD 1 (MASTER XVD) • 3= XVD 2 (SLAVE XVD)	2 ... 3	2	num.
1L	**1L00**	**51074**	**49483.6**	BYTE			RW	**Analogue input type 1Ai1** • 0 = Probe not configured • 1 = NTC. • 2 = Pt1000 • 3 = 4..20 mA • 4 = 0-5 V ratiometric transducer • 5 = 0-10 V • 6 = extended range NTC	0 ... 6	3	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
1L	**1L01**	**51075**	**49484**	BYTE			RW	**Analogue input type 1Ai2** • 0 = Probe not configured • 1 = NTC. • 2 = Pt1000 • 3 = NOT USED • 4 = NOT USED • 5 = NOT USED • 6 = extended range NTC	0 ... 6	1	num.
1L	**1L02**	**51076**	**49484.2**	BYTE			RW	**Analogue input type 1Ai3** • 0 = Probe not configured • 1 = NTC. • 2 = NOT USED • 3 = NOT USED • 4 = NOT USED • 5 = NOT USED • 6 = extended range NTC • 7 = DI (digital input)	0 ... 7	1	num.
1L	**1L03**	**51077**	**49484.4**	BYTE			RW	**Analogue input type 1Ai4** See 1L02	0 ... 7	1	num.
1L	**1L10**	**18310**	**49485.2**	WORD	Y	-1	RW	**Analogue input 1Ai1 full scale value. See Note***	1L11 ... 9999	70	bar
1L	**1L11**	**18314**	**49485.4**	WORD	Y	-1	RW	**Analogue input 1Ai1 start scale value**	-145 ...1L10	-5	bar
1L	**1L20**	**51086**	**49486.2**	BYTE	Y	-1	RW	**Analogue input 1Ai1 differential** the differential is calculated on the pressure or temperature value depending on the selected probe type	-120 ... 120	0	bar/°C
1L	**1L21**	**51087**	**49486.4**	BYTE	Y	-1	RW	**Analogue input 1Ai2 differential** the differential is calculated on the temperature value depending on the selected probe type	-120 ... 120	0	°C
1L	**1L22**	**51088**	**49486.6**	BYTE	Y	-1	RW	**Analogue input 1Ai3 differential** See 1L21	-120 ... 120	0	°C
1L	**1L23**	**51089**	**49487**	BYTE	Y	-1	RW	**Analogue input 1Ai4 differential** See 1L21	-120 ... 120	0	°C
1L	**1L30**	**51094**	**49487.2**	BYTE			RW	**1Ai1 analogue input configuration** • 0=not used • 1= evaporator out, • 2=saturation, • 3=backup evaporator out • 4=backup saturation (Note: temperature only) • 5 = valve opening direct control	0 ... 5	2	num.
1L	**1L31**	**51095**	**49487.4**	BYTE			RW	**1Ai2 analogue input configuration** • 0 = not used • 1 = evaporator out, • 2=saturation, • 3=backup evaporator out • 4=backup saturation (Note: temperature only)	0 ... 4	1	num.
1L	**1L32**	**51096**	**49487.6**	BYTE			RW	**1Ai3 analogue input configuration**	0 ... 4	0	num.

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
								See 1L30			
1L	**1L33**	**51097**	**49488**	BYTE			RW	**1Ai4 analogue input configuration** See 1L30	0 … 4	0	num.
1L	**1L40**	**51092**	**49488.2**	BYTE	Y		RW	**1Ai3 digital input configuration** • 0= Digital input not configured • ±1= ON/OFF driver (regulation) • ±2= defrost • ±3= alarm • ±4= installation operating mode COOL / HEAT (see parameters **1E21…1E22**) • ±5= NOT USED • ±6= NOT USED • ±7= NOT USED	-7 … 7	0	num.
1L	**1L41**	**51093**	**49488.4**	BYTE	Y		RW	**1Ai4 digital input configuration** See 1L40	-7 … 7	5	num.
1L	**1L91**	**51099**	**49489**	BYTE	Y		RW	**1dO digital output configuration** • 0 = not configured • ±1= solenoid valve control • ±2= alarm	-2 … 2	0	num.
1E	**1E00**	**51026**	**49489.2**	BYTE			RW	**Valve model** **(see parameters dE01…dE09, dE80, see XVD parameters table in the Appendix)** **0= customisable** 1…12= NOT USED **13= ALCO EXM/EXL** **14= SANHUA QA(Q)** 15= NOT USED	0 … 15	14	num.
1E	**1E10**	**51027**	**49489.4**	BYTE			RW	**Maximum valve opening percentage** Defines the maximum valve opening value or the actuation limitation as a percentage. 0 indicates valve fully closed	0 … 100	100	%
1E	**1E11**	**51028**	**49489.6**	BYTE			RW	**Valve actuation percentage after blackout** Value calculated automatically but editable using this parameter for first startup	0 … 100	0	%
1E	**1E12**	**51029**	**49490**	BYTE			RW	**Valve actuation percentage after defrost** Value calculated automatically but editable using this parameter for first startup. Se = 0 the percentage is defined by 1E11	0 … 100	0	%
1E	**1E13**	**51030**	**49490.2**	BYTE			RW	**Operating time at max opening for alarm signal** If valve opening remains at a value greater than 1E10 for the time defined by 1E13 a maximum opening alarm E107 will be tripped (see Alarms section) Se = 0 signalling disabled	0 … 255	60	Min
1E	**1E14**	**51031**	**49490.4**	BYTE			RW	**Minimum valve useful opening percentage** If the regulator commands an output less than or equal to 1E14, the actual output will be = 0.	0 … IE15	0	%
1E	**1E15**	**51032**	**49490.6**	BYTE			RW	**Maximum valve useful opening percentage** If the regulator commands an output greater than or equal to 1E15 the actual output is 1E10 (with 1E15 < 1E10). Disregarded if 1E15 > 1E10	IE14 … IE10	100	%
1E	**1E16**	**51033**	**49491**	BYTE			RW	**Valve opening percentage during probe error** In the case of a probe error defines opening of the valve, as a percentage value	0 … 100	0	%

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
1E	**1E20**	**51034**	**49491.2**	BYTE			RW	**Refrigerant type selection** To use only if the configuration is set to 7. Otherwise 1E20 will be disregarded. 0=R404A; 1=r22; 2=R410a; 3=R134a; 4=R744 (CO2); 5=R407C; 6=R427A; 7= customisable	0 ... 7	2	num
1E	**1E21**	**51035**	**49491.4**	BYTE			RW	**System type operating mode COOL** **In the case of 1E21=0 the user can set parameters 1E30...1E38,1E50...1E53** **See XVD Open parameters set in the Appendix:** **V12_dE30....V12_dE53, ..., V16_dE30....V16_dE53**	0 ... 16	12	num.
1E	**1E22**	**51036**	**49491.6**	BYTE			RW	**System type operating mode HEAT** See 1E21	0 ... 16	13	num.
1E	**1E30**	**51068**	**49492.4**	BYTE			RW	**Enable reference overheating recalculation** Makes it possible to enable automatic recalculation of the reference setpoint for superheating control 0= recalculation disabled. Setpoint = 1E32; 1 = automatic recalculation enabled	0 ... 1	0	flag
1E	**1E31**	**18288**	**49492.6**	WORD		-1	RW	**Overheating upper threshold** Makes it possible to set setpoint **SP4** a to **1E31 (SP2)** for control of superheating after a power loss or on exit from defrost cycle. Active for the time defined by **dE51** (or during disabling of MOP function)	0 ... 1000	50	°C
1E	**1E32**	**18286**	**49493**	WORD		-1	RW	**Overheating lower threshold** Makes it possible to program setpoint **SP2** for control of superheating (target superheating) If dE30=1 and calculated setpoint < **1E32**, the dynamic setpoint will be set = **1E32**.	0 ... 1000	50	°C
1E	**1E33**	**18290**	**49493.2**	WORD			RW	**Overheating reference recalculation period** Valid for 1E30=1 Defines period of recalculation of the dynamic setpoint (every 1E33 seconds)	0 ... 999	20	sec
1E	**1E34**	**18292**	**49493.4**	WORD		-1	RW	**Overheating recalculation step** The dynamic setpoint varies by 1E34 degrees in accordance with the superheating value with respect to 1E32.	0 ... 1000	1	°C
1E	**1E35**	**18272**	**49493.6**	WORD			RW	**Valve opening freezing timer after OFF->ON**	0 ... 1999	0	sec
1E	**1E36**	**18294**	**49494**	WORD	Y	-1	RW	**Overheating proportional band**	-9999 ... -1	-100	K
1E	**1E37**	**18296**	**49494.2**	WORD			RW	**Overheating full time**	0 ... 1999	40	sec
1E	**1E38**	**18298**	**49494.4**	WORD			RW	**Overheating derivative time**	0 ... 1999	0	sec
1E	**1E47**	**51072**	**49494.6**	BYTE			RW	**Enable valve manual opening** 0= valve automatic opening; 1= valve manual opening	0 ... 1	0	flag
1E	**1E48**	**18302**	**49495**	WORD		-1	RW	**Valve manual opening** Note: valid if 1E47=1. Note: changing valve opening from automatic to manual (1E47=1) the opening percentage is not 0% as per default parameter but rather the percentage indicated by this parameter	0 ... 1000	0	%
1E	**1E50**	**51052**	**49495.2**	BYTE			RW	**Enable MOP** 0=MOP disabled; 1=MOP enabled.	0 ... 1	0	flag

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
1E	**1E51**	**18276**	**49495.4**	WORD			RW	**MOP disable duration** Delay time for MOP activation at startup of return from a defrost cycle.	0 ... 999	0	sec
1E	**1E52**	**18274**	**49495.6**	WORD	Y	-1	RW	**Evaporator temperature upper threshold** MOP setpoint	-600 ... 1000	0	°C
1E	**1E53**	**51053**	**49496**	BYTE			RW	**Min time that temperature upper threshold is exceeded for alarm activation** If threshold 1E52 is exceeded for a time longer than 1E53 the MOP alarm is tripped.	0 ... 255	180	sec
	2xx							**For descriptions of parameters 2xx refer to the relative parameters 1xx**			
2R	**2R00**	**51008**	**49497**	BYTE			RW	**Driver EEV2 enabling**	0 ... 1	0	flag
2R	**2R30**	**51013**	**49497.2**	BYTE			RW	**Analogue input 2Ai1 configuration**	0 ... 30	0	num.
2R	**2R31**	**51014**	**49497.4**	BYTE			RW	**Analogue input 2Ai2 configuration**	0 ... 16	0	num.
2R	**2R32**	**51015**	**49497.6**	BYTE			RW	**Analogue input 2Ai3 configuration**	0 ... 16	0	num.
2R	**2R33**	**51016**	**49498**	BYTE			RW	**Analogue input 2Ai4 configuration**	0 ... 16	0	num.
2R	**2R40**	**51009**	**49498.2**	BYTE	Y		RW	**Digital input 2Ai3 configuration**	-58 ... 58	0	num.
2R	**2R41**	**51010**	**49498.4**	BYTE	Y		RW	**Digital input 2Ai4 configuration**	-58 ... 58	0	num.
2R	**2R91**	**51020**	**49499**	BYTE	Y		RW	**Digital output 2dO configuration**	-53 ... 53	0	num.
2F	**2F02**	**51281**	**49499.2**	BYTE			RW	**Control from digital inputs or serial port**	0 ... 3	1	num.
2F	**2F10**	**51280**	**49499.4**	BYTE			RW	**Lincus protocol controller address COM0**	2 ... 3	3	num.
2L	**2L00**	**51330**	**49499.6**	BYTE			RW	**Analogue input type 2Ai1**	0 ... 6	3	num.
2L	**2L01**	**51331**	**49500**	BYTE			RW	**Analogue input type 2Ai2**	0 ... 6	1	num.
2L	**2L02**	**51332**	**49500.2**	BYTE			RW	**Analogue input type 2Ai3**	0 ... 7	1	num.
2L	**2L03**	**51333**	**49500.4**	BYTE			RW	**Analogue input type 2Ai4**	0 ... 7	1	num.
2L	**2L10**	**18566**	**49501.2**	WORD	Y	-1	RW	**Analogue input 2Ai1 full scale value. See Note***	2L11 ... 9999	70	bar
2L	**2L11**	**18570**	**49501.4**	WORD	Y	-1	RW	**Analogue input 2Ai1 start of scale value**	-145 ... 2L10	-5	bar
2L	**2L20**	**51342**	**49502.2**	BYTE	Y	-1	RW	**Analogue input 2Ai1 differential**	-120 ... 120	0	bar/°C
2L	**2L21**	**51343**	**49502.4**	BYTE	Y	-1	RW	**Analogue input 2Ai2 differential**	-120 ... 120	0	°C
2L	**2L22**	**51344**	**49502.6**	BYTE	Y	-1	RW	**Analogue input 2Ai3 differential**	-120 ... 120	0	°C
2L	**2L23**	**51345**	**49503**	BYTE	Y	-1	RW	**Analogue input 2Ai4 differential**	-120 ... 120	0	°C
2L	**2L30**	**51350**	**49503.2**	BYTE			RW	**Analogue input 2Ai1 configuration**	0 ... 5	2	num.
2L	**2L31**	**51351**	**49503.4**	BYTE			RW	**Analogue input 2Ai2 configuration**	0 ... 5	1	num.
2L	**2L32**	**51352**	**49503.6**	BYTE			RW	**Analogue input 2Ai3 configuration**	0 ... 4	0	num.
2L	**2L33**	**51353**	**49504**	BYTE			RW	**Analogue input 2Ai4 configuration**	0 ... 4	0	num.
2L	**2L40**	**51348**	**49504.2**	BYTE	Y		RW	**Digital input 2Ai3 configuration**	-7 ... 7	0	num.
2L	**2L41**	**51349**	**49504.4**	BYTE	Y		RW	**Digital input 2Ai4 configuration**	-7 ... 7	0	num.
2L	**2L91**	**51355**	**49505**	BYTE	Y		RW	**Digital output 2dO configuration**	-2 ... 2	0	num.
2E	**2E00**	**51282**	**49505.2**	BYTE			RW	**Valve model**	0 ... 15	14	num.
2E	**2E10**	**51283**	**49505.4**	BYTE			RW	**Maximum valve opening percentage**	0 ... 100	100	%
2E	**2E11**	**51284**	**49505.6**	BYTE			RW	**Valve actuation percentage after blackout**	0 ... 100	0	%
2E	**2E12**	**51285**	**49506**	BYTE			RW	**Valve actuation percentage after defrost**	0 ... 100	0	%

FOLDER	LABEL	ADDR	VIS ADDR	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
2E	**2E13**	**51286**	**49506.2**	BYTE			RW	**Operating time at max opening for alarm signal**	0 ... 255	60	Min
2E	**2E14**	**51287**	**49506.4**	BYTE			RW	**Minimum valve useful opening percentage**	0 ... 2E15	0	%
2E	**2E15**	**51288**	**49506.6**	BYTE			RW	**Maximum valve useful opening percentage**	2E14 ... 2E10	100	%
2E	**2E16**	**51289**	**49507**	BYTE			RW	**Valve opening percentage during probe error**	0 ... 100	2	%
2E	**2E20**	**51290**	**49507.2**	BYTE			RW	**Select type of gas**	0 ... 7	2	num.
2E	**2E21**	**51291**	**49507.4**	BYTE			RW	**Type of system operating mode COOL**	0 ... 16	1	num.
2E	**2E22**	**51292**	**49507.6**	BYTE			RW	**Type of system operating mode HEAT**	0 ... 16	2	num.
2E	**2E30**	**51324**	**49508.4**	BYTE			RW	**Enable reference overheating recalculation**	0 ... 1	0	flag
2E	**2E31**	**18544**	**49508.6**	WORD		-1	RW	**Overheating upper threshold**	0 ... 1000	50	°C
2E	**2E32**	**18542**	**49509**	WORD		-1	RW	**Overheating lower threshold**	0 ... 1000	50	°C
2E	**2E33**	**18546**	**49509.2**	WORD			RW	**Overheating reference recalculation period**	0 ... 999	20	sec
2E	**2E34**	**18548**	**49509.4**	WORD		-1	RW	**Overheating recalculation step**	0 ... 1000	1	°C
2E	**2E35**	**18528**	**49509.6**	WORD			RW	**Valve opening freezing timer after OFF->ON**	0 ... 1999	0	sec
2E	**2E36**	**18550**	**49510**	WORD	Y	-1	RW	**Overheating proportional band**	-9999 ... -1	-100	K
2E	**2E37**	**18552**	**49510.2**	WORD			RW	**Overheating full time**	0 ... 1999	40	sec
2E	**2E38**	**18554**	**49510.4**	WORD			RW	**Overheating derivative time**	0 ... 1999	0	sec
2E	**2E47**	**51328**	**49510.6**	BYTE			RW	**Enable valve manual opening**	0 ... 1	0	flag
2E	**2E48**	**18558**	**49511**	WORD		-1	RW	**Valve manual opening**	0 ... 1000	0	%
2E	**2E50**	**51308**	**49511.2**	BYTE			RW	**Enable MOP**	0 ... 1	0	flag
2E	**2E51**	**18532**	**49511.4**	WORD			RW	**MOP disable time at start-up**	0 ... 999	0	sec
2E	**2E52**	**18530**	**49511.6**	WORD	Y	-1	RW	**Evaporator temperature upper threshold**	-600 ... 1000	0	°C
2E	**2E53**	**51309**	**49512**	BYTE			RW	**Min time that temp upper threshold is exceeded for alarm activation**	0 ... 255	180	sec

***Note. To set 1L10/2L10 use Device Manager o 32x74 SKP10 terminal to ensure parameters' values correct viewing in their full range**

27.3.2 Folder visibility table

LABEL	ADDRESS	R/W	DESCRIPTION	DATA SIZE	RANGE	DEFAULT	U.M.
_VisSt0	**49424**	RW	Folder Ai visibility	2 bits	0 ... 3	3	num.
_VisSt1	**49424.2**	RW	Visibility folder	2 bits	0 ... 3	3	num.
_VisSt2	**49424.4**	RW	Folder AO visibility	2 bits	0 ... 3	3	num.
_VisSt3	**49424.6**	RW	Folder dO visibility	2 bits	0 ... 3	3	num.
_VisSt4	**49425**	RW	Folder SP visibility	2 bits	0 ... 3	3	num.
_VisSt5	**49425.2**	RW	Folder Sr visibility	2 bits	0 ... 3	3	num.
_VisSt6	**49425.4**	RW	Folder Hr visibility	2 bits	0 ... 3	3	num.
_VisPa0	**49425.6**	RW	Folder Par visibility	2 bits	0 ... 3	3	num.
_VisPa1	**49426**	RW	Folder FnC visibility	2 bits	0 ... 3	3	num.
_VisPa2	**49426.2**	RW	Folder PASS visibility	2 bits	0 ... 3	3	num.
_VisPa3	**49426.4**	RW	Folder EU visibility	2 bits	0 ... 3	3	num.
_VisSSp0	**49426.6**	RW	Folder SP/COOL visibility	2 bits	0 ... 3	3	num.
_VisSSp1	**49427**	RW	Folder SP/HEAT visibility	2 bits	0 ... 3	3	num.
_VisSSp2	**49427.2**	RW	Folder SP/AS visibility	2 bits	0 ... 3	3	num.
_VisSSp3	**49427.4**	RW	Folder SP\AL visibility	2 bits	0 ... 3	3	num.
_VisSSr0	**49427.6**	RW	Folder Sr\COOL visibility	2 bits	0 ... 3	3	num.
_VisSSr1	**49428**	RW	Folder Sr\HEAT visibility	2 bits	0 ... 3	3	num.
_VisSSr2	**49428.2**	RW	Folder Sr\AS visibility	2 bits	0 ... 3	3	num.
_VisPP0	**49428.4**	RW	Folder Par\CL visibility	2 bits	0 ... 3	3	num.
_VisPP1	**49428.6**	RW	Folder Par\Cr visibility	2 bits	0 ... 3	3	num.
_VisPP2	**49429**	RW	Folder Par\CE visibility	2 bits	0 ... 3	3	num.
_VisPP3	**49429.2**	RW	Folder Par\CF visibility	2 bits	0 ... 3	3	num.
_VisPP4	**49429.4**	RW	Folder Par\Ui visibility	2 bits	0 ... 3	3	num.
_VisPP5	**49429.6**	RW	Folder Par\1R visibility	2 bits	0 ... 3	3	num.
_VisPP6	**49430**	RW	Folder Par\1F visibility	2 bits	0 ... 3	3	num.
_VisPP7	**49430.2**	RW	Folder Par\1L visibility	2 bits	0 ... 3	3	num.
_VisPP8	**49430.4**	RW	Folder Par\1E visibility	2 bits	0 ... 3	3	num.
_VisPP9	**49430.6**	RW	Folder Par\2R visibility	2 bits	0 ... 3	0	num.
_VisPP10	**49431**	RW	Folder Par\2F visibility	2 bits	0 ... 3	0	num.
_VisPP11	**49431.2**	RW	Folder Par\2L visibility	2 bits	0 ... 3	0	num.
_VisPP12	**49431.4**	RW	Folder Par\2E visibility	2 bits	0 ... 3	0	num.
_VisPP13	**49431.6**	RW	Folder Par\tr visibility	2 bits	0 ... 3	3	num.
_VisPP14	**49432**	RW	Folder Par\St visibility	2 bits	0 ... 3	3	num.
_VisPP15	**49432.2**	RW	Folder Par\RI visibility	2 bits	0 ... 3	3	num.

LABEL	ADDRESS	R/W	DESCRIPTION	DATA SIZE	RANGE	DEFAULT	U.M.
_VisPP16	**49432.4**	RW	Folder Par\CP visibility	2 bits	0 ... 3	3	num.
_VisPP17	**49432.6**	RW	Folder Par\Pi visibility	2 bits	0 ... 3	3	num.
_VisPP18	**49433**	RW	Folder Par\Fi visibility	2 bits	0 ... 3	3	num.
_VisPP19	**49433.2**	RW	Folder Par\FE visibility	2 bits	0 ... 3	3	num.
_VisPP20	**49433.4**	RW	Folder Par\PE visibility	2 bits	0 ... 3	3	num.
_VisPP21	**49433.6**	RW	Folder Par\Hi visibility	2 bits	0 ... 3	3	num.
_VisPP22	**49434**	RW	Folder Par\HE visibility	2 bits	0 ... 3	3	num.
_VisPP23	**49434.2**	RW	Folder Par\HA visibility	2 bits	0 ... 3	3	num.
_VisPP24	**49434.4**	RW	Folder Par\br visibility	2 bits	0 ... 3	3	num.
_VisPP26	**49435**	RW	Folder Par\dF visibility	2 bits	0 ... 3	3	num.
_VisPP27	**49435.2**	RW	Folder Par\dS visibility	2 bits	0 ... 3	3	num.
_VisPP28	**49435.4**	RW	Folder Par\Ad visibility	2 bits	0 ... 3	3	num.
_VisPP29	**49435.6**	RW	Folder Par\AF visibility	2 bits	0 ... 3	3	num.
_VisPP30	**49436**	RW	Folder Par\AS visibility	2 bits	0 ... 3	3	num.
_VisPP31	**49436.2**	RW	Folder Par\HP visibility	2 bits	0 ... 3	3	num.
_VisPP32	**49436.4**	RW	Folder Par\PL visibility	2 bits	0 ... 3	3	num.
_VisPP33	**49436.6**	RW	Folder Par\tE visibility	2 bits	0 ... 3	3	num.
_VisPP34	**49437**	RW	Folder Par\AL visibility	2 bits	0 ... 3	3	num.
_VisPF0	**49437.4**	RW	Folder FnC\deF visibility	2 bits	0 ... 3	3	num.
_VisPF1	**49437.6**	RW	Folder FnC\tA visibility	2 bits	0 ... 3	3	num.
_VisPF2	**49438**	RW	Folder FnC\St visibility	2 bits	0 ... 3	3	num.
_VisPF3	**49438.2**	RW	Folder FnC\CC visibility	2 bits	0 ... 3	3	num.
_VisPF4	**49438.4**	RW	Folder FnC\Eur visibility	2 bits	0 ... 3	3	num.
_VisPFCC0	**49623.6**	RW	Folder FnC\CC\UL visibility	2 bits	0 ... 3	3	num.
_VisPFCC1	**49624**	RW	Folder FnC\CC\dL visibility	2 bits	0 ... 3	3	num.
_VisPFCC2	**49624.2**	RW	Folder FnC\CC\Fr visibility	2 bits	0 ... 3	3	num.

27.3.3 Client Table

RESOURCE	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEF	U.M.
AI	LocalAInput[0]	696	WORD	Y	-1	R	Analogue input AIL1	-500 ... 999	0	°C
AI	LocalAInput[1]	698	WORD	Y	-1	R	Analogue input AIL2	-500 ... 999	0	°C
AI	LocalAInput[2]	700	WORD	Y	-1	R	Analogue input AIL3	-500 ... 999	0	°C/Bar
AI	LocalAInput[3]	702	WORD	Y	-1	R	Analogue input AIL4	-500 ... 999	0	°C/Bar
AI	LocalAInput[4]	704	WORD	Y	-1	R	Analogue input AIL5	-500 ... 999	0	°C
DI	LocalDigInput DIL1	33442	1 bits			R	Digital input DIL1	0 ... 1	0	num.
DI	LocalDigInput DIL2	33442.1	1 bits			R	Digital input DIL2	0 ... 1	0	num.
DI	LocalDigInput DIL3	33442.2	1 bits			R	Digital input DIL3	0 ... 1	0	num.
DI	LocalDigInput DIL4	33442.3	1 bits			R	Digital input DIL5	0 ... 1	0	num.
DI	LocalDigInput DIL5	33442.4	1 bits			R	Digital input DIL5	0 ... 1	0	num.
DI	LocalDigInput DIL6	33442.5	1 bits			R	Digital input DIL6	0 ... 1	0	num.
DO	LocalDigOutput DOL1	33443.2	1 bits			R	Digital output DOL1	0 ... 1	0	num.
DO	LocalDigOutput DOL2	33443.3	1 bits			R	Digital output DOL2	0 ... 1	0	num.
DO	LocalDigOutput DOL3	33443.4	1 bits			R	Digital output DOL3	0 ... 1	0	num.
DO	LocalDigOutput DOL1	33443	1 bits			R	Digital output DOL4	0 ... 1	0	num.
DO	LocalDigOutput DOL5	33443.1	1 bits			R	Digital output DOL5	0 ... 1	0	num.
DO	LocalDigOutput DOL6	33443.5	1 bits			R	Digital output DOL6	0 ... 1	0	num.
AO	AOL LocalDigOutput 1	33443.6	1 bits			R	Digital output AOL1	0 ... 1	0	num.
AO	AOL LocalDigOutput 2	33443.7	1 bits			R	Digital output AOL2	0 ... 1	0	num.
AO	PowerTk[0]	33508	BYTE	Y		R	Analogue output TCL1	0 ... 100	0	num.
AO	PowerTk[1]	33509	BYTE	Y		R	Analogue output AOL1	0 ... 100	0	num.
AO	PowerTk[2]	33510	BYTE	Y		R	Analogue output AOL2	0 ... 100	0	num.
AO	OutPWM[0]	750	WORD	Y	-1	R	Analogue output AOL3	0 ... 999	0	num.
AO	OutPWM[1]	752	WORD	Y	-1	R	Analogue output AOL4	0 ... 999	0	num.
AO	OutPWM[2]	754	WORD	Y	-1	R	Analogue output AOL5	0 ... 999	0	num.
AI	ExtAInput[0]	1148	WORD	Y	-1	R	Analogue input AIE1	-500 ... 999	0	°C
AI	ExtAInput[1]	1150	WORD	Y	-1	R	Analogue input AIE2	-500 ... 999	0	°C

RESOURCE	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEF	U.M.
AI	ExtAInput[2]	1152	WORD	Y	-1	R	Analogue input AIE3	-500 ... 999	0	°C/Bar
AI	ExtAInput[3]	1154	WORD	Y	-1	R	Analogue input AIE4	-500 ... 999	0	°C/Bar
AI	ExtAInput[4]	1156	WORD	Y	-1	R	Analogue input AIE5	-500 ... 999	0	°C
DI	ExtDigInput DIE1	34040	1 bits			R	Digital input DIE1	0 ... 1	0	num.
DI	ExtDigInput DIE2	34040.1	1 bits			R	Digital input DIE2	0 ... 1	0	num.
DI	ExtDigInput DIE3	34040.2	1 bits			R	Digital input DIE3	0 ... 1	0	num.
DI	ExtDigInput DIE4	34040.3	1 bits			R	Digital input DIE4	0 ... 1	0	num.
DI	ExtDigInput DIE5	34040.4	1 bits			R	Digital input DIE5	0 ... 1	0	num.
DI	ExtDigInput DIE6	34040.5	1 bits			R	Digital input DIE6	0 ... 1	0	num.
DO	ExtDigOutput DOE1	34041	1 bits			R	Digital output DOE1	0 ... 1	0	num.
DO	ExtDigOutput DOE2	34041.1	1 bits			R	Digital output DOE2	0 ... 1	0	num.
DO	ExtDigOutput DOE3	34041.2	1 bits			R	Digital output DOE3	0 ... 1	0	num.
DO	ExtDigOutput DOE4	34041.3	1 bits			R	Digital output DOE4	0 ... 1	0	num.
DO	ExtDigOutput DOE5	34041.4	1 bits			R	Digital output DOE5	0 ... 1	0	num.
DO	ExtDigOutput DOE6	34041.5	1 bits			R	Digital output DOE6	0 ... 1	0	num.
AO	ExtDigOutput AOE1	34041.6	1 bits			R	Digital output AOE1	0 ... 1	0	num.
AO	ExtDigOutput AOE2	34041.7	1 bits			R	Digital output AOE2	0 ... 1	0	num.
AO	ExtTKOut[0]	34008	BYTE	Y		R	Analogue output TCE1	0 ... 100	0	num.
AO	ExtTKOut[1]	34010	BYTE	Y		R	Analogue output AOE1	0 ... 100	0	num.
AO	ExtTKOut[2]	34012	BYTE	Y		R	Analogue output AOE2	0 ... 100	0	num.
AO	ExtPWMOut[0]	1234	WORD	Y	-1	R	Analogue output AOE3	0 ... 999	0	num.
AO	ExtPWMOut[1]	1236	WORD	Y	-1	R	Analogue output AOE4	0 ... 999	0	num.
AO	ExtPWMOut[2]	1238	WORD	Y	-1	R	Analogue output AOE5	0 ... 999	0	num.
AI	RemAInput[0]	1144	WORD	Y	-1	R	Analogue input AIr1	-500 ... 999	0	°C
AI	RemAInput[1]	1148	WORD	Y	-1	R	Analogue input AIr2	-500 ... 999	0	°C/Bar
AI	EEV1AInput[0]	1158	WORD	Y	-1	R	Analogue input 1AI1	-500 ... 9999		°C/Bar
AI	EEV1AInput[1]	1160	WORD	Y	-1	R	Analogue input 1AI2	-500 ... 9999		°C
AI	EEV1AInput[2]	1162	WORD	Y	-1	R	Analogue input 1AI3	-500 ... 9999		°C
AI	EEV1AInput[3]	1164	WORD	Y	-1	R	Analogue input 1AI4	-500 ... 9999		°C
DI	EEV1DigInput[0]	34042	1 bits			R	Digital input 1AI3	0 ... 1		flag

RESOURCE	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEF	U.M.
DI	EEV1DigInput[1]	34042.1	1 bits			R	Digital input 1AI4	0 ... 1		flag
DO	EEV1DigOutput[1]	34045.1	1 bits			R	Control output 1DO	0 ... 1		flag
AI	EEV2AInput[0]	1166	WORD	Y	-1	R	Analogue input 2AI1	-500 ... 9999		°C/Bar
AI	EEV2AInput[1]	1168	WORD	Y	-1	R	Analogue input 2AI2	-500 ... 9999		°C
AI	EEV2AInput[2]	1170	WORD	Y	-1	R	Analogue input 2AI3	-500 ... 9999		°C
AI	EEV2AInput[3]	1172	WORD	Y	-1	R	Analogue input 2AI4	-500 ... 9999		°C
DI	EEV2DigInput[0]	34046	1 bits			R	Digital input 2AI3	0 ... 1		flag
DI	EEV2DigInput[1]	34046.1	1 bits			R	Digital input 2AI4	0 ... 1		flag
DO	EEV2DigOutput[1]	34049.1	1 bits			R	Control output 2DO	0 ... 1		flag
setpoint	Cool real setpoint	1321	WORD	Y	-1	R	Cool mode setpoint	-500 ... 999	0	°C
setpoint	Heat real setpoint	1323	WORD	Y	-1	R	Heat mode setpoint	-500 ... 999	0	°C
setpoint	SBSetDHWReal	1399	WORD	Y	-1	R	ACS or anti-legionnaire's disease setpoint	-500 ... 999	0	°C
hysteresis	SBIstCoolReal	1325	WORD	Y	-1	R	Cool mode hysteresis	-500 ... 999	0	°C
hysteresis	SBIstHeatReal	1327	WORD	Y	-1	R	Heat mode hysteresis	-500 ... 999	0	°C
AI	EEV1ResInput[0]	1174	WORD	Y	-1	R	Valve EEV1 superheating temperature	-500 ... 9999		°C
AI	EEV1ResInput[1]	1176	WORD	Y	-1	R	Valve EEV1 saturation temperature	-500 ... 9999		°C
AI	EEV1ResInput[2]	1178	WORD	Y	-1	R	Valve EEV1 superheating temperature (backup)	-500 ... 9999		°C
AI	EEV1ResInput[3]	1180	WORD	Y	-1	R	Valve EEV1 saturation temperature (backup)	-500 ... 9999		°C
AI	EEV1ResInput[4]	1182	WORD	Y	-1	R	Valve EEV1 superheating	-500 ... 9999		K/°R
AI	EEV1ResInput[5]	1184	WORD	Y	-1	R	Valve EEV1 evaporator pressure	-500 ... 9999		bar
AI	EEV1ResInput[6]	1186	WORD		-1	R	Valve EEV1 opening percentage	-500 ... 9999		%
AI	EEV1ResInput[7]	1188	WORD	Y	-1	R	Valve EEV1 superheating setpoint	-500 ... 9999		K/°R
AI	EEV2ResInput[0]	1190	WORD	Y	-1	R	Valve EEV2 superheating temperature	-500 ... 9999		°C
AI	EEV2ResInput[1]	1192	WORD	Y	-1	R	Valve EEV2 saturation temperature	-500 ... 9999		°C
AI	EEV2ResInput[2]	1194	WORD	Y	-1	R	Valve EEV2 superheating temperature (backup)	-500 ... 9999		°C
AI	EEV2ResInput[3]	1196	WORD	Y	-1	R	Valve EEV2 saturation temperature (backup)	-500 ... 9999		°C
AI	EEV2ResInput[4]	1198	WORD	Y	-1	R	Valve EEV2 superheating	-500 ... 9999		K/°R
AI	EEV2ResInput[5]	1200	WORD	Y	-1	R	Valve EEV2 evaporator pressure	-500 ... 9999		bar
AI	EEV2ResInput[6]	1202	WORD		-1	R	Valve EEV2 opening percentage	-500 ... 9999		%
AI	EEV2ResInput[7]	1204	WORD	Y	-1	R	Valve EEV2 superheating setpoint	-500 ... 9999		K/°R

RESOURCE	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEF	U.M.
time	_TimMinOnOnCps	826	WORD			R	Compressors minimum on/on time timer	0 ... 32768	0	d
time	_TimMinOfOfCps	828	WORD			R	Compressors minimum off/off time timer	0 ... 32768	0	d
time	_TimMinOnOnPrz	830	WORD			R	Capacity steps minimum on/on time timer	0 ... 32768	0	d
time	_TimMinOfOfPrz	832	WORD			R	Capacity steps minimum off/off time timer	0 ... 32768	0	d
time	_TimMinOfOnCp0	834	WORD			R	Compressor 1 minimum on/off timer	0 ... 32768	0	d
time	_TimMinOfOnCp1	836	WORD			R	Compressor 2 minimum on/off timer	0 ... 32768	0	d
time	_TimMinOfOnCp2	838	WORD			R	Compressor 3 minimum on/off timer	0 ... 32768	0	d
time	_TimMinOfOnCp3	840	WORD			R	Compressor 4 minimum on/off timer	0 ... 32768	0	d
time	_TimMinOnOnCp0	842	WORD			R	Compressor 1 minimum on/on timer	0 ... 32768	0	d
time	_TimMinOnOnCp1	844	WORD			R	Compressor 2 minimum on/on timer	0 ... 32768	0	d
time	_TimMinOnOnCp2	846	WORD			R	Compressor 3 minimum on/on timer	0 ... 32768	0	d
time	_TimMinOnOnCp3	848	WORD			R	Compressor 4 minimum on/on timer	0 ... 32768	0	d
time	_TimMinOnCp0	850	WORD			R	Compressor 1 minimum on time timer	0 ... 32768	0	d
time	_TimMinOnCp1	852	WORD			R	Compressor 2 minimum on time timer	0 ... 32768	0	d
time	_TimMinOnCp2	854	WORD			R	Compressor 3 minimum on time timer	0 ... 32768	0	d
time	_TimMinOnCp3	856	WORD			R	Compressor 4 minimum on time timer	0 ... 32768	0	d
time	_TimEntraDefrostC1	866	WORD			R	Circuit 1 defrost interval/duration timer	0 ... 32768	0	d
time	_TimEntraDefrostC2	868	WORD			R	Circuit 2 defrost interval/duration timer	0 ... 32768	0	d
time	_TimSgoccioC1	870	WORD			R	Circuit 1 coil drainage time timer	0 ... 32768	0	d
time	_TimSgoccioC2	872	WORD			R	Circuit 2 coil drainage time timer	0 ... 32768	0	d
time	_TimRitOnCpPomPri	876	WORD			R	Timer compressor on delay after internal pump	0 ... 32768	0	d
time	_TimRitOfPomPriCp	878	WORD			R	Timer internal pump off delay after compressors	0 ... 32768	0	d
time	_TimEnvelopeTimTS	1002	WORD			R	Discharge temperature correction timer	0 ... 32768	0	d
time	_TimEnvelopeTimTST	1004	WORD			R	Superheating setpoint correction/scanning timer	0 ... 32768	0	min
time	_TimEnvelopeTimTtransient	1006	WORD			R	Initial transient timer for compression ratio control	0 ... 32768	0	min
time	_TimEnvelopeTimSafety	1008	WORD			R	Timer for compressor safety operation and for oil recovery	0 ... 32768	0	min
time	_TimInverterOff	1010	WORD			R	Inverter off timer	0 ... 32768	0	d
state	_DefrostOnC1	34179.2	1 bits			R	Defrost 1	0 ... 1	0	num.
state	_DefrostOnC2	34179.3	1 bits			R	Defrost 2	0 ... 1	0	num.
state	_ASPCal	34182.6	1 bits			R	ACS status with heat pump	0 ... 1	0	num.

RESOURCE	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEF	U.M.
state	_ALPCal	34182.7	1 bits			R	Anti-legionnaire's status with heat pump	0 ... 1	0	num.
mode	_MemoOff	33284	1 bits			R	Device OFF	0 ... 1	0	num.
mode	_MemoRemotOff	33284.1	1 bits			R	Device OFF	0 ... 1	0	num.
mode	_MemoLocalStBy	33284.2	1 bits			R	Device STANDBY	0 ... 1	0	num.
mode	_MemoRemotStBy	33284.3	1 bits			R	Device STANDBY	0 ... 1	0	num.
mode	_MemoLocalCool	33284.4	1 bits			R	Device COOL	0 ... 1	0	num.
mode	_MemoRemotCool	33284.5	1 bits			R	Device COOL	0 ... 1	0	num.
mode	_MemoLocalHeat	33284.6	1 bits			R	Device HEAT	0 ... 1	0	num.
mode	_MemoRemotHeat	33284.7	1 bits			R	Device HEAT	0 ... 1	0	num.
mode	_MemoLocalAS	33286	1 bits			R	Device in DHW	0 ... 1	0	num.
mode	_MemoRemotAS	33286.1	1 bits			R	Device in DHW	0 ... 1	0	num.
counter	STCPOperatingHours[0]	1285	WORD			R	Compressor 1 operating hours	0 ... 65535	0	hours
counter	STCPOperatingHours[1]	1287	WORD			R	Compressor 2 operating hours	0 ... 65535	0	hours
counter	STCPOperatingHours[2]	1289	WORD			R	Compressor 3 operating hours	0 ... 65535	0	hours
counter	STCPOperatingHours[3]	1291	WORD			R	Compressor 4 operating hours	0 ... 65535	0	hours
counter	STPMOperatingHours[0]	1293	WORD			R	Pump 1 operating hours	0 ... 65535	0	hours
counter	STPMOperatingHours[1]	1295	WORD			R	Pump 2 operating hours	0 ... 65535	0	hours
counter	STPMOperatingHours[2]	1297	WORD			R	Pump 3 operating hours	0 ... 65535	0	hours
differential	SBDiffSetPoint	1341	WORD	Y	-1	R	Temperature controller setpoint dynamic differential	-500 ... 999	0	°C
offset	SBDiffAdaptive	1343	WORD	Y	-1	R	Adaptive function offset	-500 ... 999	0	°C
differential	STDiffResPri	1345	WORD	Y	-1	R	Supplementary heater setpoint dynamic differential	-500 ... 999	0	°C
differential	STDiffWater Heater	1347	WORD	Y	-1	R	Water heater setpoint dynamic differential	-500 ... 999	0	°C
setpoint	SBSetStartSbri	1355	WORD	Y	-1	R	Defrost start set point	-500 ... 999	0	°C
state	SBCircuiti[0].OutAttive	34145	BYTE			R	Temperature control steps supplied circuit 1	0 ... 4	0	num.
state	SBCircuiti[0].OutAttive	34151	BYTE			R	Temperature control steps supplied circuit 2	0 ... 4	0	num.
state	EEV1Status	34043	BYTE			R	EEV1 regulation status	0 ... 255	0	num.
state	EEV2Status	34047	BYTE			R	EEV2 regulation status	0 ... 255	0	num.
alarm	E000	33360	1 bits			R	General alarm	0 ... 1	0	flag
alarm	E001	33360.1	1 bits			R	Digital high pressure alarm circuit 1	0 ... 1	0	flag
alarm	E002	33360.2	1 bits			R	Digital high pressure alarm circuit 2	0 ... 1	0	flag

RESOURCE	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEF	U.M.
alarm	E003	33360.3	1 bits			R	Analogue high pressure alarm circuit 1	0 ... 1	0	flag
alarm	E004	33360.4	1 bits			R	Analogue high pressure alarm circuit 2	0 ... 1	0	flag
alarm	E005	33360.5	1 bits			R	Digital low pressure alarm circuit 1	0 ... 1	0	flag
alarm	E006	33360.6	1 bits			R	Digital low pressure alarm circuit 2	0 ... 1	0	flag
alarm	E007	33360.7	1 bits			R	Analogue low pressure alarm circuit 1	0 ... 1	0	flag
alarm	E008	33361	1 bits			R	Analogue low pressure alarm circuit 2	0 ... 1	0	flag
alarm	E009	33361.1	1 bits			R	Low refrigerant alarm	0 ... 1	0	flag
alarm	E010	33361.2	1 bits			R	Compressor 1 thermal switch alarm	0 ... 1	0	flag
alarm	E011	33361.3	1 bits			R	Compressor 2 thermal switch alarm	0 ... 1	0	flag
alarm	E012	33361.4	1 bits			R	Compressor 3 thermal switch alarm	0 ... 1	0	flag
alarm	E013	33361.5	1 bits			R	Compressor 4 thermal switch alarm	0 ... 1	0	flag
alarm	E015	33361.7	1 bits			R	Compressor 1 oil pressure switch alarm	0 ... 1	0	flag
alarm	E016	33362	1 bits			R	Compressor 2 oil pressure switch alarm	0 ... 1	0	flag
alarm	E017	33362.1	1 bits			R	Compressor 3 oil pressure switch alarm	0 ... 1	0	flag
alarm	E018	33362.2	1 bits			R	Compressor 4 oil pressure switch alarm	0 ... 1	0	flag
alarm	E020	33362.4	1 bits			R	Internal circuit flow meter alarm	0 ... 1	0	flag
alarm	E021	33362.5	1 bits			R	Primary circuit pump 1 thermal switch alarm	0 ... 1	0	flag
alarm	E022	33362.6	1 bits			R	Primary circuit pump 2 thermal switch alarm	0 ... 1	0	flag
alarm	E025	33363.1	1 bits			R	Primary circuit pump thermal cut-out alarm	0 ... 1	0	flag
alarm	E026	33363.2	1 bits			R	External circuit water pump thermal switch alarm	0 ... 1	0	flag
alarm	E030	33363.6	1 bits			R	Internal circuit antifreeze alarm	0 ... 1	0	flag
alarm	E031	33363.7	1 bits			R	External circuit antifreeze alarm	0 ... 1	0	flag
alarm	E035	33364.3	1 bits			R	High temperature alarm	0 ... 1	0	flag
alarm	E040	33365	1 bits			R	Internal exchanger fan thermal switch alarm	0 ... 1	0	flag
alarm	E041	33365.1	1 bits			R	External exchanger fan thermal switch alarm circuit 1	0 ... 1	0	flag
alarm	E042	33365.2	1 bits			R	External exchanger fan thermal switch alarm circuit 2	0 ... 1	0	flag
alarm	E045	33365.5	1 bits			R	Faulty clock alarm	0 ... 1	0	flag
alarm	E046	33365.6	1 bits			R	Time lost alarm	0 ... 1	0	flag
alarm	E047	33365.7	1 bits			R	LAN communication absent alarm	0 ... 1	0	flag
alarm	E048	33366	1 bits			R	Anti-Legionnaire's Alarm	0 ... 1	0	flag

RESOURCE	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEF	U.M.
alarm	E050	33366.2	1 bits			R	Primary exchanger electric heater 1 thermal switch alarm	0 ... 1	0	flag
alarm	E051	33366.3	1 bits			R	Primary exchanger electric heater 2 thermal switch alarm	0 ... 1	0	flag
alarm	E056	33367	1 bits			R	Auxiliary output alarm	0 ... 1	0	flag
alarm	E060	33367.4	1 bits			R	Primary exchanger air/water inlet temperature probe faulty alarm	0 ... 1	0	flag
alarm	E061	33367.5	1 bits			R	Primary exchanger air/water outlet temperature probe faulty alarm	0 ... 1	0	flag
alarm	E062	33367.6	1 bits			R	Faulty disposable exchanger temperature probe alarm	0 ... 1	0	flag
alarm	E063	33367.7	1 bits			R	Faulty disposable exchanger air/water inlet temperature probe alarm	0 ... 1	0	flag
alarm	E064	33368	1 bits			R	Faulty disposable exchanger air/water outlet temperature probe alarm	0 ... 1	0	flag
alarm	E066	33368.2	1 bits			R	Sanitary water temperature probe faulty alarm	0 ... 1	0	flag
alarm	E067	33368.3	1 bits			R	Faulty display probe alarm	0 ... 1	0	flag
alarm	E068	33368.4	1 bits			R	Faulty external temperature probe alarm	0 ... 1	0	flag
alarm	E069	33368.5	1 bits			R	Faulty circuit 1 or 2 high pressure transducer alarm	0 ... 1	0	flag
alarm	E070	33368.6	1 bits			R	Faulty circuit 1 or 2 low pressure transducer alarm	0 ... 1	0	flag
alarm	E073	33369.1	1 bits			R	Faulty dynamic setpoint input alarm	0 ... 1	0	flag
alarm	E074	33369.2	1 bits			R	Faulty primary exchanger transducer alarm	0 ... 1	0	flag
alarm	E075	33369.3	1 bits			R	Faulty disposable exchanger 1 or 2 transducer alarm	0 ... 1	0	flag
alarm	E080	33370	1 bits			R	Configuration error alarm	0 ... 1	0	flag
alarm	E081	33370.1	1 bits			R	Compressor operating hours exceeded warning	0 ... 1	0	flag
alarm	E085	33370.5	1 bits			R	Primary circuit pump operating hours exceeded signal	0 ... 1	0	flag
alarm	E086	33370.6	1 bits			R	External circuit pump operating hours exceeded signal	0 ... 1	0	flag
alarm	E090	33371.2	1 bits			R	Alarm log full warning	0 ... 1	0	flag
alarm	E101	33372.5	1 bits			R	Input error dAi1 EEV1	0 ... 1		flag
alarm	E102	33372.6	1 bits			R	Input error dAi2 EEV1	0 ... 1		flag
alarm	E103	33372.7	1 bits			R	Input error dAi3 EEV1	0 ... 1		flag
alarm	E104	33373	1 bits			R	Input error dAi4 EEV1	0 ... 1		flag
alarm	E105	33373.1	1 bits			R	Valve EEV1 superheating probe alarm	0 ... 1		flag
alarm	E106	33373.2	1 bits			R	Valve EEV1 saturation probe alarm	0 ... 1		flag
alarm	E107	33373.3	1 bits			R	Valve EEV1 MOP alarm	0 ... 1		flag
alarm	E108	33373.4	1 bits			R	Valve EEV1 max output alarm	0 ... 1		flag
alarm	E109	33373.5	1 bits			R	Valve EEV1 external alarm	0 ... 1		flag

RESOURCE	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEF	U.M.
alarm	E110	33373.6	1 bits			R	Valve EEV1 no-link alarm	0 ... 1		flag
alarm	E111	33373.7	1 bits			R	Valve EEV1 motor alarm: current consumption too high	0 ... 1		flag
alarm	E112	33374	1 bits			R	Valve EEV1 motor alarm: winding 1 not connected	0 ... 1		flag
alarm	E113	33374.1	1 bits			R	Valve EEV1 motor alarm: winding 1 short-circuited	0 ... 1		flag
alarm	E114	33374.2	1 bits			R	Valve EEV1 motor alarm: winding 2 not connected	0 ... 1		flag
alarm	E115	33374.3	1 bits			R	Valve EEV1 motor alarm: winding 2 short-circuited	0 ... 1		flag
alarm	E201	33385.1	1 bits			R	Input error dAi1 EEV2	0 ... 1		flag
alarm	E202	33385.2	1 bits			R	Input error dAi2 EEV2	0 ... 1		flag
alarm	E203	33385.3	1 bits			R	Input error dAi3 EEV2	0 ... 1		flag
alarm	E204	33385.4	1 bits			R	Input error dAi4 EEV2	0 ... 1		flag
alarm	E205	33385.5	1 bits			R	Valve EEV2 superheating probe alarm	0 ... 1		flag
alarm	E206	33385.6	1 bits			R	Valve EEV2 saturation probe alarm	0 ... 1		flag
alarm	E207	33385.7	1 bits			R	Valve EEV2 MOP alarm	0 ... 1		flag
alarm	E208	33386	1 bits			R	Valve EEV2 max output alarm	0 ... 1		flag
alarm	E209	33386.1	1 bits			R	Valve EEV2 external alarm	0 ... 1		flag
alarm	E210	33386.2	1 bits			R	Valve EEV2 no-link alarm	0 ... 1		flag
alarm	E211	33386.3	1 bits			R	Valve EEV2 motor alarm: current consumption too high	0 ... 1		flag
alarm	E212	33386.4	1 bits			R	Valve EEV2 motor alarm: winding 1 not connected	0 ... 1		flag
alarm	E213	33386.5	1 bits			R	Valve EEV2 motor alarm: winding 1 short-circuited	0 ... 1		flag
alarm	E214	33386.6	1 bits			R	Valve EEV2 motor alarm: winding 2 not connected	0 ... 1		flag
alarm	E215	33386.7	1 bits			R	Valve EEV2 motor alarm: winding 2 short-circuited	0 ... 1		flag
net command	Remote_Mute	33822.2	1 bits			W	Manual alarms reset	0 ... 1	0	num.
net command	Remote_Cool	33822.3	1 bits			W	Select COOL mode	0 ... 1	0	num.
net command	Remote_Heat	33822.4	1 bits			W	Select HEAT mode	0 ... 1	0	num.
net command	Remote_StBy	33822.5	1 bits			W	Select STANDBY mode	0 ... 1	0	num.
net command	Remote_Defrost	33822.6	1 bits			W	Manual defrost activation	0 ... 1	0	num.
net command	Remote_OnOff	33822.7	1 bits			W	Select ON/OFF mode	0 ... 1	0	num.
net command	RemoteFormatStorAll	33823	1 bits			W	Reset alarm history	0 ... 1	0	num.
net command	Remote_AS	33823.1	1 bits			W	Select DHW mode	0 ... 1	0	num.
net command	Remote_RemTimeBands	33823.2	1 bits			W	Enable/Disable Time Bands	0 ... 1	0	num.

RESOURCE	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEF	U.M.
net command	CMD_LOCK_DISP_ON	33282.2	1 bits			W	Keypad lock	0 ... 1	0	num.
net command	CMD_LOCK_DISP_OFF	33282.2	1 bits			W	Keypad unlock	0 ... 1	0	num.
net command	CMD_RESET	33280	1 bits			W	Device reset	0 ... 1	0	num.

28 FUNCTIONS (FOLDER FNC)

The Functions menu is used to perform a number of manual functions such as switching the device on/off, acknowledging alarms, deleting the alarm history, running a manual defrost and using the Multi Function key (MFK).
Several of these operations can be performed from the keyboard and main display using the keys - see User Interface chapter.
By means of a parameter – see parameters chapter – the functions associated with keys can be disabled and password-only access to these functions can be allowed at a "Service" level.
For more details, see the table below:

	Label	Operation	Function activated by [key] if configured
FnC	dEF	Manual defrost	YES [UP]
	tA	Reset alarms	YES [UP+DOWN]
	St	Switch terminal on/off	YES [DOWN]
	CC	Using the Multi Function Key	NO
	EUr	Reset alarm log	NO

To open the Functions menu (folder Fnc) execute steps 1-4 as indicated below

1	2
	
To view folder FnC from the main display, press the Esc and Set keys at the same time. [esc+set]	Pressing both keys will open the Programming menu: --- The first folder displayed is PAr.
3	4
	
Scroll with the "Up" and "DOWN" keys until you find the FnC folder. --- Press the set key to open the Functions menu.	The first label displayed is dEF. --- Scroll using the "up" and "down" keys to find other labels/folders.

28.1 Manual defrost activation (folder dEF)

See 1-4	Press [esc + set] in the main screen. The label 'PAr' will appear. Scroll with 'UP' and 'DOWN' to display the 'FnC' label. Press 'set'. The label 'dEF' will appear. Scroll with 'UP' and 'DOWN' to display the 'dEF' label.
	
Press the 'set' key to activate defrost manually from the keyboard	The DEFROST LED will start to blink.

28.2 Manual Reset (folder tA)

See 1-4	Press [esc + set] in the main screen. The label 'PAr' will appear. Scroll with 'UP' and 'DOWN' to display the 'FnC' label. Press 'set'. The label 'dEF' will appear. Scroll with 'UP' and 'DOWN' to display the 'tA' label
	Press the 'set' key for manual reset - - - - - - - - - N.B.: resetting an active alarm will save the alarm in the alarm log.
Press the "set" key to activate defrost manually from the keyboard	The DEFROST LED will start to blink.

28.3 Change On/OFF state (folder St)

See 1-4	Press [esc + set] in the main screen. The label 'PAr' will appear. Scroll with 'UP' and 'DOWN' to display the 'FnC' label. Press 'set'. The label 'dEF' will appear. Scroll with 'UP' and 'DOWN' to display 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	

28.4 Multi Function key

When connected to the TTL serial port, the Multi Function Key (MFK) allows you to program device parameters (up/download parameter map to or from one or more devices of the same type) rapidly and also program the device's firmware.

Connecting the Multi Function Key

NOTE: Use the **YELLOW** Cable to make the connection between MFK and SBA600.

For rapid programming of the parameters, the upload (label UL), download (label dL) and multi function key formatting (label Fr) operations are performed as explained below:

UPLOAD (copy from CONTROLLER to MULTI FUNCTION KEY)
This operation serves to download the programming parameters and alarms log from Energy SBA600 to the Multi Function Key.
DOWNLOAD (copy from MULTI FUNCTION KEY to CONTROLLER)
This operation serves to upload the programming parameters from the Multi Function Key to the controller.
FORMAT*
Formatting the Multi Function Key consists of deleting its contents
* this should be done prior to Uploading when the key is used for the first time

See 1-4	**Upload / Download / Formatting** **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 display the 'FnC' label. Press 'set'. The label 'dEF' will appear. Scroll with 'UP' and 'DOWN' to display the 'CC' label.
	
The commands you need to use the Multi Function Key are in the "CC" folder. Press 'set' to access the functions.	Use the 'UP' and 'DOWN' keys to display the desired function: UL for upload / dL for download /Fr for format Press the 'set' key and the upload (or download) will be performed (in this example, dL- download) Wait for a few seconds...
	
Wait for a few seconds... If this operation is completed successfully, 'yes' is displayed; otherwise 'Err' is displayed (°). On completion, remove the MFK	

28.4.1 Download from reset

Connect the MFK with the device switched off.

Firmware download
At start up, if compatible firmware is installed on the MFK (the MFK can be prepared in this sense with the Device Manager software), the new firmware is downloaded into the device.
This occurs as follows:
- firmware verification/update (MFK LED flashes)
- termination with successful programming (MFK steadily lit)
- switch off the device

If compatible firmware is not loaded into the MFK, no firmware download can occur.
If, on termination, the MFK LED does not remain steadily lit, the operation must be repeated as this means it has failed.

Parameters download
When the device is switched on, if there is a compatible parameter map in the MFK, the programming parameters are loaded into the device;

	
lamp test completed...	**Case A** ...the display shows dLY... If the procedure was completed successfully.
	
Case B ...the display shows dLn... If the procedure was not completed successfully (°)	In both cases, the instrument will be switched OFF locally (OFF appears on the display). When you press [DOWN] (°°), the controller will operate: • With the new map **Case A** • With the previous map **Case B** Remove the Multi Function Key when the operation is completed (°°) see user interface chapter, (folder Par/UI) local ON/OFF section Change On/OFF state (folder St) section

N.B.:

- if the MFK contains both compatible firmware and a compatible parameter map, the firmware is downloaded first and then (after the device has been switched off and back on again manually) the parameter map is downloaded
- The formatting function is **ONLY REQUIRED FOR UPLOADING (**)**:
  - o to use the Multi Function Key the first time (Multi Function Key that has never been used) and
  - o to use the Multi Function Key with models that are not reciprocally compatible.
  - o (**) a pre-programmed card supplied by Eliwell to DOWNLOAD parameters does not need to be formatted. **NOTE: Formatting can NOT be cancelled.**
- after the download operation, the instrument will work with the newly loaded parameters map/firmware.
- 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 controller
- Check the Multi Function Key – Energy SBA600 connection (check the TTL cable)
- Check that the key is compatible with the controller
- Contact Eliwell Technical Support

28.5 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 display the 'FnC' label. Press 'set'. The label 'dEF' will appear. Scroll with 'UP' and 'DOWN' to display the 'EUr' label.
	
Press the "set" key for 3 seconds [set]	The 'YES' label is displayed to indicate that the alarm log has been deleted

29 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.

29.1.1 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.

29.1.2 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.

29.1.3 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

30 SUPERVISION

The serial TTL – which we will call COM1 – can be used to configure the device, parameters, states, and variables with Modbus via the Modbus protocol.

30.1 Configuration with Modbus RTU

Modbus is a client/server protocol for communication between devices connected in a network.
Modbus devices communicate using a master-slave technique in which only one device (master) can send messages. The other devices in the network (slaves) respond, returning the data requested by the master or executing the action specified in the message sent. A slave is a device connected to a network that processes information and sends the results to the master using the Modbus protocol.
The master device can send messages to individual slaves or to the entire network (broadcast) whilst slaves can only respond individually to the master.
The Modbus standard used by Eliwell employs the RTU code for data transmission.

30.1.1 Data format (RTU)

The coding model used defines the structure of messages transmitted on the network and the way in which this information is deciphered. The type of coding is usually selected on the basis of specific parameters (baud rate, parity, etc.)***; furthermore, some devices support only specific coding models, although it must be the same one for all devices connected in a Modbus network.
The protocol uses the RTU binary method with bytes configured as follows:
8 bits for data, even parity bit, 1 stop bit (non-configurable).

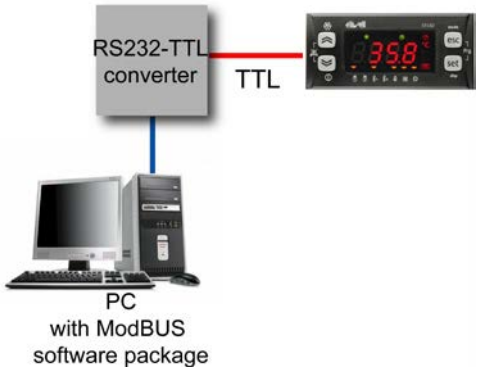
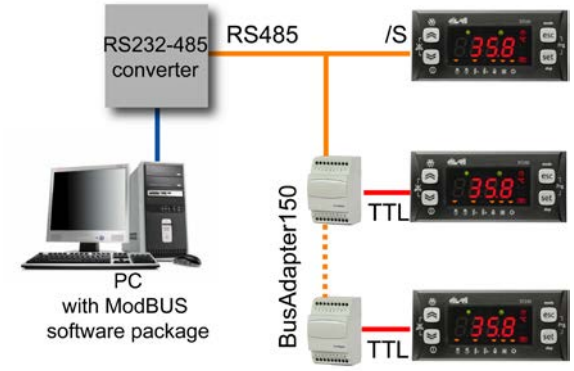
***can be set via parameters

CF30- Modbus protocol controller address
CF31- Modbus protocol Baudrate

N.B.: the transmission rate must be set to 9600 baud.
Parameter setting allows full configuration of the device
Parameters can be changed using:

- Device keypad
- 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 connection to multiple devices Via RS485**
	

PC connection / Interface	RS232 cable
Device / Bus Adapter connection	5-core TTL cable (30cm) (other measurements/lengths available)
Bus Adapter	BA150
Bus Adapter / Interface connection	RS485 cable Shielded and twisted (e.g.: Belden cable model 8762)

30.1.2 Modbus commands available and data areas

The following commands are implemented:

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

Multiple reading of the 2 real setpoints

Measurement	**Decimal**	**Hex**	**Size**
Device address (slave):	1	0x01	bytes
Read command code:	3	0x03	bytes
Start address:	975	0x03CF	Word
Number of words to read:	3	0x0003	Word

Configuration of COOL operating mode

Value 8 written in the word for remote commands at address h2FC.

Measurement	Decimal	Hex	Size
Device address (slave):	1	0x01	bytes
Write command code:	10	0x0A	bytes
Write address:	764	0x02FC	Word
Number of words to write:	1	0x0001	Word
Number of byte (No. word x 2):	2	0x02	Word
Value (word) to write:	8	0x0008	Word

On completion of the operation the device will switch to COOL mode (if enabled).

Configuration of ON/OFF operating mode
Value 128 written in the word for remote commands at address h2FC.

On completion of the operation the device will toggle the On/Off sate (if enabled).

The RAM variables can be monitored and the possible commands are listed below.

List of possible commands:

- Manual alarm reset
- Change operating mode (Heat, Cool and St-By)
- Switch device on/off
- Enable defrost

Following this procedure, additional operations are also possible, including:

- Read alarm log
- Change/set time
- Reset operating time of compressor and pump outputs

Reading the alarm log
The alarm log is saved in EEPROM in a circular buffer composed of logical 7-byte records in the following formats:

Byte	Bits	Index	Data	Values
0	0	Bit 0	Free alarm record flag	Must always be 0
	1	Bit 1	Alarm state	0 = alarm reset; 1 = alarm in progress
	2	Bit 2	Automatic reset alarm	0 = automatic reset; 1 = manual reset
	3	-	Not used	
	4	-		
	5	-		
	6	-		
	7	-		
1	0	Bit 0	Alarm start minutes	0-59 = minutes >59 = indeterminate value
	1	Bit 1		
	2	Bit 2		
	3	Bit 3		
	4	Bit 4		
	5	Bit 5		
	6	Bit 0	Alarm end minutes	0-59 = minutes >59 = indeterminate value
	7	Bit 1		
2	0	Bit 2		
	1	Bit 3		
	2	Bit 4		
	3	Bit 5		
	4	Bit 0	Alarm start hours	0-23 = hours >23 = indeterminate value
	5	Bit 1		
	6	Bit 2		
	7	Bit 3		
3	0	Bit 4		
	1	Bit 0	Alarm end hours	0-23 = hours >23 = indeterminate value
	2	Bit 1		
	3	Bit 2		
	4	Bit 3		
	5	Bit 4		
	6	Bit 0	Alarm start date	1-31 = day 0 >31 = indeterminate value
	7	Bit 1		
4	0	Bit 2		
	1	Bit 3		
	2	Bit 4		
	3	Bit 0	Alarm end date	1-31 = day 0 >31 = indeterminate value
	4	Bit 1		
	5	Bit 2		
	6	Bit 3		

	7	Bit 4		
5	0	Bit 0	Alarm start month	0-23 = hours >23 = indeterminate value
	1	Bit 1		
	2	Bit 2		
	3	Bit 3		
	4	Bit 0	Alarm end month	0-23 = hours >23 = indeterminate 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 find the index of the first record present, read variable ***PntStorAll*** at the address h83A8.
To find the number of records present, read variable ***NumStorAll*** at the address h83A9.

Address 0x83A8 => data: 0x0027 = Index of first record (the most recent);
Address 0x83A8 => data: 0x0027 = number of records present (39);

Calculation of the address of the most recent record:
Address EU00 = 51712 + (N-1)x7 = 51712 + 17x7 = 51832 (0xCA77)

Read EU00
TX: 01, 03, CA, 77, 00, 07, 8B, CA.
RX: 01, 03, 0E, 00, 82, 00, DD, 00, CF, 00, FE, 00, 04, 00, 06, 00, 3C, 9B, 13.

Address 0xCA77 => date: 0x0082 = Byte 0 of the alarm log record
Address 0xCA78 => date: 0x00DD = Byte 1 of the alarm log record
Address 0xCA79 => date: 0x00CF = Byte 2 of the alarm log record
Address 0xCA7A => date: 0x00FE = Byte 3 of the alarm log record
Address 0xCA7B => date: 0x0004 = Byte 4 of the alarm log record
Address 0xCA7C => date: 0x0006 = Byte 5 of the alarm log record
Address 0xCA7D => date: 0x003C = Byte 6 of the alarm log record

Free alarm record flag = b 0 = 0
Free alarm record flag = b 1 = 1
Automatic reset alarm = b 0 = 0
Not Used = b 10000 = free
Alarm start minutes = b 011101 = 29
Alarm end minutes = b 111111 = 63 (indeterminate)
Alarm start hours = b 01100 = 12
Alarm end hours = b 11111 = 31 (indeterminate)
Alarm start date = b 10011 = 19
Alarm end date = b 00000 = 0 (indeterminate)
Alarm start month = b 0110 = 6
Alarm end month = b 0000 = 0 (indeterminate)
Alarm code = b 00111100 = 60

The result shows that on EU00 there is an **Er60** started on **19/06** at **12.19** still active.

To read EU01, the address is determined as follows:
Address EU01 = Address EU00 - 7 = 51832 - 7 = 51825

To read EU02 continue subtracting 7 from the address EU01 and so on…

N.B.: The minimum limit is the address 51712 (hCA00) after which, if there are still alarms to be read, it starts again from address 52404 (hCCB5) (the buffer is circular and after the 99th record, the older ones are overwritten).

Reading time changes/settings

To write the time, address the structure ***DataWrite*** to address h82F4.
The seconds bytes must be written last!

Example: time setting **h11:33** del **28/03/2007**

Measurement	Network	Decimal	Hex	Size
0: seconds	H82F4	0	0x0000	bytes
1: minutes	H82F5	33	0x0021	bytes
2: hours	H82F6	11	0x000B	bytes
3: day of week	H82F7	-	-	bytes
4: day of month	H82F8	28	0x001C	bytes
5: month	H82F9	3	0x0003	bytes
6: year	H82FA	7	0x0007	bytes

NOTE: The seconds bytes must be written last!

Write sequence:
The following 6-word sequence is written at address H82F5: 46, 12, 0, 19, 6, 8.

A word equal to 00 is written at address H82F4.

Resetting operating hours
To read and/or clear operating time, address the counters in the device's EEPROM and RAM.

STCPOreFunz[0] at address h3AB Operating hours CP1 (in Ram)
STCPOreFunz[1] at address h3AD Operating hours CP2 (in Ram)
STPMOreFunz[0] at address h3B3 Operating hours P1 (in Ram)
STPMOreFunz[1] at address h3B5 Operating hours P2 (in Ram)

EE_OreFunzCP0 at address h4F20 Operating hours CP1 (in EEPROM)
EE_OreFunzCP1 at address h4F22 Operating hours CP2 (in EEPROM)
EE_OreFunzP0 at address h4F38 Operating hours P1 (in EEPROM)
EE_OreFunzP1 at address h4F38 Operating hours P2 (in EEPROM)

Multiple reading of operating hours CP at address h3AB in RAM.
The full command to be sent to the device will be:

Address 0x03AB => date: 0x0065 = 101 operating hours CP1;
Address 0x03AC => date: 0x0000 = not used
Address 0x03AD => date: 0x0001 = 1 operating hour CP2;

Clear time CP1 (in RAM and EEPROM)
Write 0 operating hours CP at address h3AB in RAM.

Write 0 operating hours CP at address h4F20 in Eeprom.

Variable list:
See Parameters (PAr) Chapter, Client Table

30.2 Configuration of device address

The address of a device (Device Number) in a ModBus message is defined by parameter
CF30 - Modbus protocol controller address

The address 0 is used for broadcast messages that all slaves recognize. Slaves do not respond to broadcast messages.

30.2.1 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).

30.2.2 Configuration of variable addresses / states

The list of addresses is given in the Parameters chapter, under the section headed Client Table ADDRESS column.

31 ANNEXE – XVD DRIVER

XVD is the Eliwell driver platform solution with open board for management of servo-driven electronic stepper expansion valves of the single pole type suitable for a range of requirements on the HVAC/R market and beyond.

The facility to select the type of refrigerant and compatibility with the most popular valve models on the market make KVC a particularly versatile module.
XVD also makes it possible to configure a refrigerant that is not included in the preset factory list.

Operating the valve with a current driven motor and independent operation for heating and cooling by means of double mapping of the regulator improves performance.

In fact, XVD allows very precise, stable and reliable regulation of the flow of refrigerant with a consequent increase in efficiency and energy saving through control of superheating and opening of the valve in accordance with the performance required of the system and different working conditions.

Reliability is guaranteed by isolated serial connections and backup sensors.

XVD is used in association with the Energy Flex SBA series of compact controllers for management of chillers and heat pumps with up to 2 circuits and 4 compressors per circuit.

Parameters configuration

XVD has a Modbus RTU serial communication standard interface and the option of downloading parameter maps and applications via the Multi Function Key.

Ratiometric pressure sensors can also be connected with no need for any further serial interfaces.

All digital inputs and outputs are independent and configurable, meaning they can be adapted to suit any system.
The power supply is 24V~/24V⎓

31.1.1 Main functions

- Refrigerant selection
- Backup probes for saturation control and evaporator outlet (superheating)
- Parameter settings from SBA or PC
- Multi Function Key (**MFK**) to download or upload parameter maps and applications
- **Device**Manager software for rapid parametric programming
- Configurable ratiometric NTC inputs, Pt1000, 4...20 mA, 0...10 V, 0...5 V

31.2 Models and Features

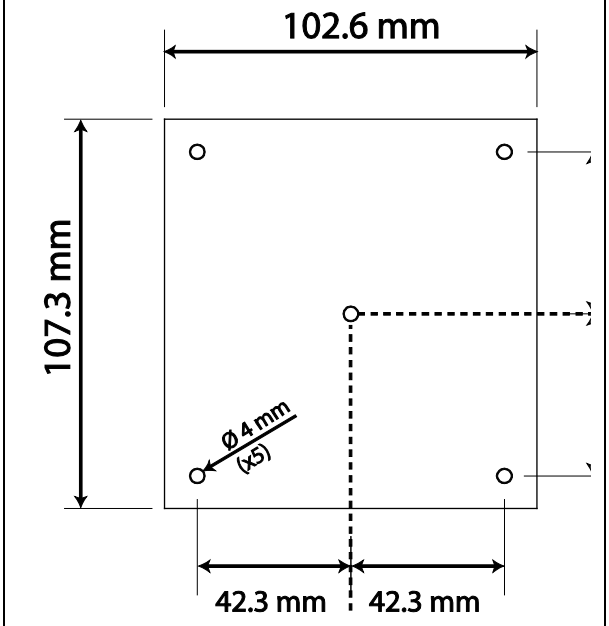
-->See Models chapter

31.3 XVD assembly

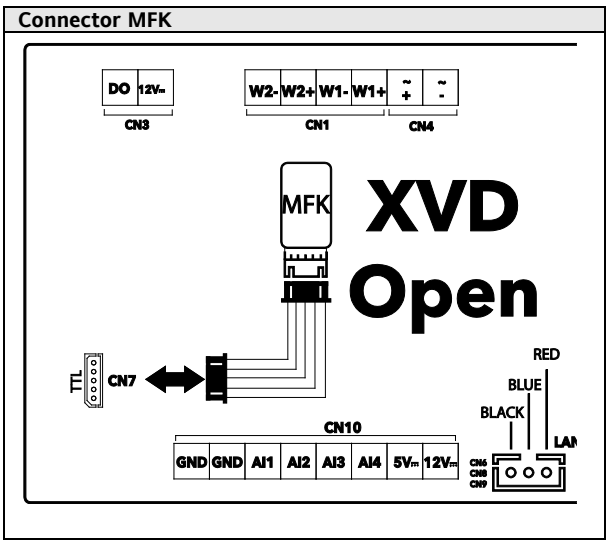
The boards are set up for installation on the rear of the panel.
To install, use plastic spacers to be inserted in the 4 holes in the board
Fit the board in environments in which the temperature does not exceed 55 °C and where there is sufficient air circulation.
The board is open and must be adequately protected from dust and water.

The permissible ambient temperature range for correct operation is between –5 and 55 °C with 90% non-condensing relative humidity.

XVD driver mechanical dimensions



Connector MFK



31.4 Electrical connections

31.4.1 General warnings

Before proceeding make sure the controller is connected to a suitable external transformer. The following rules must be followed when connecting boards to each other and to the application:

- **Check the rating data of the valve as declared by the manufacturer's manual**
- **Loads that exceed the maximum limits specified in this manual/product label must not be applied to outputs.**
- **When connecting loads, follow connection diagrams carefully.**
- **To avoid electrical coupling, wire SELV services separately from high voltage services.**

Before connecting the valve configure the XVD driver appropriately by selecting the valve type from among the compatible options

IMPORTANT!
Make sure the appliance is switched off before working on the electrical connections. All operations must be carried out by qualified personnel.

The connection is made by means of removable screw connectors (use wires with maximum section ≤2.5mm²) mounted on the boards.

To ensure proper connections, comply with the following:

- Power supplies other than those specified can seriously damage the system.
- Use cables of suitable section for the terminals
- Separate the cables of probes from inductive loads and high voltage connections to prevent any electromagnetic interference. Do not place the probe cables near other electrical equipment (switches, meters, etc.)
- Make connections as short as possible and do not wind them around electrically connected parts.
- To avoid causing static discharges, do not touch the electronic components on the boards.
- The controller must be connected to a suitable transformer that complies with the specifications provided in the Specifications chapter.

Important!
Make sure that the power supply is of the correct voltage for the controller.

31.4.1.1 Analogue Inputs-Probes

Temperature probes

Temperature probes have no connection polarity and can be extended using a normal two-core cable (note that the extension of the probes tends to impact negatively on the instrument's EMC: take great care with the wiring).

Pressure probes

Important!
Pressure probes have a specific connection polarity which must be observed.

Signal cables (temperature/pressure probes, digital inputs, TTL serial) must be wired separately from high voltage cables. Eliwell-supplied probes are recommended. Contact the Eliwell sales department for availability.

31.4.1.2 Serial connections

TTL

Use a 5-wire TTL cable up to 30cm in length.
An Eliwell-supplied TTL cable is recommended. Contact the Eliwell sales department for availability.

MFK

TTL for connection to MFK

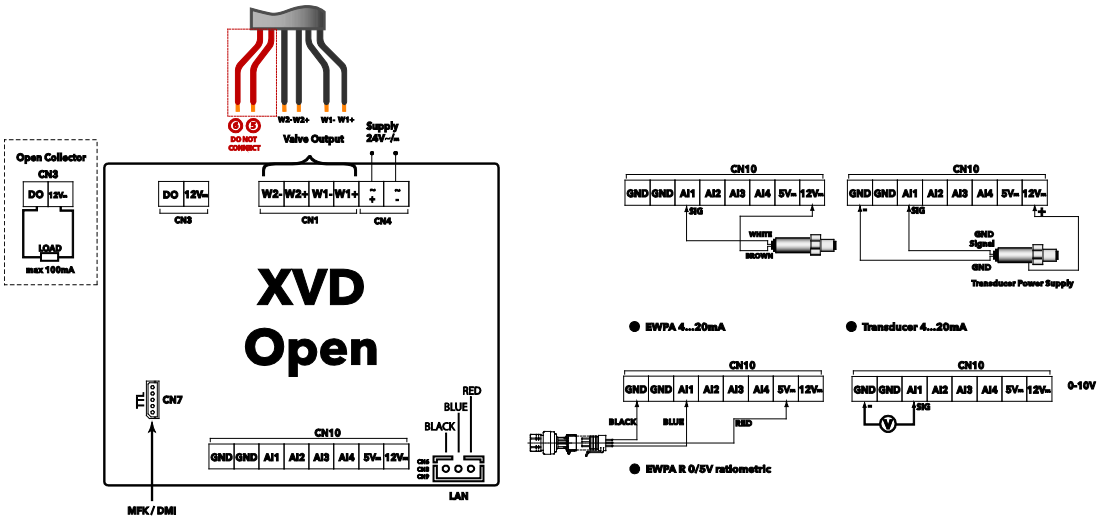
LAN

3-wire powered LAN serial output available on terminal board (removable quick connector) for connection to the LAN (see Applications section)
Max distance 100m
This connection is to be used to connect the modules of the Flex series (including the SKP 10 terminal)

N.B.: If the driver is connected in a LAN with instruments from the Energy Flex series, XVD will behave as an expansion: **the SKP 10 terminal will act on modules of the Flex series (in which the XVD parameters are replicated) and not on XVD**
To modify the parameters directly or display the resources of XVD, use the serial port in association with Device Manager

31.5 Wiring diagrams

XVD Open

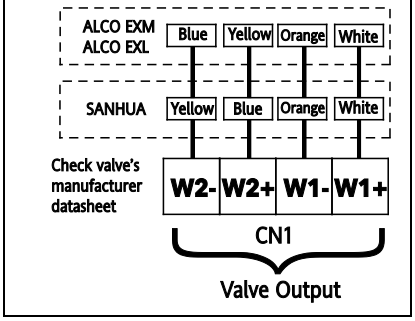


Terminal	Label	Description	Notes	Parameters SBA Folder 1L/2L
CN3	**Open Collector**	Load power Open Collector	**Max LOAD 100mA Max LOAD 100mA (CN3/12V⎓ + CN10/12V⎓)**	1L91 2L91
CN1	**Valve Output**	Valve output	**DO NOT connect / DO NOT short the 5th and 6th wire of the valve, if present**	
CN4	**Supply**	Power supply	In the case of a DC supply, check polarity	
		Ground	We advise connecting the ground wire if possible	
CN6 CN8 CN9	**LAN**	Voltage serial connection	BLACK= GND; BLUE=SIGNAL; RED=12V⎓ (INPUT)	
CN10	**GND**	Ground		
	5 V⎓	Probes power supply	For ratiometric probe	
	12V⎓	Probes power supply	Power supply for probes with 4..20 mA current input Max LOAD 100mA **(CN3/12V⎓ + CN10/12V⎓)**	
	AI1	Analogue input 1		1L10 / 1L11 / 1L20 2L10 / 2L11 / 2L20
	AI2	Analogue input 2		1L12 / 1L13 / 1L21 2L12 / 2L13 / 2L21
	AI3	Analogue input 3		1L22 2L22
	AI4	Analogue input 4		1L23 2L23
MFK		Connection to MultiFunctionKey		
CN7	TTL	Televis/MODBUS connection	Via Bus**Adapter**	

Colours of probes and transducers	
Black	Black
Blue	Blue
Brown	Brown
Red	Red
White	White
Yellow	Yellow
Signal	Signal
Transducer	Transducer
Transducer Power Supply	Transducer power supply

31.5.1 Compatible valves connection

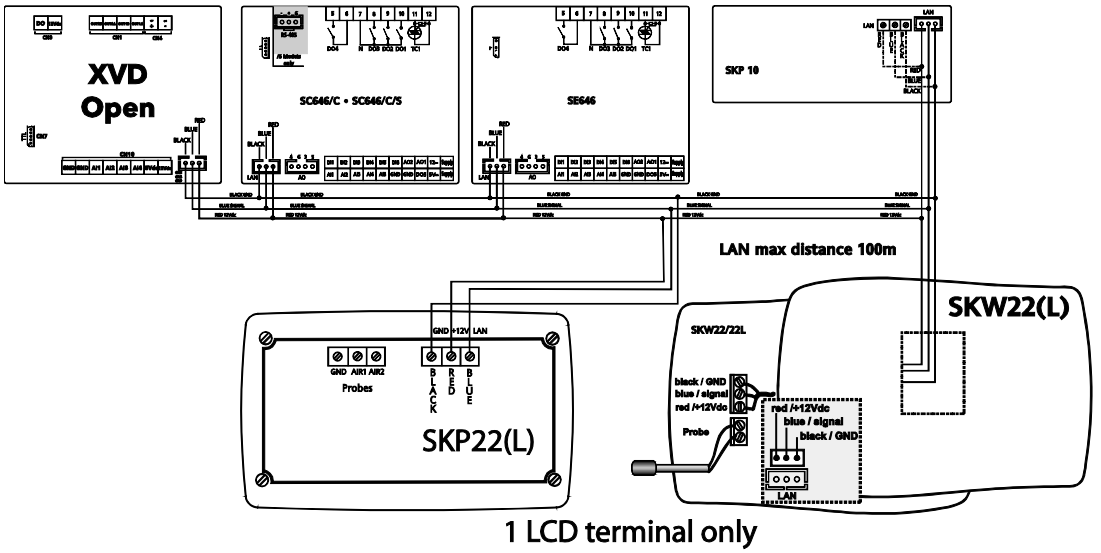
Compatible valves connection



Colour	Colour
Black	Black
Blue	Blue
Brown	Brown
Red	Red
White	White
Yellow	Yellow
Note	
Check valve manufacturer's datasheet	
Check the rating data of the valve as shown in the manufacturer's manual	

3-wire LAN powered serial output available on the terminal board for connection to SBA.
Max distance 100 m

31.5.2 Example of XVD / Energy Flex connection



Wire colours	
Black GND	Black GND
Blue Signal	Blue Signal
Red +12Vdc	Red +12Vdc
Probe	Probe

31.6 Technical Specifications

	Standard	Min.	Max.
Supply voltage	24 V~/ ⎓		
Supply frequency	50 Hz/60 Hz	---	---
Power consumption	30 VA / 25 W	---	---
Insulation class	2	---	---
Working temperature	25 °C	-5 °C	55 °C
Working humidity (non-condensing)	30%	10%	90%
Storage temperature	25 °C	-20 °C	85 °C
Storage humidity (non-condensing)	30%	10%	90%

Classification	
The product meets the requirements of the following European Community Directives:	Directive 2006/95/EC Directive 89/108/EC
It also complies with the following harmonized regulations:	EN 60730-2-6 / EN 60730-2-9 / EN 60730-1
Use	Operating (not safety) device for incorporation
Mounting	Panel or on DIN Omega bar support.
Type of action	1.B
Pollution class	2 (normal)
Voltage surge category	II
Nominal pulse voltage	2500V
Digital outputs	refer to the label on the controller
Fire resistance category	D
Software class and structure	A
PTI of materials used for insulation	PTI 250V
Period of electrical stress of insulating parts	Long period

31.7 I/O features

Analogue input	**NTC probe** 103AT 10kΩ	**NTC extended range**	**Pt1000**	**4-20 mA**	**Ratiometric 0-5V**	**0-10 V**	**Digital input**
AI1	●	●	●	●	●	●	-
AI2	●	●	●	-	-	-	-
AI3	●	●	-	-	-	-	●
AI4	●	●	-	-	-	-	●
Measurement range	-50°C ... +99.9 °C	-40°C ... +150.0 °C	-0.5 ... +99.9;	-14.5 ... +999.9;	-14.5 ... +999.9;	0.0 ... +100.0;	-
Accuracy	1% full scale	1% full scale	1% full scale	1% full scale	1% full scale	1% full scale	-
Corrective action	0.1°C	0.1°C	0.1°C	0.1 bar	0.1 bar	0.1 bar	-
Impedance	/	/	/	100Ohm	110KOhm	21KOhm	-

Digital output Open Collector safety extra low voltage SELV **DO**	1 x **Open Collector** output Max current **100mA** @12V⎓

31.8 Serial

Label	**Description**
TTL	1 TTL serial for connection with a PC via a suitable interface module
MFK	1 TTL serial port for connection to MFK to upload/download parameters and/or SW application
LAN	Removable quick connect terminals for integration of Energy Flex network

31.9 Transformer

The instrument must be connected to a suitable current transformer with the following features:

- Primary voltage: Depending on requirements of the individual device and/or country of installation.
- Secondary voltage: 24 V~/⎓
- Power supply frequency: 50/60 Hz
- Power: 30 VA / 25 W

Note: cable must be no longer than 10 m

31.9.1 Dimensions

	Length (L) mm	Depth (d) mm	Height (H) mm	Notes
XVD dimensions	102.6	1.6	107.3	Open board

31.10 MFK

Download for reset
The **Multi Function Key** (**MFK**) is an accessory that when connected to the TTL serial port, allows rapid programming of the controller parameters (up/download parameter map to or from one or more controllers of the same type) rapidly and/or the controller's application software.

For rapid programming of the parameters, the upload (label UL), download (label dL) and multi function key formatting (label Fr) operations are performed as explained below:

UPLOAD (copy from CONTROLLER to MFK)
With this operation the programming parameters will be uploaded from EVD to **MFK**
DOWNLOAD (copy from MFK to CONTROLLER)
This operation downloads the programming parameters from **MFK** to the instrument.
FORMAT*
Formatting **MFK** consists of deleting its contents
* this should be done prior to Uploading when the key is used for the first time

Connect the Key with the controller switched off.

Firmware download
At start up, if compatible firmware is installed on the **MFK** (**MFK** can be prepared with firmware using the Device Manager software), the new firmware is downloaded to the controller.
This occurs as follows:
- firmware verification/update (**MFK** LED flashes)
- termination with successful programming (**MFK LED** steadily lit)
- switch off the controller

If compatible firmware is not loaded on the **MFK**, no firmware download can occur.
If, on termination, the **MFK** LED does not remain steadily lit, the operation must be repeated as this means it has failed.

Download parameters
When the controller is switched on, if there is a compatible parameter map in the MFK the programming parameters are loaded into the controller;

N.B.:
- If the MFK is loaded with both a compatible firmware and a compatible parameter map, the firmware is downloaded first and then (after the controller has been switched off and back on again manually) the parameter map
- 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 reciprocally compatible.
- (**) a pre-programmed board supplied by Eliwell to DOWNLOAD parameters does not need to be formatted. **NOTE: Formatting CANNOT be undone.**
- after the download operation the instrument will work with the newly loaded parameters map/firmware.
- Remove the key on completion of the operation

31.11 Operation

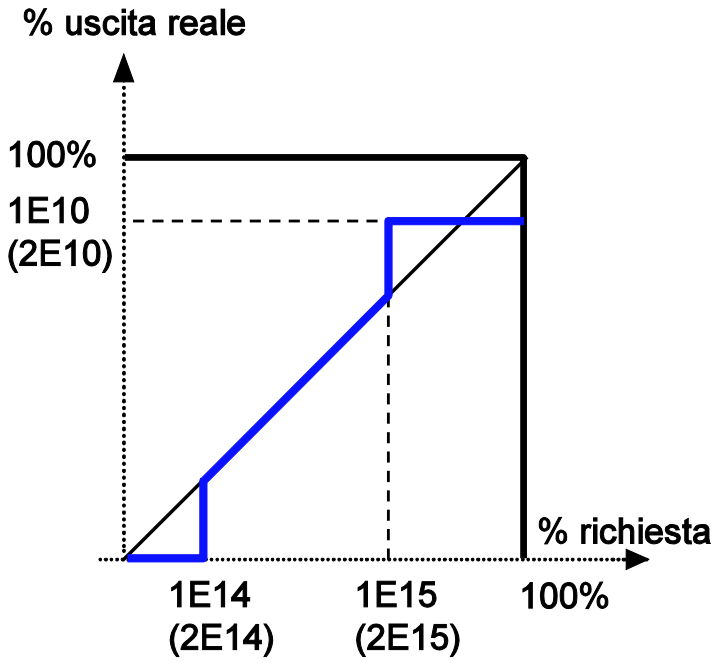
XVD is a controller for electronic step type expansion valves that regulates the minimum superheating value at the evaporator outlet.

The regulation value is the percentage opening of the valve, which is translated into a percentage of activation of the valve output on the basis of the following parameters:
• **1E10 / 2E10** - **Maximum valve opening percentage (**maximum opening of the valve);
• **1E14 / 2E14** - **Minimum valve useful opening percentage (**minimum effective opening of the valve);
• **1E15 / 2E15** - **Maximum valve opening percentage (**maximum effective opening of the valve).

If the regulator commands an output greater than or equal to **1E15 / 2E15**, the actual output will be equal to **1E10 / 2E10**.
N.B.: If **1E15 >1E10 (2E15 > 2E15)** the function is disregarded.

If the regulator commands an output less than or equal to **dE14**, the actual output will be 0.

If the regulator commands an output greater than or equal to **1E10 / 2E10** for a time greater than **1E13 / 2E13** a maximum opening alarm **E108 / E208** is generated to signal a critical condition of the system, such as low charge, undersized design, etc.
N.B.: to disable this signal set **1E13 / 2E13** =0.



Saturation set
XVD calculates the real superheating value using the two analogue inputs for superheating, dA13, and saturation, dAI1.

By means of a PID controller the regulator modulates opening of the valve in such a way that superheating reaches setpoint **1E32 / 2E32**. The algorithm is dynamic: the effective superheating value may fail to reach the programmed setpoint or it may drop below said value temporarily.
If this results in the egress of liquid from the evaporator the **1E32 / 2E32** setpoint value must be increased.
N.B.: valid for **1E30=1 (2E30=1)**

System type 1E21 (2E21).
The PID configuration parameters will be uploaded automatically by the controlled by selecting the type of system defined by parameter **1E21 / 2E21**.

MOP (Maximum Operating Pressure)
MOP regulation envisages a threshold defined by the pressure setpoint **1E52 / 2E52.**
Once this threshold has been exceeded for a time greater than **1E53 / 2E53**, a MOP alarm will be generated (see **E107 / E207**).

- MOP regulation can be enabled by means of parameter **1E501/ 2E50.**
- MOP regulation can be disabled when the controller is powered on / on return from a defrost condition for a time equal to **1E51 / 2E51**.

31.12 XVD applications

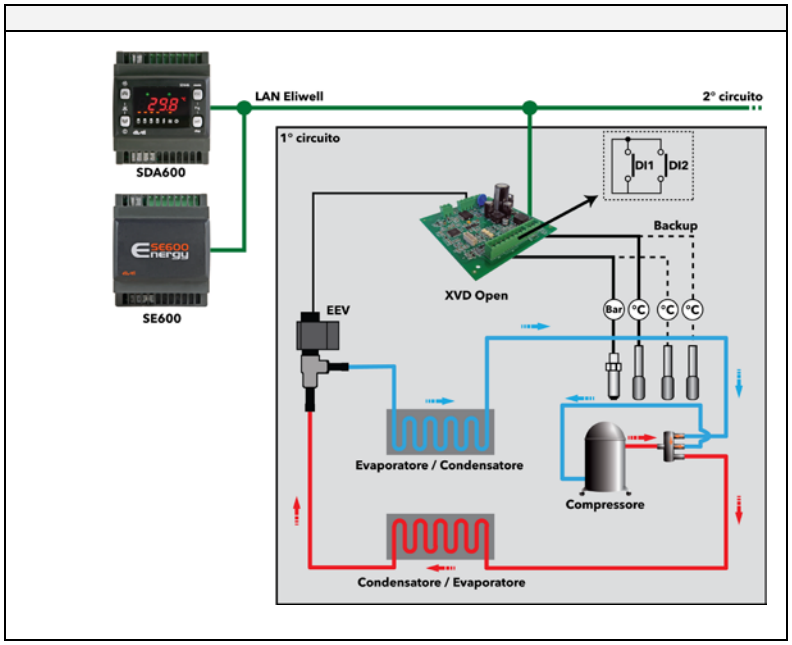
31.12.1.1 Digital Inputs regulation

AI3 and AI4 can be configured as digital inputs.
Setup of digital inputs is performed by means of parameters 1L40 and 1L41 / 2L40 and 2L41
If they are different from zero the digital inputs assume priority over the corresponding serial commands (if they are configured in the same manner AI3 assumes priority).
The command is transmitted on a digital input or serial interface on the basis of parameters dF02 / dF02

Value 1L40/1L41 2L40/2L41			
±1	ON	Regulation activation	Forcing valve opening to value: **1E11/2E11 - Valve actuation percentage after power loss** For a period: **1E35/2E35 - Valve opening freeze timer after OFF->ON**
	OFF	Regulation deactivation	Valve closing (saving of current percentage to **1E11/2E11**)
±2	ON	Defrost	Valve closing Note: the digital input configured ±1 is disregarded until defrost end At the end of the defrost cycle the valve is forced open to the value defined by: **1E12/2E12 - Valve actuation percentage after defrost (If ≠ 0)** Otherwise refer to **1E11/2E11**
	OFF	No defrost	See regulation ON
±3	ON	Preheat	Valve closing
	OFF	No alarm	/
±4	ON	Preset factory regulation	Activation of regulation with profile defined by **1E22/2E22 – Type of system operating mode HEAT**
	OFF		Activation of regulation with profile defined by **1E21/2E21 – Type of system operating mode COOL**

31.12.2 Example of 1 circuit heat pump application

• Driver XVD controls the electronic expansion valve (EEV)
• Driver XVD receives commands for defrosting and control of EEV from Energy Flex via the Eliwell LAN.
In the absence of communication XVD closes valve EEV and signals an alarm condition.



31.12.3 Example of 2 circuit heat pump

Application 2 XVD drivers - 1 Energy Flex series controller
The network can manage a maximum of 2 XVD drivers + 1 Energy Flex
- Driver 1 controls electronic expansion valve 1 (first circuit EEV);
- Driver 2 controls electronic expansion valve 2 (second circuit EEV)

- Drivers 1&2 receive commands for defrosting and control of the respective expansion valves EEV (1 per circuit) from Energy Flex via the Eliwell LAN.

Set the network address using the dipswitches for XVD;
- 0= first circuit);
- 1= second circuit

In the absence of communication XVD closes valve EEV and signals an alarm condition.

31.13 Alarms

The XVD controller can run full diagnostics on the system, signalling any operating faults with specific alarms, and record and signal, directly on the SBA display, specific user-defined events to achieve greater control over the system as a whole.

Alarm conditions

The alarm condition is always signalled by LEDs in correspondence with the alarm icon and by activation of the output on relays, if appropriately configured.
Probe errors are displayed directly on the SBA display

Alarms Table
See SBA600 Alarms section

31.14 Configuration with Modbus RTU

The TTL serial port - which we will call COM0 – can be used to configure the controller, parameters, states, and variables with Modbus via the Modbus protocol.

Modbus is a client/server protocol for communication between devices connected in a network.
Modbus devices communicate using a master-slave technique in which only one device (master) can send messages. The other devices in the network (slaves) respond, returning the data requested by the master or executing the action specified in the message sent. A slave is a device connected to a network that processes information and sends the results to the master using the Modbus protocol.
The master device can send messages to individual slaves or to the entire network (broadcast) whilst slaves can only respond individually to the master.
The Modbus standard used by Eliwell employs the RTU code for data transmission.

31.14.1 Data format (RTU)

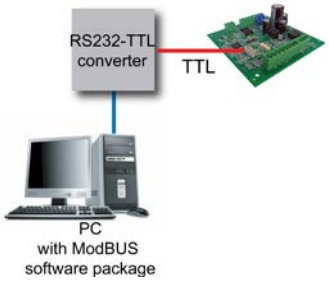
The coding model used defines the structure of messages transmitted on the network and the way in which this information is deciphered. The type of coding is usually selected on the basis of specific parameters (baud rate, parity, etc.)***; furthermore, some devices support only specific coding models, although it must be the same one for all devices connected in a Modbus network.
The protocol uses the RTU binary method with bytes configured as follows:
8 bits for data, even parity bit, 1 stop bit (non-configurable).

***can be set via parameters

- **dF30 - Modbus protocol controller address**
- **dF31 - Modbus protocol baud rate**
- **dF32 - Modbus protocol parity**

Parameter setting allows full configurability of the controller. The parameters are editable by sending data via the Modbus protocol directly to an individual controller.
The connection diagram when using Modbus is shown below

ModBus - Connection diagram of single controller via TTL



31.14.2 Modbus commands available and data areas

The following commands are implemented:

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	60 BYTES
Maximum length in bytes of messages received by device	60 BYTES

31.15 Configuration of device address

The address of a device (Device Number) in a ModBus message is defined by parameter **dF30**
The address 0 is used for broadcast messages that all slaves recognize. Slaves do not respond to broadcast messages.

31.15.1 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).

31.15.2 Configuration of variable addresses / states

List of addresses

31.16 Table of XVD parameters

Folder label	Meaning of acronym (label)	Parameters:
dF	**d**river protocol con**F**iguration	Protocols Configuration
dE	**D**river valve configuration	Valve configuration

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

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VALUE PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
dF	**dF10**	**49166**	BYTE					RW	Lincus protocol controller address COM0 • 2= XVD 1 (MASTER XVD) • 3= XVD 2 (SLAVE XVD) Other values NOT USED	0 … 15	2	num.
dF	dF30	**49175**	BYTE			**49437.6**	Y	RW	**Modbus protocol controller address** NOTE: 0 (zero) is not included	1 … 255	1	num.
dF	dF31	**49176**	BYTE			**49438**	Y	RW	• **Modbus protocol Baudrate** • 0=1200 baud • 1=2400 baud • 2=4800 baud • 3=9600 baud • 4=19200 baud • 5=38400 baud (maximum speed that can be set using **Device**Manager software) • 6=57600 baud • 7=115200 baud	0 … 7	3	num.
dF	dF32	**49177**	BYTE			**49438.2**	Y	RW	• **Modbus protocol parity** • 0 = NONE • 1= EVEN • 2= ODD	0 … 2	1	num.
dF	**dF60**	**16426**	BYTE					RW	**Client code 1**	0 … 999	0	num.
dF	**dF61**	**16428**	BYTE					RW	**Client code 2**	0 … 999	0	num.

Parameters dE01...dE09/dE80 are visible and settable only if the SBA600 parameter 1E00 / 2E00 - Valve model =0.
The Modbus addresses in the case of 1E00 / 2E00 =0 are shown below
Note that visibility of parameters dE01...dE09/dE80 cannot be set via serial line
Check the data shown in the valve manual supplied by the manufacturer to ensure they are correctly configured

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VALUE PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
dE	dE01	**16720**	WORD			/	Y	RW	**Stepper motor maximum speed** Establishes the maximum speed of the valve motor to ensure the steps are precise and complete	-1999 ... 9999	See table A	Steps (step/s)
dE	dE02	**16752**	WORD			/		RW	**Stepper motor complete opening** Defines the maximum number of valve steps. Total excursion is referred to FULL STEP mode (dE07=0) Complete opening of the valve is determined by arrival at said value	0 ... 9999	See table A	Steps
dE	dE03	**49552**	BYTE			/		RW	**Stepper motor extra movement in total closure** Defines the number of extra steps of the valve beyond the full stroke position to ensure correct total closure. A total closure command means the valve will be positioned at zero plus an additional number of steps dE03	0. .. 255	See table A	Steps
dE	dE04	**16800**	WORD			/		RW	**Stepper motor winding maximum current** Defines the maximum current per phase utilised by the valve (maximum torque)	0 ... 9999	See table A	mA
dE	dE05	**49600**	BYTE			/		RW	**Stepper motor winding resistance** Defines the electrical resistance of each phase winding (connection faults check)	0 ... 255	See table A	Ohms
dE	dE06	**16848**	WORD			/		RW	**Stepper motor winding rated current** Defines the current circulating in the phases in the valve stopped condition (minimum torque)	0 ... 9999	See table A	mA
dE	dE07	**16848**	BYTE			/		RW	**Type of stepper motor control** Defines the control mode. • 0= FULL STEP • 1= FULL STEP • 2= MICRO STEP Note that current control is at the maximum value for FULL STEP mode while for the other two modes modulating the winding current value allows higher resolution and smoother movements although with lower torque. Refer to stepper motor literature for more details	0 ... 2	See table A	num.
dE	dE08	**50960**	BYTE			/		RW	**Activate / disable stepper motor duty cycle** In the case of Superheating of the valve reduce the activation duty cycle to give it time to cool	0 ... 100	See table A	%
dE	dE09	**50976**	BYTE			/		RW	**Stepper motor acceleration / deceleration** Defines acceleration/deceleration at motor start/stop. The time between one step and the next is reduced by dE09 ms at each step until dE01 is reached If =0 no acceleration is applied	0 ... 255	See table A	10*ms/step
dE	dE80	**49648**	BYTE			/		RW	**Stepper motor minimum speed for acceleration / deceleration** Defines the minimum speed at which the motor starts and stops	0 ... 255	See table A	Steps Steps/s

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VALUE PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
dE	dE19	**49648**	BYTE			/		RW	**Tolerance on stepper motor winding resistance** (the value is expressed as a percentage of dE05) Defines the extent to which the load resistance is considered to be variable with respect to the parameter defined by dE05 (wiring faults check)	0 ... 255	255	%
dE	dE93	**49231**	BYTE			**49444.2**	Y	RW	**Motor activation / disabling time** Defines the period of stepper motor activation / deactivation cycles (Duty cycle. See dE08	0 ... 255	10	Sec*10
Parameters dE30...dE38/dE50...dE53 can be displayed and set on the basis of parameters dE21...dE23 **The Modbus addresses in the case of dE21=0 are shown below** **Note that visibility of these parameters cannot be set via serial line**												
dE	dE30	**49308**	BYTE			**49445.6**		RW	**Enable reference superheating recalculation** Makes it possible to enable automatic recalculation of the reference setpoint for superheating control 0= recalculation disabled. Setpoint = dE32; 1 = automatic recalculation enabled	0...1	0	num.
dE	dE31	**16512**	WORD		-1	**49446**		RW	**Superheating upper threshold** Makes it possible to set setpoint **SP4** a to **dE31 (SP2)** for control of superheating after a power loss or on exit from a defrost cycle. Active for the time defined by **dE51** (or during disabling of MOP function)	0...1000	60	°C/°F
dE	dE32	**16510**	WORD		-1	**49446.2**		RW	**Superheating lower threshold** Makes it possible to program setpoint **SP2** for control of superheating (target superheating) If dE30=1 and the calculated setpoint < **1E32**, the dynamic setpoint will be set = **dE32**.	0...1000	60	°C/°F
dE	dE33	**16514**	WORD			**49446.4**		RW	**Superheating reference recalculation period** Valid for dE30=1 Defines period of recalculation of the dynamic setpoint (every dE33 seconds)	0...999	20	sec
dE	dE34	**16516**	WORD		-1	**49446.6**		RW	**Superheating recalculation step** The dynamic setpoint varies by dE34 degrees in accordance with the superheating value with respect to dE32.	0...1000	1	°C/°F
dE	dE35	**16470**	WORD			**49447**		RW	**Valve opening freezing timer after OFF->ON**	0...1999	0	sec
dE	dE36	**16518**	WORD	Y	-1	**49447.2**		RW	**Superheating proportional band**	-9999...-1	-100	K
dE	dE37	**16520**	WORD			**49447.4**		RW	**Superheating full time**	0...1999	40	sec
dE	dE38	**16522**	WORD			**49447.6**		RW	**Superheating derivative time**	0...1999	0	sec
dE	dE50	**49270**	BYTE			**49450.4**		RW	**Enable MOP** 0=MOP disabled; 1=MOP enabled.	0 ... 1	0	num.

FOLDER	LABEL	VALUE PAR ADDRESS	DATA SIZE	CPL	EXP	VALUE PAR ADDRESS	RESET (Y/N)	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
dE	dE51	**16478**	WORD			**49450.6**		RW	**MOP disable duration** Delay time for MOP activation at startup or return from a defrost cycle.	0 ...999	0	sec
dE	dE52	**16472**	WORD	Y	-1	**49451**		RW	**Evaporator temperature upper threshold** MOP setpoint	-60 ... 100	0	°C/°F
dE	dE53	**49271**	BYTE			**49451.2**		RW	**Min time that temperature upper threshold is exceeded for alarm activation** If threshold dE52 is exceeded for a time longer than dE53 the MOP alarm is tripped.	0 ... 255	180	sec

The default values for compatible valves (selectable via **1E00 / 2E00 – Valve Model ≠0**) are factory settings and cannot be edited
Refer to the summary table with the default values

1E00 - 2E00	VALVE type	dE01	dE02	dE03	dE04	dE05	dE06	dE07	dE08	dE09	dE80
		Steps/s	steps	steps	mA	Ohms	mA	Num.	%	10*ms/step	Steps/s
0	**customisable**	**-45**	**250**	**50**	**105**	**92**	**35**	**1**	**100**	**50**	**10**
1…12, 15	NOT USED	/	/	/	/	/	/	/	/	/	/
13	ALCO EXM / EXL	45	250	50	200	133	70	1	100	50	10
14	SANHUA QA(Q)	-45	250	50	105	92	35	1	100	50	10

The default values of the factory preset configurations can be altered via serial line. Refer also to the following table

31.16.1 Table A

Valve configuration parameters dE01..dE09, dE80 with 1E00 / 2E00 – Valve model ≠0

1E00/2E00	VALVE	LABEL	PAR VALUE ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
0	**customisable**	**See parameters / visibility table**									
13	ALCO EXM / EXL	**dE01**	**16746**	WORD			RW	Stepper motor maximum speed	0 … 9999	45	steps/s
13	ALCO EXM / EXL	**dE02**	**16778**	WORD			RW	Stepper motor complete opening	0 … 9999	250	steps
13	ALCO EXM / EXL	**dE03**	**49565**	BYTE			RW	Stepper motor extra movement in total closure	0 … 255	50	steps
13	ALCO EXM / EXL	**dE04**	**16826**	WORD			RW	Stepper motor winding maximum current	0 … 9999	200	mA
13	ALCO EXM / EXL	**dE05**	**49613**	BYTE			RW	Stepper motor winding resistance	0 … 255	133	ohms
13	ALCO EXM / EXL	**dE06**	**16874**	WORD			RW	Stepper motor winding rated current	0 … 9999	70	mA
13	ALCO EXM / EXL	**dE07**	**49661**	BYTE			RW	Type of stepper motor control	0 … 2	1	num.
13	ALCO EXM / EXL	**dE08**	**50973**	BYTE			RW	Activate/disable stepper motor duty cycle	0 … 100	100	%
13	ALCO EXM / EXL	**dE09**	**50989**	BYTE			RW	Stepper motor acceleration / deceleration	0 … 255	50	ms*10/step
13	ALCO EXM / EXL	**dE80**	**51005**	BYTE			RW	Stepper motor minimum speed for acceleration/deceleration	0 … 255	10	steps/s
14	SANHUA QA(Q)	**dE01**	**16748**	WORD			RW	Stepper motor maximum speed	0 … 9999	-45	steps/s
14	SANHUA QA(Q)	**dE02**	**16780**	WORD			RW	Stepper motor complete opening	0 … 9999	250	steps
14	SANHUA QA(Q)	**dE03**	**49566**	BYTE			RW	Stepper motor extra movement in total closure	0 … 255	50	steps
14	SANHUA QA(Q)	**dE04**	**16828**	WORD			RW	Stepper motor winding maximum current	0 … 9999	105	mA
14	SANHUA QA(Q)	**dE05**	**49614**	BYTE			RW	Stepper motor winding resistance	0 … 255	92	ohms
14	SANHUA QA(Q)	**dE06**	**16876**	WORD			RW	Stepper motor winding rated current	0 … 9999	35	mA
14	SANHUA QA(Q)	**dE07**	**49662**	BYTE			RW	Type of stepper motor control	0 … 2	1	num.
14	SANHUA QA(Q)	**dE08**	**50974**	BYTE			RW	Activate / disable stepper motor duty cycle	0 … 100	100	%
14	SANHUA QA(Q)	**dE09**	**50990**	BYTE			RW	Stepper motor acceleration / deceleration	0 … 255	50	ms*10/step
14	SANHUA QA(Q)	**dE80**	**51006**	BYTE			RW	Stepper motor minimum speed for acceleration/deceleration	0 … 255	10	steps/s

31.16.2 Table B

Working modes

The default values for operating modes (selectable via **SBA600 parameters 1E21/2E21 1E22/2E22 ≠0)** are preset in the factory and cannot be edited
Refer to the summary table with the default values

		Flag	K	K	sec	K	sec	K	sec	sec		Flag	sec	°C	sec
1E21/1E22 2E21/2E22	**Parameters**	**1E30 2E30**	**1E31 2E31**	**1E32 2E32**	**1E33 2E33**	**1E34 2E34**	**1E35 2E35**	**1E36 2E36**	**1E37 2E37**	**1E38 2E38**	**...**	**1E50 2E50**	**1E51 2E51**	**1E52 2E52**	**1E53 2E53**
0	**Customisable See parameters 1E30...1E38, 1E50...1E53 SBA600**	**0**	**50**	**50**	**20**	**1**	**0**	**-100**	**40**	**0**		**10**	**10**	**10**	**10**
1E21/1E22 2E21/2E22	**Operating mode**	**dE30**	**dE31**	**dE32**	**dE33**	**dE34**	**dE35**	**dE36**	**dE37**	**dE38**	**...**	**dE50**	**dE51**	**dE52**	**dE53**
12	**COOL**	0	60	60	20	1	0	-100	40	0		0	0	0	180
13	**HEAT**	0	60	60	20	1	0	-60	60	0		0	0	0	180
14		0	60	60	20	1	0	-30	100	0		0	0	0	180
15		0	60	60	20	1	0	-20	150	0		0	0	0	180
16		0	60	60	20	1	0	-15	100	0		0	0	0	180

The default values of the factory preset configurations can be altered via serial line. Refer also to the following table

FOLDER	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
Vx	**V12_dE30**	**50397**	BYTE			RW	Enable reference Superheating recalculation	0 ... 1	0	flag
Vx	**V12_dE31**	**17632**	WORD		-1	RW	Superheating upper threshold	0 ... 1000	60	K
Vx	**V12_dE32**	**17630**	WORD		-1	RW	Superheating lower threshold	0 ... 1000	60	K
Vx	**V12_dE33**	**17634**	WORD			RW	Superheating reference recalculation period	0 ... 999	20	seconds
Vx	**V12_dE34**	**17636**	WORD		-1	RW	Superheating recalculation step	0 ... 1000	1	K
Vx	**V12_dE35**	**17658**	WORD			RW	Valve opening freezing timer after OFF->ON	0 ... 1999	0	seconds
Vx	**V12_dE36**	**17638**	WORD	Y	-1	RW	Superheating proportional band	-9999 ... -1	-100	K
Vx	**V12_dE37**	**17640**	WORD			RW	Superheating full time	0 ... 1999	40	seconds
Vx	**V12_dE38**	**17642**	WORD			RW	Superheating derivative time	0 ... 1999	0	seconds
Vx	**V12_dE50**	**50396**	BYTE			RW	Enable MOP	0 ... 1	0	flag
Vx	**V12_dE51**	**17600**	WORD			RW	Duration of MOP disable time at start-up	0 ... 999	0	seconds
Vx	**V12_dE52**	**17602**	WORD	Y	-1	RW	Evaporator temperature upper threshold	-600 ... 1000	0	°C
Vx	**V12_dE53**	**50395**	BYTE			RW	Min time that temp upper threshold is exceeded for alarm activation	0 ... 255	180	seconds
Vx	**V13_dE30**	**50461**	BYTE			RW	Enable reference superheating recalculation	0 ... 1	0	flag
Vx	**V13_dE31**	**17696**	WORD		-1	RW	Superheating upper threshold	0 ... 1000	60	K
Vx	**V13_dE32**	**17694**	WORD		-1	RW	Superheating lower threshold	0 ... 1000	60	K
Vx	**V13_dE33**	**17698**	WORD			RW	Superheating reference recalculation period	0 ... 999	20	seconds

FOLDER	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
Vx	**V13_dE34**	**17700**	WORD		-1	RW	Superheating recalculation step	0 ... 1000	1	K
Vx	**V13_dE35**	**17722**	WORD			RW	Valve opening freezing timer after OFF->ON	0 ... 1999	0	seconds
Vx	**V13_dE36**	**17702**	WORD	Y	-1	RW	Superheating proportional band	-9999 ... -1	-60	K
Vx	**V13_dE37**	**17704**	WORD			RW	Superheating full time	0 ... 1999	60	seconds
Vx	**V13_dE38**	**17706**	WORD			RW	Superheating derivative time	0 ... 1999	0	seconds
Vx	**V13_dE50**	**50460**	BYTE			RW	Enable MOP	0 ... 1	0	flag
Vx	**V13_dE51**	**17664**	WORD			RW	Duration of MOP disable time at start-up	0 ... 999	0	seconds
Vx	**V13_dE52**	**17666**	WORD	Y	-1	RW	Evaporator temperature upper threshold	-600 ... 1000	0	°C
Vx	**V13_dE53**	**50459**	BYTE			RW	Min time max temp threshold exceeded for alarm activation	0 ... 255	180	seconds
Vx	**V14_dE30**	**50525**	BYTE			RW	Enable reference superheating recalculation	0 ... 1	0	flag
Vx	**V14_dE31**	**17760**	WORD		-1	RW	Superheating upper threshold	0 ... 1000	60	K
Vx	**V14_dE32**	**17758**	WORD		-1	RW	Superheating lower threshold	0 ... 1000	60	K
Vx	**V14_dE33**	**17762**	WORD			RW	Superheating reference recalculation period	0 ... 999	20	seconds
Vx	**V14_dE34**	**17764**	WORD		-1	RW	Superheating recalculation step	0 ... 1000	1	K
Vx	**V14_dE35**	**17786**	WORD			RW	Valve opening freezing timer after OFF->ON	0 ... 1999	0	seconds
Vx	**V14_dE36**	**17766**	WORD	Y	-1	RW	Superheating proportional band	-9999 ... -1	-30	K
Vx	**V14_dE37**	**17768**	WORD			RW	Superheating full time	0 ... 1999	100	seconds
Vx	**V14_dE38**	**17770**	WORD			RW	Superheating derivative time	0 ... 1999	0	seconds
Vx	**V14_dE50**	**50524**	BYTE			RW	Enable MOP	0 ... 1	0	flag
Vx	**V14_dE51**	**17728**	WORD			RW	Duration of MOP disable time at start-up	0 ... 999	0	seconds
Vx	**V14_dE52**	**17730**	WORD	Y	-1	RW	Evaporator temperature upper threshold	-600 ... 1000	0	°C
Vx	**V14_dE53**	**50523**	BYTE			RW	Min time max temp threshold exceeded for alarm activation	0 ... 255	180	seconds
Vx	**V15_dE30**	**50589**	BYTE			RW	Enable reference superheating recalculation	0 ... 1	0	flag
Vx	**V15_dE31**	**17824**	WORD		-1	RW	Superheating upper threshold	0 ... 1000	60	K
Vx	**V15_dE32**	**17822**	WORD		-1	RW	Superheating lower threshold	0 ... 1000	60	K
Vx	**V15_dE33**	**17826**	WORD			RW	Superheating reference recalculation period	0 ... 999	20	seconds
Vx	**V15_dE34**	**17828**	WORD		-1	RW	Superheating recalculation step	0 ... 1000	1	K
Vx	**V15_dE35**	**17850**	WORD			RW	Valve opening freezing timer after OFF->ON	0 ... 1999	0	seconds
Vx	**V15_dE36**	**17830**	WORD	Y	-1	RW	Superheating proportional band	-9999 ... -1	-20	K
Vx	**V15_dE37**	**17832**	WORD			RW	Superheating full time	0 ... 1999	150	seconds
Vx	**V15_dE38**	**17834**	WORD			RW	Superheating derivative time	0 ... 1999	0	seconds
Vx	**V15_dE50**	**50588**	BYTE			RW	Enable MOP	0 ... 1	0	flag
Vx	**V15_dE51**	**17792**	WORD			RW	Duration of MOP disable time at start-up	0 ... 999	0	seconds
Vx	**V15_dE52**	**17794**	WORD	Y	-1	RW	Evaporator temperature upper threshold	-600 ... 1000	0	°C
Vx	**V15_dE53**	**50587**	BYTE			RW	Min time max temp threshold exceeded for alarm activation	0 ... 255	180	seconds
Vx	**V16_dE30**	**50653**	BYTE			RW	Enable reference superheating recalculation	0 ... 1	0	flag
Vx	**V16_dE31**	**17888**	WORD		-1	RW	Superheating upper threshold	0 ... 1000	60	K

FOLDER	LABEL	ADDRESS	DATA SIZE	CPL	EXP	R/W	DESCRIPTION	RANGE	DEFAULT	U.M.
Vx	**V16_dE32**	**17886**	WORD		-1	RW	Superheating lower threshold	0 ... 1000	60	K
Vx	**V16_dE33**	**17890**	WORD			RW	Superheating reference recalculation period	0 ... 999	20	seconds
Vx	**V16_dE34**	**17892**	WORD		-1	RW	Superheating recalculation step	0 ... 1000	1	K
Vx	**V16_dE35**	**17914**	WORD			RW	Valve opening freezing timer after OFF->ON	0 ... 1999	0	seconds
Vx	**V16_dE36**	**17894**	WORD	Y	-1	RW	Superheating proportional band	-9999 ... -1	-15	K
Vx	**V16_dE37**	**17896**	WORD			RW	Superheating full time	0 ... 1999	100	seconds
Vx	**V16_dE38**	**17898**	WORD			RW	Superheating derivative time	0 ... 1999	0	seconds
Vx	**V16_dE50**	**50652**	BYTE			RW	Enable MOP	0 ... 1	0	flag
Vx	**V16_dE51**	**17856**	WORD			RW	Duration of MOP disable time at start-up	0 ... 999	0	seconds
Vx	**V16_dE52**	**17858**	WORD	Y	-1	RW	Evaporator temperature upper threshold	-600 ... 1000	0	°C
Vx	**V16_dE53**	**50651**	BYTE			RW	Min time max temp threshold exceeded for alarm activation	0 ... 255	180	seconds

32 MODELS AND ACCESSORIES

32.1 Models

32.1.1 Models SB ● SD ● SC

Model	Digital inputs (§)	Digital inputs (*)	Analogue outputs (*)	PWM analogue outputs (**)	Analogue outputs (**)	Analogue inputs (**)	Digital outputs
	(DI1...DI6)	(DO1...DO4) (+ DO6)	(TC1)	(AO1-AO2)	(AO3-AO5)	(AI)	(DO5)
646	**6**	**4**	**1**	**2**	**3**	5	1
655	**6**	**5**	//	**2**	**3**	5	1
Model	**(DI1...DI6)**	**(DO1 DO2 DO3)**	**(TC1, TC2)**	**(A01)**	**(AO3-AO5)**	**(AI)**	**(DO4, DO5)**
636	**6**	**3**	**2**	**1**	**3**	5	2

32.1.2 Expansion modules

Model	Digital inputs (§)	Digital inputs (*)	Analogue outputs (*)	PWM analogue outputs (**)	Analogue outputs (**)	Analogue inputs (**)	Digital outputs
	(DI1...DI6)	(DO1...DO4) (+ DO6)	(TC1)	(AO1-AO2)	(AO3-AO5)	(AI)	(DO5)
SE632	**6**	**3**	//	**2**	//	3	1
SE646	**6**	**4**	1	**2**	**3**	5	1
SE655	**6**	**5**	//	**2**	**3**	5	1

TTL supplied as standard
(*) high voltage
(**) low voltage (SELV: SAFETY EXTRA LOW VOLTAGE)
(§) voltage free
(§§) instead of OC: PPM
outputs Open Collector
PWM Pulse Width Modulation
PPM Pulse Position Modulation
/S integrated RS485 serial
/C indicates the presence of an RTC (Real Time Clock)
NOTE: TC2 corresponds to AO2 (TC2=AO2) - see chapter Plant configuration (folder PAr/CL-Cr-CF)

32.1.3 Models XVD

Model	Voltage-free analogue Safety low voltage (SELV)	Digital Output Open Collector	LAN	Power supply
XVD Open	**4**	1	**YES**	24 V~/⎓ Imax 0.8 A/ph

32.1.4 List of compatible valves

Driver XVD is compatible with the valves listed below.
For use with other valves consult Eliwell Technical Support.
Eliwell cannot assume liability in relation to data supplied by the valve manufacturer, including technical alterations and updates.
Always consult the valve manufacturer's technical manual to check the rating data and correct operation of the valve.

Model	Power supply	Notes
SANHUA QA(Q)12		**single pole**
ALCO EXM246		**single pole**
ALCO EXM246		**single pole**

32.1.5 Terminals

Model		Mounting	Dimensions	Display	Voltage-free analogue Safety low voltage (SELV)
SKP10		**Panel**	**74x32x30 mm**	**LED / 4 digit**	-
SKW22		**Wall**	**137x96.5x31.3 mm**	**LCD**	1 integrated NTC 1 configurable V/I input
SKW22L		**Wall**	**137x96.5x31.3 mm**	**LCD backlit**	1 integrated NTC 1 configurable V/I input
SKP22		**Panel (°)**	**160x96x10mm**	**LCD**	1 NTC input 1 configurable NTC/DI/4...20 mA input
SKP22L		**Panel (°)**	**160x96x10mm**	**LCD backlit**	

Power supply from base
(*) Contact the Eliwell Sales Office for wall-mounting accessories.

32.2 Accessories

N.B.: The photos are purely guideline to show the *accessories*. The dimensions shown in the figures are not to scale.

Name		Part number	Description		Documentation / Notes
Transformer		TF411205	230V~/12V 6VA transformer (protected)		
		TF411210	230V~/12V 11VA transformer (protected)		
Multi Function Key		MFK100T000000	Programming key to upload/download parameters Alarms and applications log		
Expansion module EXP11		MW320100	230V 10A expansion module with base fitted to DIN guide		
Cables		COLV0000E0100	Wiring (connector + 1m cables) to connect safety low voltage inputs and outputs (SELV)		
		COLV0000035100	WIRING for serial port RS-485		
		COLV000042100	WIRING Smart – AO3-4-5 (connector + 1m cables)		
EMC filter		FT111201	LC filter, network filter, recommended for applications with fan speed control.		
Temperature probes		SN691150	NTC probe 103AT, 1.5m (plastic cap, 2-wire cable)		
		SN8DED11502C0	NTC103AT 1.5m IP 68 5x20 -50+110°C		**Double insulated Cable**
		SN8DED13002C0	NTC103AT 3.0m IP 68 5x20 -50+110°C		
		SN8DAE11502C0	NTC103AT 1.5m IP 68 6x20 -50+110°C		
		SN8DAE13002C0	NTC103AT 3.0m IP 68 6x20 -50+110°C		
Ratiometric transducers		TD420010	Ratiometric transducer EWPA 010 R 0/5V 0/10BAR Female connector		**Includes packard IP67 2m cable**
		TD420030	Ratiometric transducer EWPA 030 R 0/5V 0/30BAR Female connector		
		TD420050	Ratiometric transducer EWPA 050 R 0/5V 0/50BAR Female connector		
Pressure *transducers* (1)		(1)	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*** **Instruction sheet 9IS64173** EWPA EN-IT-ES-DE-FR-RU

Name		Part number	Description	Documentation / Notes
Pressure switches		(1)	HR range (automatic reset) - minimum 100,000 ON/OFF cycles	
		(1)	HL range (manual reset) - minimum 6,000 ON/OFF cycles	
		(1)	HC series (automatic reset) - minimum 250,000 ON/OFF cycles	
Fan modules		For codes **See instruction sheet (1)**	**CFS FAN MODULES** Single-phase speed controllers for currents from 2A to 9A	**Instruction sheet 8FI40014** CFS - Fan Speed Modules GB-I-E-D-F
		MW991300	**CF-REL FAN MODULE** 6A 230V relay	**Instruction sheet 8FI40014** CFS - Fan Speed Modules GB-I-E-D-F
		MW991012	**FAN MODULE CFS05 TANDEM** TRIAC 5+5A 230V	**Instruction sheet 8FI40016** CFS05 - Fan Speed Module GB-I-E-D-F
		Contact Eliwell Sales Department	THREE-PHASE FAN CONTROLLER	Contact Eliwell Sales Department
Interface modules		DM1003002000	DM100-3 Manufacturer	

Name		Part number	Description	Documentation / Notes
Connections		BA11250N3700	**Bus Adapter 130 TTL** RS485 communication interface TTL/RS-485 12V aux. output for power supply to device. TTL cable L = 1m (2)	**Instruction Sheet 9IS43084** BusAdapter 130-150-350 GB-I-E-D-F
		BA10000R3700	**Bus Adapter 150 TTL** RS485 communication interface TTL/RS-485 TTL cable L = 1m (2)	
		BARF0TS00NH00 (1)	RadioAdapter TTL/WIRELESS 802.15.4	**Instruction Sheet 8FI40023** RadioAdapter GB-I-E-D-F **Manual 9MAX0010** RadioAdapter GB-I-E-D-F
		WA0ET00X700	WebAdapter	**Instruction sheet 9IS44065** WebAdapter GB-I-E-D-F-RUS **Manual 8MA00202** WebAdapter **X = 0 IT; 1 EN; 2 FR; 3 ES; 5 DE; A RU**
		WA0WF00X700	WebAdapter Wi-Fi	
Software Tools		Contact Eliwell Sales Department	Device Manager	Contact Eliwell Sales Department
Demo Case		VAL00031K	Demo case	

(1) Various part numbers available. Contact the Sales Department
(2) Various lengths can be requested

GENERAL NOTES:
COHV and COLV wiring are not necessary if they are made by the manufacturer.
Connection of remote keyboard via 3-way cables with no optional modules.
Eliwell also has multiple NTC probes for each different cable type (PVC or silicone) and length.

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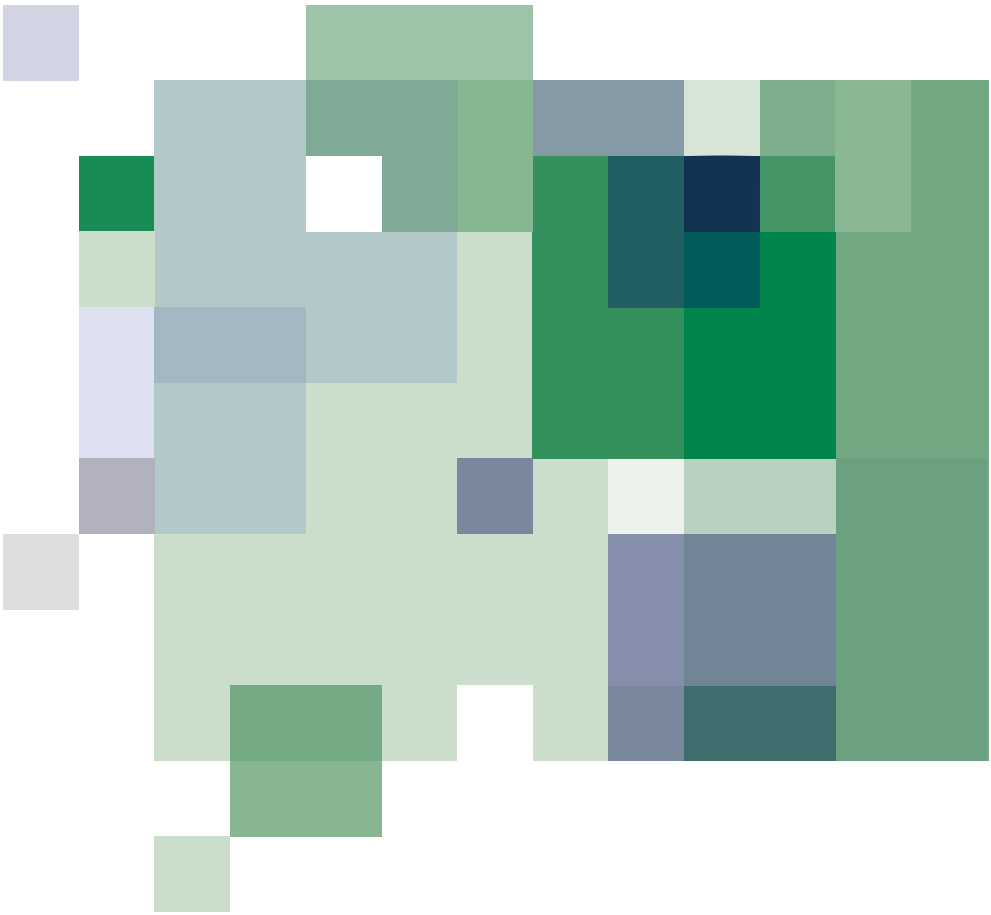

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