ENERGY 200
Electronic Control for mono & bi-Compressor CHILLERS

User Manual

1 CONTENTS

2 HOW TO USE THIS MANUAL

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

References

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

Cross references

Cross references:
All words written in *italics* are referenced in the subject index to help you find the page containing details on this subject; supposing you read the following text:
"when the alarm is triggered, the *compressors* will be shut down"
The italics mean that you will find a reference to the page on the topic of *compressors* listed under the item *compressors* in the index.
If you are consulting the manual "on-line" (using a computer), words which appear in italics are hyperlinks: just click on a word in italics with the mouse to go directly to the part of the manual that discusses this topic.

Icons for emphasis:

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

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

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

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

3 INTRODUCTION

Energy 200 is a compact device that permits control of air conditioning units of the following types:
- air-air
- air-water
- water-water
- motor-condensing

single-circuit, with 1 or 2 *compressors* (steps).

It is possible to control *condensation fan* speed proportionately for currents of up to 2 A without using external devices.

Main characteristics:
- Temperature control based on inflowing or outflowing probe, depending on the type of machine and its configuration
- Condensation control
- Input may be configured for an NTC temperature probe or for a 4...20 mA signal (through *parameters*)
- Automatic change-over
- *Boiler* or supplementary electrical heater control for *heating*
- *Internal fan control* up to 3 steps in the air-air application
- *Dynamic set point*
- Parameter setting from the *keyboard* or through a personal computer
- *Copy card* for uploading and downloading parameter maps
- *Remote keyboard* (up to 100 m) which may be connected up directly without a serial interface
- 4-20 mA or 0-10 V output (optional internal card)
- *User interface* with a menu featuring 2 different levels of access through password management
- Interface menu may be fully configured from a PC.
- Only *for Energy 2xxB* devices it is available the instrument control through modbus protocol

3.1 Components

We will now look at the basic *components* and accessories in the system and how they are connected.

3.1.1 Basic module

The *basic module* is an electronic board, to be connected up as illustrated in the *connection diagrams*.

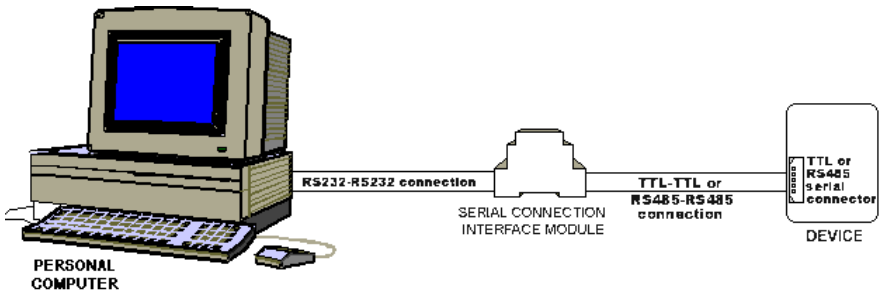
3.1.2 Keyboards

Two types of *keyboard* are available:
- Panel *keyboard*
- Wall-mounted *keyboard*

3.1.3 Interface module

A device which permits the controller to interface with a Personal Computer

It must be connected up as illustrated in the figure



The PC must be connected with the *interface module*, and the *interface module* with the device, with no power on to any of the devices, and in compliance with current safety *regulations*. Be careful to avoid electrostatic shocks, especially on exposed metal parts of the devices; allow electrostatic shocks to discharge into the ground before handling.

3.2 Copy Card

A device which may be used to upload and download the Energy 200 parameter map.

3.2.1 Fan modules

May be used to connect fans to Energy 200's low voltage outputs.

3.2.2 Param Manager

If you have an adequate Personal Computer with Windows 95 or a more recent operating system, the *Param Manager* software, and adequate *interface module* and proper wiring, you can have full control over all Energy 200 *parameters* via Personal Computer.
The instrument can be programmed easily and quickly using a series of interfaces which permit a logical, guided approach.

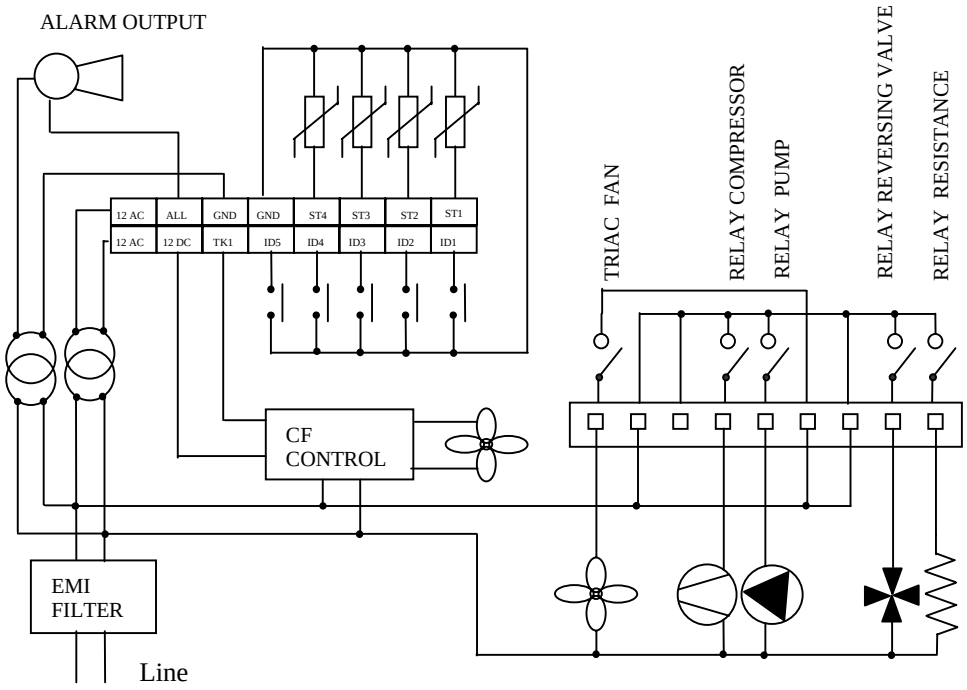
4 INSTALLATION

Before proceeding with any operation, first make sure that you have connected up the power supply to the device through an appropriate external *current transformer*.
Always follow these rules when connecting boards to one another and to the application:
Never apply *loads* which exceed the limits set forth in these specifications to outputs;
Always comply with *connection diagrams* when connecting up *loads*;
To prevent electrical couplings, always wire low voltage *loads* separately from high voltage *loads*;

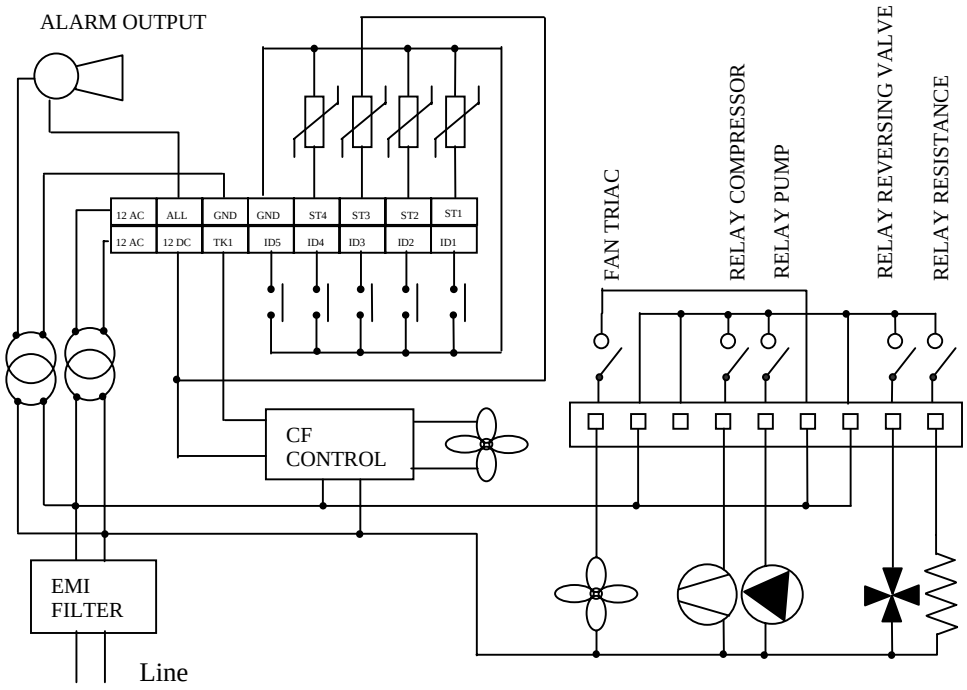
4.1 Connection diagrams

There are three models of Energy 200:
- Energy 210 : 2 step chiller
- Energy 211B:2 step heat pump + ext. proport. fan +modbus
- Energy 215B:2 step heat pump+ fan on/off with int. relay+modbus
- Energy 210A :optional analogue output
- Energy 210B :2 step cool + int. proport. fan + modbus
- Energy 211 : 2 step heat pump
- Energy 210BA :analogue output + modbus

Connection with ST3 probe configured as NTC



Connection with ST3 probe configured as 4..20mA



Legenda	Description	*Legenda*	Description
A	Alarm Output	**E**	Relay 1
B	EMI Filter	**F**	Relay 2
C	CF control	**G**	Relay 3
D	TK / Relay 5 (only for 215B)	**H**	Relay 4

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

4.2 Configuration of analogue inputs

Analogue inputs

There are 4 analogue inputs:

- 3 NTC type temperature probes
- 1 input which may be configured for an NTC probe or a 4...20 mA signal.

The inputs, which shall henceforth be referred to as ST1...ST4, are configured as shown in the table below:

Analogue inputs: configuration table

Pa.	Description	Value					
		0	1	2	3	4	5
Pa H05	Configuration of analogue input ST1	Probe absent	NTC input Inflowing water/air	Digital input Request for *heating*	Digital input Request for regulation algorithm	NTC input Differential	(*) on *Remote Keyboard*
Pa H06	Configuration of analogue input ST2	Probe absent	NTC input Outflowing water/air, anti-freeze	Digital input Request for *cooling*	Not permitted	Not permitted	Not permitted
Pa H07	Configuration of analogue input ST3	Probe absent	NTC input Condensation	4...20 mA input for condensation	4...20 mA input for *dynamic set point*	NTC input Anti-freeze for water-water machines with automatic (internal) reversing of coolant gas	NTC probe Regulation alogorithm in *heating* mode for water-water machines with manual reversal on water side
Pa H08	Configuration of analogue input ST4	Probe absent	NTC input Condensation	Multifunctional digital input	NTC input Outdoor temperature	(*) NTC input Anti-freeze for water-water machines with automatic (internal) reversing of coolant gas	Not permitted

* Energy 2xxB models only

If input ST3 is defined as a 4...20 mA input, the scale bottom value of the pressure input is also signfiicant: *Pa H09*, maximum input value; set the corresponding value to a current of 20 mA

4.3 Configuration of digital inputs

Digital inputs

There are 5 digital inputs, which will henceforth be identified as ID1...ID5.
ST1, ST2 and ST4 may be added to these if they are configured as digital inputs (through *parameters Pa H05*, *Pa H06*, and *Pa H08*).
A total of 8 digital inputs is thus available.

Digital inputs: polarity

The polarity of digital inputs is determined by the *parameters* listed below:

Parameter	Description	Value	
		0	1
Pa H10	Polarity of digital input ID1	Active if closed	Active if open
Pa H11	Polarity of digital input ID2	Active if closed	Active if open
Pa H12	Polarity of digital input ID3	Active if closed	Active if open
Pa H13	Polarity of digital input ID4	Active if closed	Active if open
Pa H14	Polarity of digital input ID5	Active if closed	Active if open
Pa H15	Polarity of input ST1 (configured as digital)	Active if closed	Active if open
Pa H16	Polarity of input ST2 (configured as digital)	Active if closed	Active if open
Pa H17	Polarity of input ST4 (configured as digital)	Active if closed	Active if open

Inputs ID1 and ID2 cannot be configured and fulfil the following *functions*:
ID1 : High pressure input
ID2 : Low pressure input

The *functions* of the other inputs may be configured using *parameters*:
ST1, ST2: (Refer to Analogue inputs: configuration table)
ID3, ID4, ID5 and **ST4**: as shown in the table below

Digtial inputs: configuration table

Digital input configuration parameter	Parameter code	Value						
		0	1	2	3	4	5	6

Configuration parameter ID3	*Pa H18*	Thermal switch compressor 1	Thermal switch - fan	Flow switch	Remote heat cool	Remote On-off	Thermal switch compressor 2	Request step 2
Configuration parameter ID4	*Pa H19*	Thermal switch compressor 1	Thermal switch - fan	Flow switch	Remote heat cool	Remote On-off	Thermal switch compressor 2	Request step 2
Configuration parameter ID5	*Pa H20*	Thermal switch compressor 1	Thermal switch - fan	Flow switch	Remote heat cool	Remote On-off	Thermal switch compressor 2	Request step 2
Configuration parameter ST4	*Pa H21*	Thermal switch compressor 1	Thermal switch - fan	Flow switch	Remote heat cool	Remote On-off	Thermal switch compressor 2	Request step 2

If more than one of the *parameters* appearing in table 3 is configured with the same value, the function will be called up in response to at least one of the inputs.

4.4 Configuration of outputs

Outputs

The instrument has the followint outputs:

- 4 relay contacts (5 relay contacts for Energy 215B model)
- triac outputs (all models except 215B)
- *optional output*
- 1 *keyboard* output
- *Fan module pilot output*

4.4.1 Relays

- **RL1 -** compressor, 2 A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~).
- **RL2 -** configurable, 2 A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~).
- **RL3 -** configurable, 2 A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~).
- **RL4 -** configurable, 2 A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~).
- **RL5 –** on-off fan, 2 A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~) **(only Energy 215B model).**

Outputs RL2, RL3, and RL4 may be configured as shown in the table below:

Relays: configuration table

Pa.	Description	Value			
		0	**1**	**2**	**3**
Pa H22	Configuration of relay RL2	Pump	*Internal fan* speed 1	Not permitted	Not permitted
Pa H23	Configuration of relay RL3	*Reversing valve*	*Internal fan* speed 3	Second compressor or capacity step	Not permitted
Pa H24	Configuration of relay RL4	Anti-freeze electrical heaters	*Internal fan* speed 2	*Boiler*	Not permitted

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

4.4.2 Triac/(Relay 5 ; Energy 215B model)

- **TK –** Control of *condensation fan* or supplementary anti-freeze heaters, maximum current 2 A 250V~
  The TK output may be configured as shown below:

TK output: configuration table

Pa.	Description	Value			
		0	**1**	**2**	**3**
Pa F01	Configuration of TK output	Proportional *condensation fan control*	ON-OFF temperature fan control	Anti-freeze electrical heaters for water-water machines with gas reversal	ON-OFF fan control in response to compressor

- **ALL -** 12-24 V~ output for alarm, maximum current 500 mA.

For Energy 2xxB models there are available the following *parameters*:

- *Pa H56* = defines the alarm output polarity:
  0 = the output is active (close contact) when is the alarm is active & when the device is in off mode.
  1 = in the same conditions, open contact
- *Pa H57* = defines if the alarm is active when the device is in off mode, set by *keyboard*, with remote off & in *stand-by* mode
  0 = output alarm not activated in OFF mode or *stand-by* mode
  1 = active alarm output in OFF mode or *stand-by* mode.

The power supply to the alarm output must be kept separate from the controller power supply.

4.4.3 Fan module pilot output

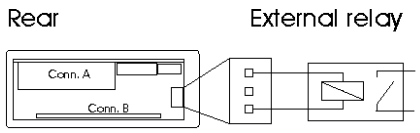
- **TK TTL –** Low voltage output piloting external fan control modules.

4.4.4 Optional output

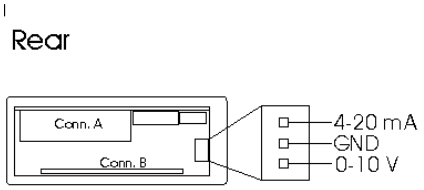
OPZ – optional internal output with configurable output.
There are two types of *optional output* for the Energy 200, corresponding to two different versions:

Open collector output

open collector output for piloting compressor 2 relay



4-20 mA and 0-10 V output: may be used with either 4-20 output or 0-10 by setting parameter H25



Parameter **H25** must be configured to suit the version used, as shown in the table below:

Optional output: configuration table

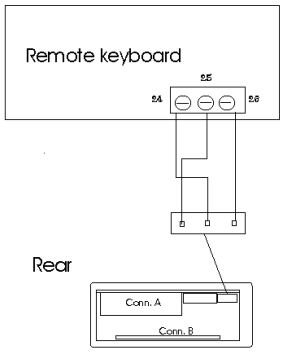
Pa.	Description	Value		
		0	**1**	**2**
Pa H25	*Optional output* configuration parameter	Open Collector output for compressor 2	Proportional *condensation fan control*, 4-20 mA	Proportional *condensation fan control*, 0-10 V

The analogue output value is directly proportionate to the external fan control. For example:
if the external fan control has an output of 50%,

- with *Pa H25*= 1, the 4...20 mA output will have a value of 12 mA (50% calculated on the *range* 4...20), while the 0-10 V output will not be significant
- if *Pa H25*= 2, the 0-10 V output will have a value of 5 V (50% of the *range* 0...10), while the 4...20 mA will not have a significant value.

4.4.5 Additional keyboard output

The *keyboard* output may be used for an additional *keyboard*.
Connect as shown in the diagram below.:



4.5 Physical quantities and units of measurement

4.5.1 Temperature- or pressure-based operation

Parameter *Pa H49* may be used to select two different types of machine: operated on the basis of temperature or of pressure.

- If *Pa H49*= 0, parameter *Pa H07*=0 (probe ST3 absent), *Pa F01* = 3 (operation in response to a request from the compressor) .

Temperature-based operation

- if *Pa H49*= 1 (temperature-based operation), *parameters Pa H07*, **F01** are forced as follows: **H07**= 1 (probe ST3 operating on the basis of temperature), **F01**= 3 (operation in response to a request from the compressor). During *defrosting*, *Pa d08* will be used as the *defrost start* temperature, and *Pa d09* as the *defrost end* temperature.

Pressure-based operation

- if *Pa H49*= 2 (pressure-based operation), *parameters Pa H07*, **F01** will be forced as follows: **H07**= 2 (probe ST3 operating on the basis of pressure), **F01**= 0 (proportional operation). During *defrosting* parameter *Pa d02* will be used as the *defrost start* pressure and *Pa d04* as the *defrost end* pressure.
- if *Pa H49*= 3, there are no constraints on the *parameters*.

Temperature- or pressure-based operation: configuration table

Pa H49	*Pa H07*	*Pa F01*
0	**0** probe ST3 absent	**3** operation in response to a request from the compressor
1	**1** probe ST3 temperature	**3** operation in response to a request from the compressor
2	**2** probe ST3 pressure	**0** proportional operation
3	No constraints	No constraints

4.5.2 Units of measurement

Control temperature may be displayed in:

- degrees °C, with decimal point
- degrees °F without decimal point.

The unit of measurement is determined by setting parameter **H52:**

Pa H52	**Unit of measurement**
0	Degrees °C
1	Degrees °F

4.6 Serial outputs

There are 2 asynchronous outputs on the control:

- channel for serial communication with a personal computer through a Microtech *interface module*
- channel for serial communication with a standard Microtech *keyboard*. Power supply 12 VDC (2400, and 8,1).

4.6.1 Copy card device

A *copy card* for reading and writing parameter maps may be connected to the serial connector.

- Copying the parameter map to the internal memory using the *copy card*: turn the power on to the instrument with the *copy card* already in place.
- Downloading the parameter map from the internal memory to the *copy card*: first connect the *copy card* to the instrument, entering the password corresponding to parameter *Pa H47*. While it is downloading data the instrument will *display* the label **Occ.** Disconnect the *copy card* when finished.

5 USER INTERFACE

The interface on the front panel of the instrument can be used to carry out all the operations connected to the use of the instrument, and in particular to:

- Set operating mode
- Respond to alarm situations
- Check the state of resources

Keyboard

Front panel of the instrument

5.1 Keys

Mode

Selects operating mode:

If the *heating* mode is enabled, each time the key is pressed the following sequence occurs:
Stand-by -→ *cooling* → *heating* → *stand-by*

if *heating* mode is not enabled:
Stand-by → *cooling* → *stand-by*

In menu mode, this key acts as a *SCROLL UP* or UP key (increasing value).

On-off – Reset alarms

Resets *alarms*, and turns the instrument on and off.
Press once to *reset* all manually *reset alarms* not currently active.

Hold down the key for 2 seconds to turn the instrument from on to off or vice versa. When it is off, only the decimal point remains on the *display*. In menu mode this key acts as a *SCROLL DOWN* or DOWN key (decreasing value)

Mode – on-off key combination

Pressing the "mode" and "on-off" *keys* at the same time.

If you press both *keys* at the same time and then release within 2 seconds, you will move one level deeper in the *display* menu.
If you press both *keys* for more than 2 seconds you will move one level up.
If you are currently viewing the lowest level in the menu and you press both *keys* and release within 2 seconds, you will go up one level.

5.2 Displays

The device can provide information of all kinds on its status, configuration, and *alarms* through a *display* and leds on the front panel.

5.2.1 Display

Normal *display* shows:

- regulation temperature in tenths of degrees celsius with a decimal point, or in degrees fahrenheit without a decimal point.
- the alarm code, if at least one alarm is active. If multiple *alarms* are active, the one with greater priority will be displayed, according to the *Table of Alarms*.
- If temperature control is not analogue and depends on the status of a digital input (ST1 or ST2 configured as digital inputs), the "On" or "Off" label will be displayed, depending on whether temperature control is active or not.
- When in menu mode, the *display* depends on the current position; labels and codes are used to help the user identify the current function.
- Decimal point: when displaying hours of operation, indicates that the value must be multiplied x 100

5.2.2 Led

Led 1 compressor 1.

- ON if compressor 1 is active
- OFF if compressore 1 is off
- *BLINK* if *safety timing* is in progress

Compressor 2 (or capacity step) *led*

- ON if compressor (capacity step) is on
- OFF if compressor (capacity step) is off
- *BLINK* if *safety timing* is in progress

Defrost *led*
- ON if *defrosting* is in progress
- OFF if *defrosting* is disabled or has been completed
- *BLINK* if timing is in progress (defrost interval)

Electrical heater/*boiler led*
- ON if the internal anti-freeze electrical heater or *boiler* is on
- OFF if the internal anti-freeze electrical heater or *boiler* is off

Heating led
- ON if the device is in *heating* mode

Cooling led
- ON if the controller is in *cooling* mode

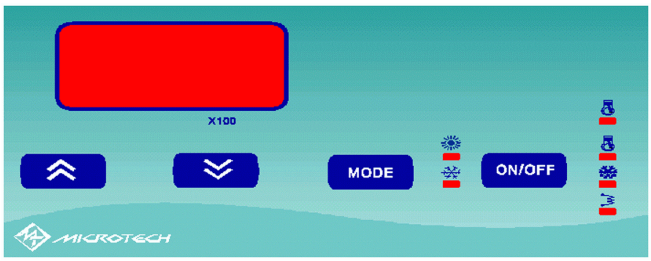
If neither the *HEATING led* nor the *COOLING led* is on, the controller is in *STAND-BY* mode

5.3 Remote keyboard

Remote keyboard

The *remote keyboard* on the *display* is an exact copy of the information displayed on the instrument, with the same leds;

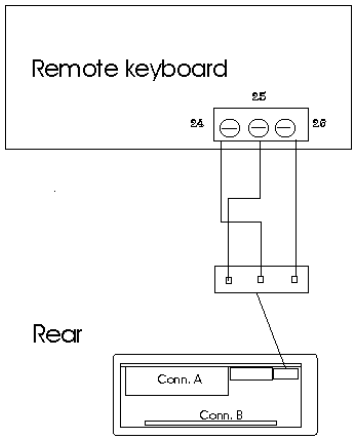
Remote keyboard



It performs exactly the same *functions* as those described in the *display* section.
The only difference is in use of the UP and DOWN *keys* (to increase and decrease value), which are separate from the MODE and ON/OFF *keys*.

Connection with the controller is illustrated below:

Connection

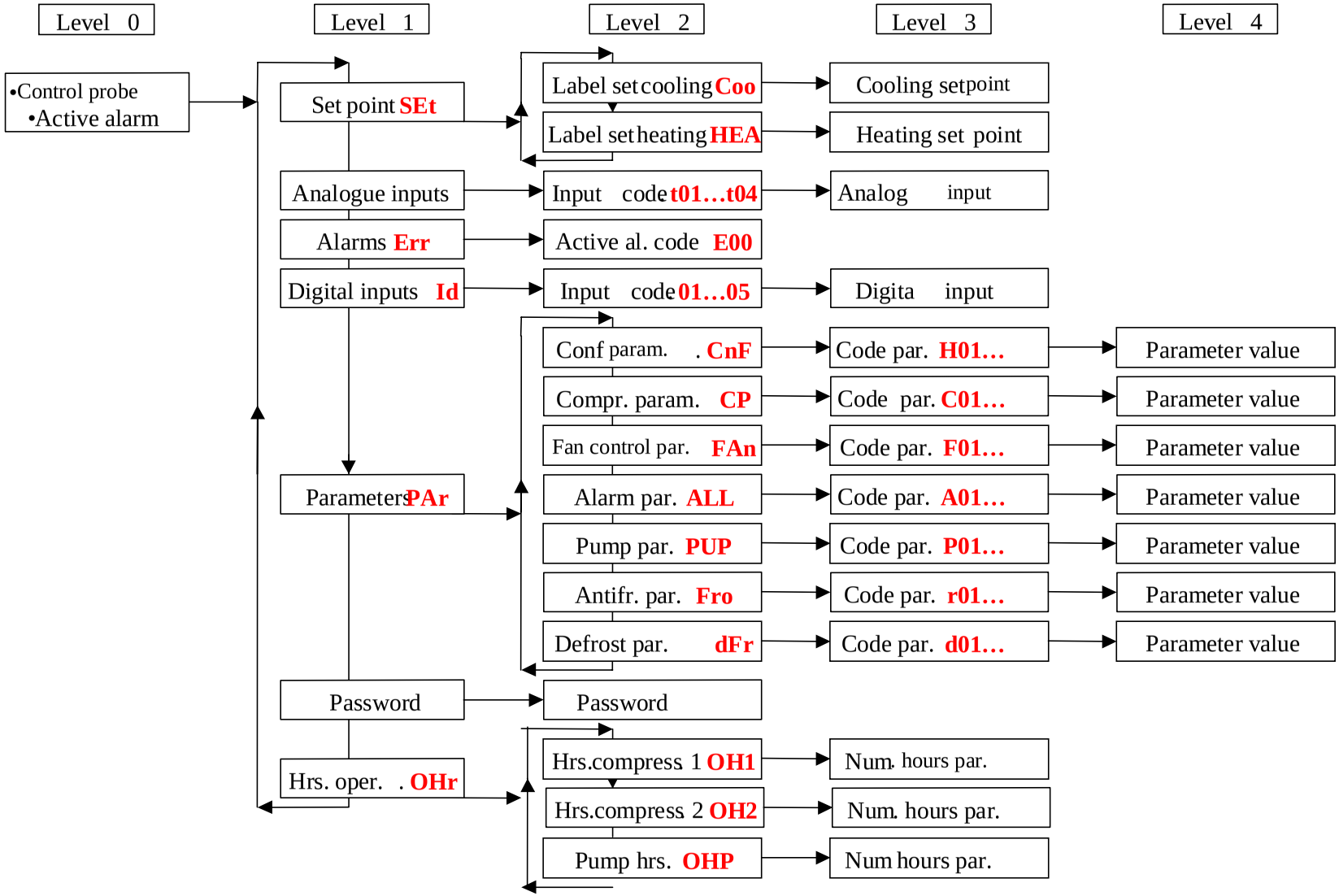


5.4 Parameter programming – Menu levels

Device *parameters* may be modified using a Personal Computer (with the required software, interface key and cables), or using the HyperCodex91keyboard.
If using the *keyboard*, access to *parameters* is arranged in a hierarchy of levels which may be accessed by pressing the "mode and "on-off" *keys* at the same time (as described above).
Each menu level is identified by a mnemonic code which appears on the *display*.
The structure is set up as shown in the diagram below:

Menu structure

Errore. Il collegamento non è valido.



5.4.1 Visibility of parameters and sub-menus

With a personal computer, interface key, suitable cables and the "*Param Manager*" software, it is possible to restrict the visibility and modification of *parameters* and entire submenus.
A "visibility value" may be assigned to each parameter, as described below:

Value	Meaning
0003	Parameter or label visible at all times
0258	Parameter or label visible if user password entered correctly (password = *Pa H46*)
0770	Parameter or label visible if user password entered correctly (password = *Pa H46*). Parameter cannot be modified.
0768	Parameter visible from PC only.

Some visibility settings are factory set.
For more information, please refer to the "*Param Manager*" instructions.

6 SYSTEM CONFIGURATION

In this section we will look at how to configure *parameters* for various *loads* on the basis of the type of *installation* to be controlled.

6.1 Compressors

Energy 200 can control systems consisting of one *cooling* circuit with 1 or 2 *compressors*.
If there is a capacity step, it will be considered as a compressor.
Each compressor is piloted by a device relay.
Compressors will turned on or off depending on the temperatures detected and the *temperature control functions* that have been set (refer to the section on Compressor controls – regulation algorithm)

6.1.1 Compressor configuration

Power step

The first compressor must be connected to output RL1;

The second compressor, if there is one, must be connected to output RL3, with the following parameter settings:

- *Pa H48*=2 (2 *compressors* per circuit)
- *Pa H23*=2 (output RL3 configured as compressor/capacity step) or *Pa H25*=0 (open collector output for the second compressor/capacity step).

IF the open collector output is used, an external relay will be required for compressor management.

Polarity of RL3

If RL3 is configured as a second compressor/capacity step output, polarity may be selected using the parameter *Pa H51*, polarity of compressor 2/ capacity step output (on relay 3 only).
- 0= relay ON if compressor 2/ capacity step ON,
- 1= relay ON if compressor 2/ capacity step OFF.

The polarity of RL1 is unvariable:
- relay ON if compressor 1/ capacity step ON

6.1.2 Compressor on/off sequence

The order in which the *compressors* come on may be modified using parameter *Pa H50*, compressor on sequence:

- *Pa H50*=0 *compressors* come on depending on the number of hours of operation (balancing hours of operation)
- *Pa H50* = 1 compressor 1 is turned on first, then compressor (or capacity step) 2 (unvaried sequence).

Balancing hours of operation

If *Pa H50*= 0, the compressor with the least hours of operation comes on first, unless it is subject to:
- a current compressor shutdown alarm (refer to *table of alarms*)
- *safety timing* in progress.

If *Pa H50*= 0, the compressor with the most hours of operation is turned off first.

Unvaried sequence

If *Pa H50*= 1:
compressor 2 (capacity step) is turned on only if compressor 1 is already on.
compressor 1 is turned off only if compressor 2 (capacity step) is already off. If there is a compressor 1 shutdown alarm, compressor 2 will be turned off immediately.

6.1.3 Compressor timing

Safety timing

The turning on and off of *compressors* must comply with safety times which may be set by the user using the *parameters* specified below:

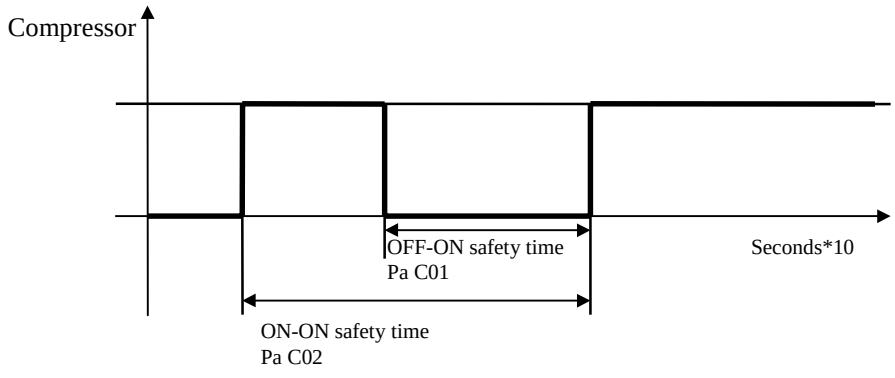
Off-on timing

There is a safety interval between the time a compressor goes off and the time the same compressor comes back on (compressor on...off safety time, controlled by parameter *Pa C01*);
This interval of time must elapse when the "Energy 200" is turned on.

On-on timing

There is a safety interval between the time a compressor is turned on and the time it is turned on again (compressor on...on safety time, controlled by parameter *Pa C02*) .

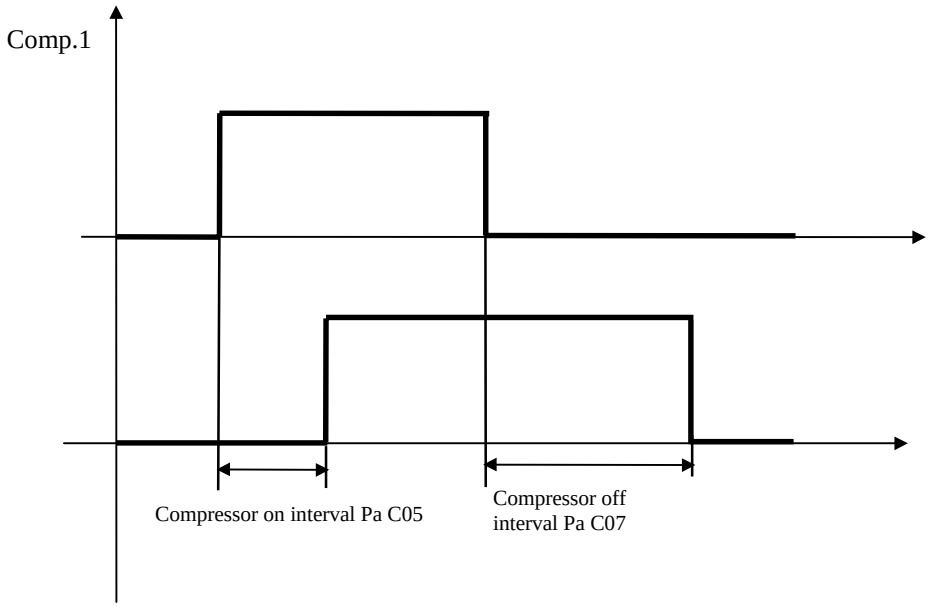
Off-on and on-on comp. diagram



On-on and off-off diagram for 2 comp.

If the system includes 2 *compressors* (or capacity steps) there are intervals of time which must pass between turning on of the 2 *compressors* (*Pa C06*) and turning off of the 2 *compressors* (*Pa C07*). An amount of time determined by parameter *Pa D11* (compressor on delay during *defrosting*) must pass between turning on a compressor and a capacity step.
The off time interval between *compressors* is not applied in the event of a **compressor shutdown alarm**, in which case they stop immediately.

On-on and off-off diagram for 2 comp.



6.2 Condensation fan

"Energy 200" may be connected with various types of fan piloting units, depending on the models available, as shown in the table below:

	TK	TK-TTL	4-20mA	0-10V
Energy 210	*	*		
Energy 210A			*	*
Energy 211	*	*		

Legend:
- TK: 230Vac/2A command
- TK-TTL: control signal for fan control modules (500w,1500w,2200w)
- 4-20mA or 0-10V: standard command for fan control through external module (inverter).

- On model Energy 210, the fan may be controlled with a proportionate output with a maximum load of 2A.
- On model Energy 211/210A, only the ON/OFF command is available for remote control (500 mA max)

6.2.1 Fan configuration

The reference is to the fan control unit located outside near the heat exchanger which normally acts as a condenser. If a heat pump is used, the exchanger will operate as an evaporator.

First of all, connect the fan up correctly to the appropriate output (refer to *connection diagrams*).

The fan output may be configured to work proportionately or as ON-OFF.
Pa F01 – Selection of triac output mode **(TK and TK TTL)**:
- 0= proportional fan output (TK)
- 1= ON-OFF fan output; in this mode the fan will be off if the proportional control has an output of 0 , on at maximum speed (no capacity step) if control output is greater than 0.
- 2= *external anti-freeze electrical heater control*, for water-water machines with gas reversal
- 3= fan command for ON-OFF operation in response to compressor request. In this mode the fan is turned off and on depending on compressor status.

The fan may also be controlled by the output associated with the optional board:
Pa H25 – configuration of optional board:
- 0= Open Collector output for second compressor
- 1= 4...20 mA fan speed output
- 2= 0-10 V fan speed output

If the output is configured as proportional TK the *PICK-UP*, *PHASE SHIFT* and *IMPULSE DURATION parameters* are alaso significant.

Pick-up

Every time the external fan is started up, power is supplied to the exchanger fan at maximum voltage, and the fan operates at maximum speed, for an amount of time equal to *Pa F02* seconds; after this time the fan operates at the speed set by the regulator.

Pa F02 = Fan *pick-up* time (seconds)

Phase shift

Determines a delay during which it is possible to compensate the different electrical characteristics of the fan drive motors:
Pa F03 = duration of fan *phase shift*, expressed asμSeconds*200.

Impulse duration

Determines the duration of the TK output piloting impulse in μseconds*200
Pa F04= triak piloting *impulse duration*

6.3 Reversing valve

The *reversing valve* is used only when operating in "heat pump" mode.

It is active if:
- relay 3 configuration parameter *Pa H23*= 0.
- heat pump is enabled, *Pa H28*= 1.

The *reversing valve* is off if the instrument is OFF or on *stand-by*.

Polarity

Polarity may be configured using the following parameter:
Pa H38= *Reversing valve* polarity
- 0: relay active in cool mode
- 1: relay active in heat mode

In *cooling* mode the *reversing valve* is never active.

6.4 Hydraulic pump

The *hydraulic pump* must be connected to the output of relay RL2 (refer to connection diagram).
It is active only if the corresponding parameter, *Pa H22*, is set to 0.

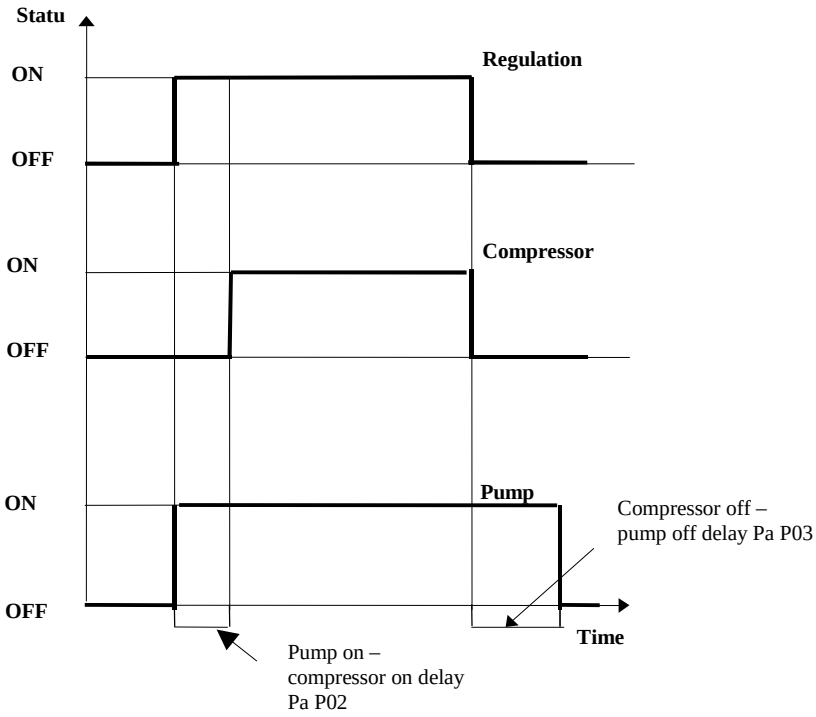
The pump may be configured to function in three different ways using parameter *Pa P01*:
- *Pa P01* = 0 : continuous operation
- *Pa P01* = 1 : operation when called up by regulation algorithm (compressor)
- *Pa P01* = 2 : *cyclic operation*

Continuous operation

CONTINUOUS OPERATION:
Pump is on at all times.

Operation in response to request

OPERATION IN RESPONSE TO REQUEST:
- The pump comes on in response to a request from the regulation algorithm.
- The compressor comes on following a delay (*Pa P02*) after the time the pump comes on.
- The pump goes off following a delay (*Pa P03*) after the regulation algorithm has OFF status.
- During *defrosting*, when the compressor is OFF, the pump stays on.



Cyclic operation

CYCLIC OPERATION:
The pump is turned on and off independently of the regulation algorithm. It operates for constant intervals of time, as described below:
- the pump stays on for an amount of time equal to *Pa P02* (seconds*10),

- the pump is then turned off and stays off for an amount of time equal to *Pa P03* (seconds*10).

The pump is turned off if:
- there is an alarm comporting pump shutodown, such as a **manually** *reset* **flow switch alarm**
- the instrument is on *stand-by* or OFF

When there is a current flow switch alarm with **automatic resetting** (refer to *table of alarms*), the pump will remain on even if the compressor is OFF due to the alarm..

For Energy 2xxB there are the following rules:
- with anti-freeze alarm on, the pump is on
- with electrical heaters on, the pump is turned on
- with anti-freeze heaters off (in off mode) the pump is turned on

6.5 Internal anti-freeze/supplementary electrical heaters

Anti-freeze/supplementary heaters are connected up to relay output RL4 (refer to connection diagram).
They are active only if the corresponding parameter, *Pa H24*, is set to 0.

If the output is configured this way, it will command the electrical heaters to come on and go off in accordance with the electrical heater *configuration parameters*, **r01...r06**, as described in the table below:

configuration

Pa.	Description	Value	
		0	1
Pa r01	Defrost configuration	comes on only when requested by control	always on during defrost
Pa r02	*Cooling* mode configuration	off during *cooling*	on during *cooling* (depending on anti-freeze electrical heater control)
Pa r03	*Heating* mode configuration	off during *heating*	on during *heating* (depending on anti-freeze electrical heater control)
Pa r04	Configuration of electrical heater control probe in *heating* mode	controlled on the basis of ST1 (refer to *connection diagrams*) if *Pa H05* (config. ST1)= 1 otherwise off	controlled on the basis of ST2 (refer to *connection diagrams*) if *Pa H06* (config. ST2)= 1 otherwise off
Pa r05	Configuration of control probe in *cooling* mode	controlled on the basis of ST1 (refer to *connection diagrams*) if *Pa H05* (config. ST1)= 1 otherwise off	controlled on the basis of ST2 (refer to *connection diagrams*) if *Pa H06* (config. ST2)= 1 otherwise off
Pa r06	Configuration when OFF or on *stand-by*	Off when instrument is OFF or on *stand-by*	On when instrument is OFF or on *stand-by*

6.6 Supplementary electrical heaters

If *Pa r15* =1 the electrical heaters will have the double meaning of di *External anti-freeze electrical heaters* and *Supplementary electrical heaters*
Their functionality are decribed in Configuration of *Supplementary Electrical Heaters* paragraph

6.7 External anti-freeze electrical heaters

External anti-freeze electrical heaters are used on water-water machines with gas reversal.
They are connected to the triac TK output (refer to connection diagram) and controlled on the basis of probe ST3 (refer to analogue inputs) .
They are active only if:
- output TK is configured for anti-freeze electrical heaters, on a water-water machine with gas reversal (*Pa F01*= 2)
- ST3 is configured as an NTC anti-freeze input on a water-water machine with gas reversal (*Pa H07*= 4)

6.8 Boiler

The output for *boiler controll*er is relay RL4 (refer to connection diagram) with a suitable configuration.

The *boiler* output may operate in two different ways:
- to supplement another *heating* resource
- to provide *heating* with *boiler* only.

SUPPLEMENTARY *BOILER*:
The output is active if:
- relay 4 configuration parameter, *Pa H24*= 2.
- heat pump is declared present, *Pa H28*= 1.
- ST4 is configured as an outdoor probe, *Pa H08*= 3.

HEATING BOILER:
The output is active if:
relay 4 configuration parameter, *Pa H24*= 2.

heat pump is declared not present (**H28**= 0)

The *boiler* is off if:
- the device is operating in *cooling* mode
- the device is on *stand-by* or OFF
- there is a *boiler* shutdown alarm (refer to *table of alarms*)

6.9 Internal fan

Outputs RL2, RL3, RL4 (refer to connection diagram) may be used for the *internal fan*, depending on the “fan control step” to be used.

1 fan control step

The *internal fan* output is active **only if**:
- relay 2 configuration parameter *Pa H22*= 1.

2 fan control steps

2 fan control steps are active if:
relay RL2 configuration parameter *Pa H22*= 1
relay RL4 configuration parameter *Pa H24*= 1

3 fan control steps

3 fan control steps are active if:
relay RL2 configuration parameter *Pa H22*= 1
relay RL4 configuration parameter *Pa H24*= 1
relay RL3 configuration parameter *Pa H23*= 1

7 TEMPERATURE CONTROL FUNCTIONS

Once Energy 200 has been configured, *loads* may be controlled on the basis of temperature and pressure conditions detected by probes and *temperature control functions* which may be defined using the appropriate *parameters*.

Operating modes

There are 4 possible *operating modes*:
- *cooling*
- *heating*
- *stand-by*
- off

Cooling

Cooling: this is the "summer" operating mode; the machine is configured for *cooling*.

Heating

Heating: this is the "winter" operating mode; the machine is configured for *heating*

Stand-by

Stand-by: the machine does not govern any temperature control function; it continues to signal *alarms*

Device off

Off: the machine is turned off.

The operating mode is determined by settings entered on the *keyboard* and by the following

Parameters:
- Operating mode parameter (Pa H27)
- Heat pump parameter (*Pa H28*)
- Configuration parameter ST1 (Pa H05) (refer to Analogue inputs: configuration table)
- Configuration parameter ST2 (Pa H06) (refer to Analogue inputs: configuration table)

Operating mode selection parameter (Pa H27)
0= Selection from *keyboard*
1= Selection from digital input (refer to digital inputs)
2= Selection from analogue input (probe ST4)

Heat pump parameter (*Pa H10*)
0 = Heat pump not present
1= Heat pump present

Heating mode is permitted only if:
- heat pump is present (*Pa H28*= 1) or
- relay RL4 is configured as *boiler* output (*Pa H24*= 2).

Operating modes: configuration table

Combinations of these *parameters* will generate the following rules:

Operating mode	**Mode selection parameter** *Pa H27*	**Configuration parameter ST1** *Pa H05*	**Configuration parameter ST2** *Pa H06*
Mode selection from *keyboard*	0	Other than 2	Other than 2
Mode selection from digital input.	1	Other than 2	Other than 2
If input ST1 is on, operating mode is *heating*; if not, *stand-by*	Any	2	Other than 2
If input ST2 is on, operating mode is *cooling*; if not, *stand-by*	Any	Other than 2	2
If input ST1 is on, operating mode is *heating*; if ST2 is on, operating mode is *cooling*; if ST1 and ST2 are both on, there is a configuration error; if neither is on, operating mode is *stand-by*	Any	2	2

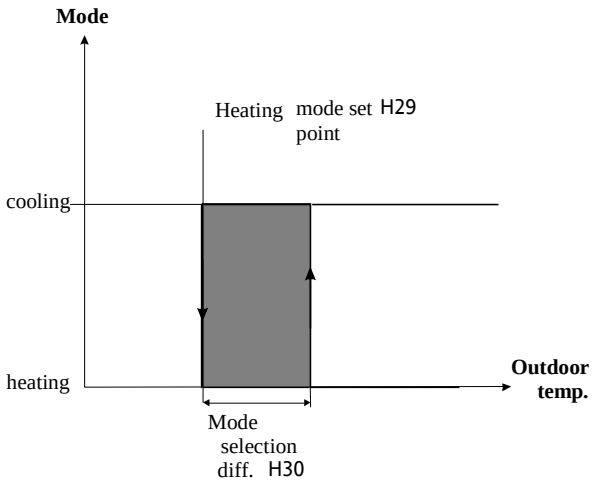
7.1 Selection of operating mode from analogue input

The controller permits selection of operating mode on the basis of the temperature detected and supplied by input ST4 (refer to analogue inputs).
This is permitted if both of the following conditions apply:
- probe ST4 is configured as an outdoor temperature probe (*Pa H08*= 3)
- mode selection parameter *Pa H27*= 2

In this case mode is selected automatically, on the basis of the following regulation algorithm *parameters*:
- *Heating* mode *set point Pa H29*
- Mode selection differential *Pa H30*.

An example of operation is provided in the diagram below:

Diagram



Mode may be changed from the *keyboard* for temperatures which fall within the mode selection differential (determined by parameter H30).
If this is not done:

- If the outdoor temperature is less than **H29**, the instrument will operate in *heating* mode,
- If the outdoor temperature is greater than **H29+H30**, the instrument will operate in *cooling* mode.

7.2 Setting set points

Loads are turned on and off dynamically on the basis of *temperature control functions*, temperature/pressure values detected by probes, and *set point*s.

There are two *set point* values:
Cooling set point: this is the *set point* used as a reference when the device is in *cooling* mode
Heating set point: this is the *set point* used as a reference when the device is in *cooling* mode

*Set point*s may be modified using the *keyboard*, by accessing the "SET" sub-menu (refer to *menu structure*).

They may be given values within a *range* determined by *parameters Pa H02 – Pa H01* (*Heating*) and *Pa H04 – Pa H03* (*Cooling*).

7.3 Dynamic set point

The regulation algorithm may be used to modify the *set point* automatically on the basis of outdoor conditions.
This modification is achieved by adding a positive or negative offset value to the *set point*, depending on:

- 4-20 mA analogue input (proportionate to a signal set by the user)

or

- temperature of outdoor probe

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

The *dynamic set point* is active if:

- Activation parameter *Pa H31* = 1
- probe ST3 (analogue inputs) is configured as a current input for a *dynamic set point* (*Pa H07* = 3) or probe ST4 (analogue inputs) is configured as an outdoor temperature probe (*Pa H08* = 3)

Control parameters

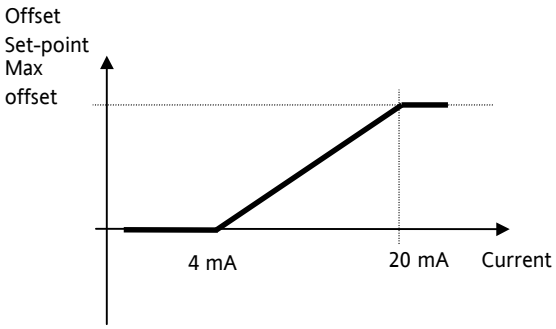
Dynamic set point control *parameters*:

- *Pa H32*= Max. offset during *cooling*.
- *Pa H33*= Max. offset during *heating*
- *Pa H34*= Outdoor temperature *set point* during *cooling*
- *Pa H35*= Outdoor temperature *set point* during *heating*
- *Pa H36*= Delta of *cooling* temperature
- *Pa H37*= Delta of *heating* temperature

The interaction of these *parameters* is illustrated in the graphs below:

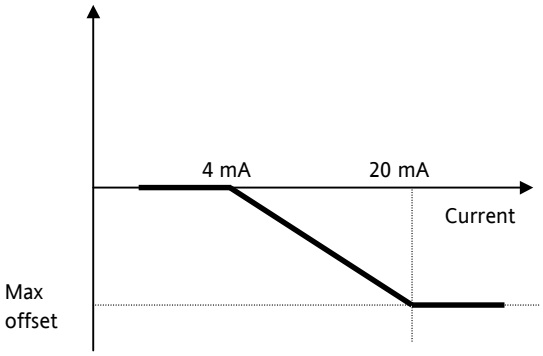
Modification depending on current input with positive offset

Positive Offset (H32>0 or H33>0)



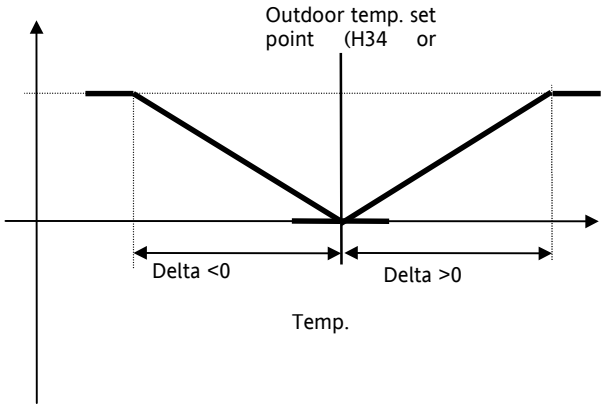
Modification depending on current input with negative offset

Negative Offset (H32<0 or H33<0)



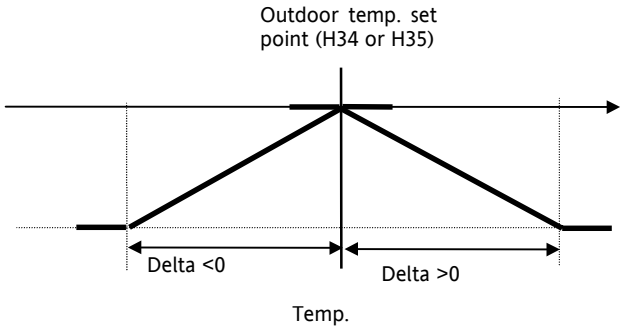
Modification depending on outdoor temperature with positive offset

Positive Offset



Modification depending on outdoor temperature with negative offset

Negative Offset



7.4 Differential temperature control

This function may be used to control temperature according to both ST1 and ST4. The function is active if:
- ST1 is configured as a differential NTC input (*Pa H05*= 4) (refer to analogue inputs)
- ST4 is configured as an outdoor temperature input (*Pa H08*= 3) (refer to analogue inputs)

In this case, the controller will not control on the basis of ST1, but on the basis of the difference between ST1-ST4.
If the ST3 configuration parameter *Pa H07* = 5 (*heating* control for water-water machines with water reversal), the controller will always control on the basis of ST3.

Differential temperature control can be used, for instance, to maintain a fluid (in *heating* or *cooling* mode) at the temperature of the outdoor environment plus a constant differential (positive or negative) determined by the user.

7.5 Switching from digital input

Digital inputs ID3, ID4, ID5 and ST4 (analogue inputs) may be configured to give an ON-OFF command. If this type of input is activated, the instrument will turn off all *loads* and show "E00" on the *display*.

7.6 Load control

The *parameters* used to control *loads* on the basis of the temperature/pressure conditions detected by the probes are described below.

7.6.1 Compressor control – regulation algorithm

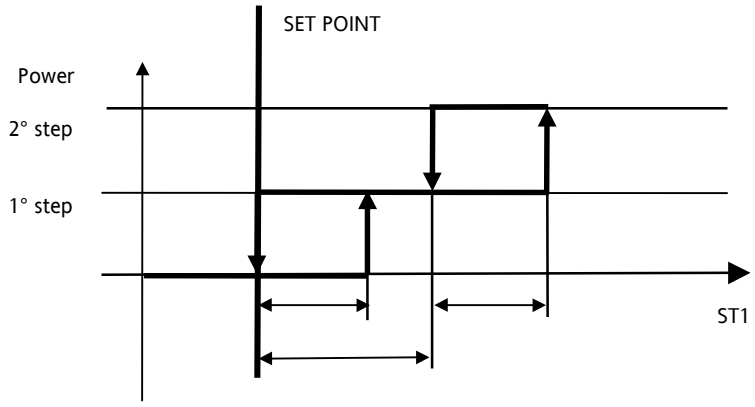
The regulation algorithm calculates the load to be supplied through the *compressors* for both *heating* and *cooling*.

Regulation algorithm in cool mode

REGULATION ALGORITHM IN COOL MODE
If probe ST2 (analogue inputs) is not configured as a digital input for requests for *cooling* (*Pa H06*=2) or probe ST1(analogue inputs) as a digital input for regulation algorithm requests (*Pa H05*=3), compressor management will depend on ambient temperature and a *SET POINT* which may be entered using the *keyboard*.

ST1 = temperature of inflowing water or inlet air
SET COOL= *cooling set point* set from *keyboard*
Pa C03 = *hysteresis* of *cooling* thermostat
Pa C05 = delta of *power step* intervention

Cooling diagram



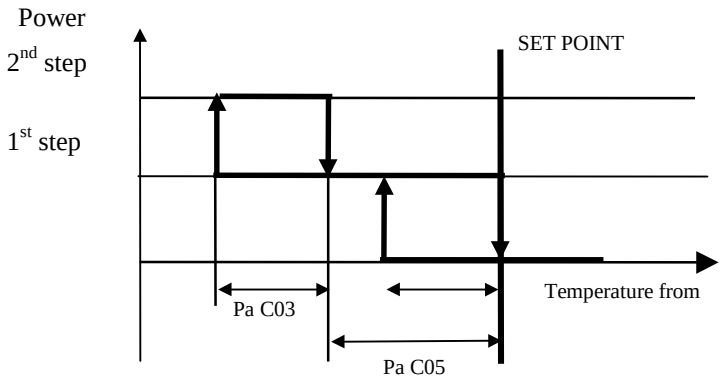
If *Pa H05*= 3, the compressor will be turned off and on depending on the status of input ST1.
If *Pa H06*= 2, the compressor will be turned off and on depending on the status of input ST2.
If a digital input is configured as a second step request (**H18** or **H19** or **H20** or **H21**= 6), the response will depend on this input. This function is active only if *Pa H05*= 3 or *Pa H06*= 2.

Regulation algorithm in heat mode

REGULATION ALGORITHM IN HEAT MODE
If probe ST1(analogue inputs) is not configured as a digital input for requests for heat (*Pa H05*=2) or as a digital input for regulation algorithm requests (*Pa H05*=3), compressor management will depend on:
- temperature ST3 (analogue inputs), if configuration parameter ST3 *Pa H07*= 5 (for water-water machines with water reversal)
- otherwise, temperature ST1(analogue inputs)
- a *HEATING SET POINT* which may be set from the *keyboard*

ST1/ST3 =Temperature of inflowing water or inlet air
SET *HEATING***=** *Heating set point* set using the *keyboard*
Pa C04 = *Hysteresis* of *heating* thermostat
Pa C05 = Delta of step intervention

Heating diagram



If *Pa H05*= 2 or 3, the compressor is turned off and on depending on the status of input ST1.
If a digital input is configured as a second step request (*Pa H18* or *Pa H19* or *Pa H20* or *Pa H21*= 6), the response depends on this input. This function is active only if *Pa H05*= 2 or 3.

A compressor will always be off if:
- It is not associated with a relay (power output)
- The compressor has been shut down (refer to *table of alarms*)
- *Safety timing* is in progress
- The *boiler* is on
- The time lapse between pump on and compressor on is in progress (*safety timing*)
- Preventilation is in progress in *cooling* mode
- Energy 200 is on *stand-by* or off
- The parameter for configuration of probe ST1 *Pa H05* = 0 (probe absent)

7.6.2 Condensation fan control

Condensation control is dependent on the condensation temperature or pressure for the circuit.
Fan control will be on if:
- at least one probe per circuit is configured as a condensation probe (pressure or temperature); if not, the fan for the circuit will come ON and go OFF in response to the circuit *compressors*.

Fan control may be independent of the compressor, or it may be carried out in response to requests from HyperCodex152compressors;
Operating mode is determined by parameter *Pa F05*:

	Value	
	0	**1**
Pa F05: **fan output mode**	if the compressor is off, the fan is off	condensation control is independent of the compressor

When the compressor is started up, if the proportional control requests fan *cut-off*, the *cut-off* may be excluded for an amount of time equal to *Pa F12* beginning when the compressor is turned on. If the controller requests *cut-off* during this time period, the fan will run at minimum speed.

If parameter *Pa F05* is set to 1, condensation control will be dependent on condensation temperature or pressure, depending on how the following *parameters* are set:

Silent speed

The fan control unit may have a minimum speed, a maximum speed, and a "silent" speed (for silent operation, for instance during the night), as well as a proportional band within these values.

The fan will always be off if:
- there is an alarm indicating that a *condensation fan* has shut down (refer to *table of alarms*).
- Energy 200 is on *stand-by* or off

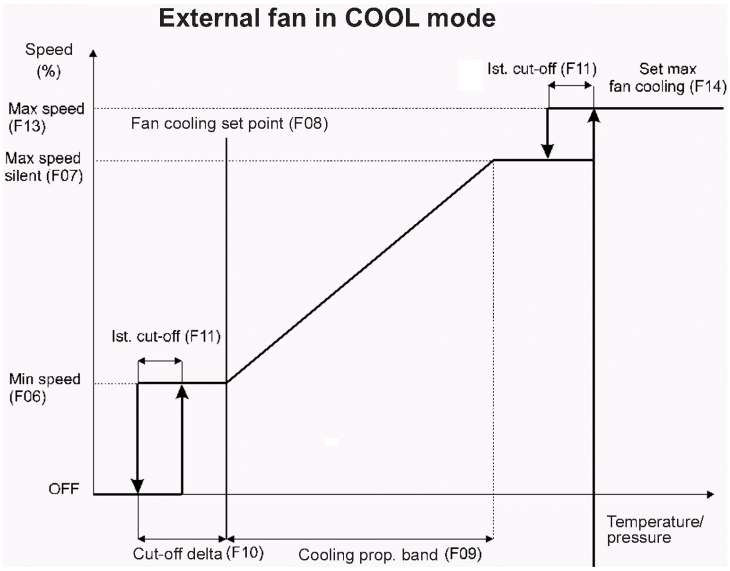
Cool mode

CONDENSATION FAN CONTROL IN COOL MODE

Pa F06 = Minimum fan speed in COOL mode;
Pa F07 = Maximum silent fan speed in COOL mode
Pa F08 = Minimum fan speed temperature/pressure *set point* in COOL mode
Pa F09 = Fan prop. band in COOL mode
Pa F10 = Fan *cut-off* delta
Pa F11 = *Cut-off hysteresis*.
Pa F13 = Maximum fan speed in COOL mode
Pa F14 = Maximum fan speed temperature/pressure *set point* in COOL mode
An example of interaction of these *parameters* is shown in the figure below:

Fan control in cool mode: diagram

Fan control in cool mode



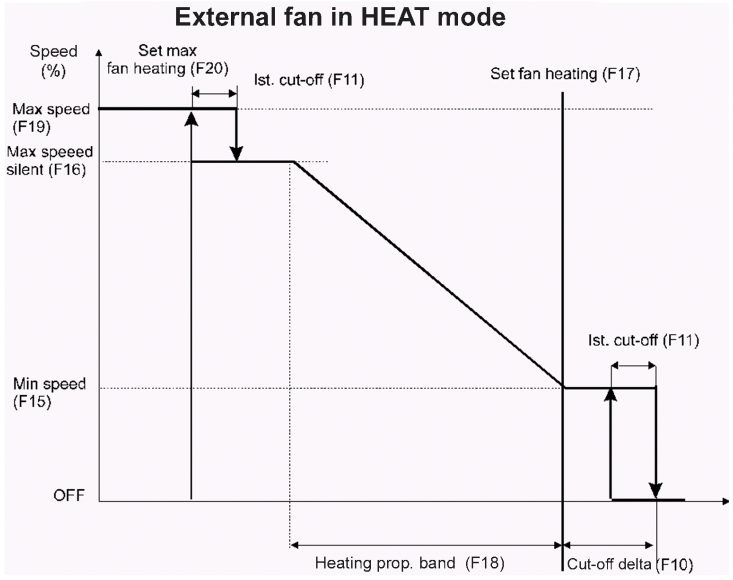
Modalità heat Heat mode

CONDENSATION FAN CONTROL IN HEAT MODE

Pa F15 = Minimum fan speed in HEAT mode;
Pa F16 = Maximum silent fan speed in HEAT mode;
Pa F17 = Minimum fan speed temperature/pressure *set point* in HEAT mode;
Pa F18 = Fan prop. band in HEAT mode;
Pa F10 = Fan *cut-off* delta;
Pa F11 = *Cut-off hysteresis*;
Pa F19 = Maximum fan speed in HEAT mode;
Pa F20 = Maximum fan speed temperature/pressure *set point* in HEAT mode.
An example of interaction of these *parameters* is shown in the figure below:

Fan control in heat mode: diagram

Fan control in heat mode



Control is not active if: :
- *defrosting* is in progress
- the *boiler* is on

For Energy 2xxB models, in drip phase, the fans work at maximum speed

7.6.3 Reversing valve control

Refer to section on *reversing valves*.

7.6.4 Hydraulic pump control

Refer to section on the *hydraulic pump*.

7.6.5 Anti-freeze/supplementary electrical heater control

Electrical heater control employs two separate *set point*s, one for *heating* mode and one for *cooling* mode:

- *Pa r07*: electrical heater 1 *set point* in *heating* mode
- *Pa r08*: electrical heater 1 *set point* 1 in *cooling* mode

The two *set point*s of the anti-freeze electrical heaters fall between minimum and maximum values which the user may set using the following *parameters*:

- *Pa r09*: maximum *set point* of anti-freeze electrical heaters
- *Pa r10*: minimum *set point* of anti-freeze electrical heaters

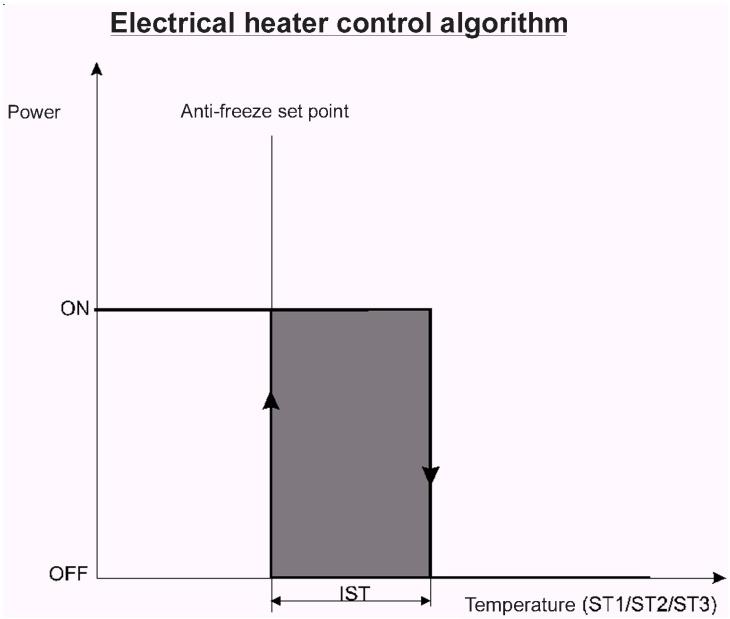
When off or on *stand-by*, control is based on the *cooling set point*, using the control probe used in the *heating* mode.

Parameter *Pa R11* determines the hysterisis around the *set point*s for the anti-freeze/*supplementary electrical heaters*.

An example of operation is shown in the diagram below:

diagram

Diagram illustrating *anti-freeze/supplementary electrical heater control*



7.6.6 External anti-freeze electrical heater control

Control is based on probe ST3 with a *set point* which may be set using parameter *Pa r12* and a *hysteresis* of *Pa r11*. Control is similar to that of internal electrical heaters.

7.6.7 Supplementary Electrical Heaters

If Pa r15=1 in *heating* mode, the electrical heaters, are activate on their regulator and also if ST1 < (SET *Heating Pa r14*).
Regulator *hysteresis* is *Pa C04* (*Heating* regulation algorithm *hysteresis*)

7.6.8 Boiler control

SUPPLEMENTARY *BOILER*:
The *boiler* is turned on in *heating* mode if outdoor temperature drops below *Pa r13*.
In this case the compressor and fan are turned off and *heating* is achieved using only the *boiler*.
The heat pump is turned back on if the outdoor temperature exceeds *Pa r14*+*Pa r13*.
If the *boiler* is working, temperature control is achieved using the *boiler* output; control is similar to compressor control in *HEATING* mode.

BOILER IN *HEATING* MODE:.
Temperature control in *heating* mode makes use of the *boiler* output, and is similar to compressor control in heat.ing mode;
The compressor and the external fan are turned off.

The *boiler* is turned off if:

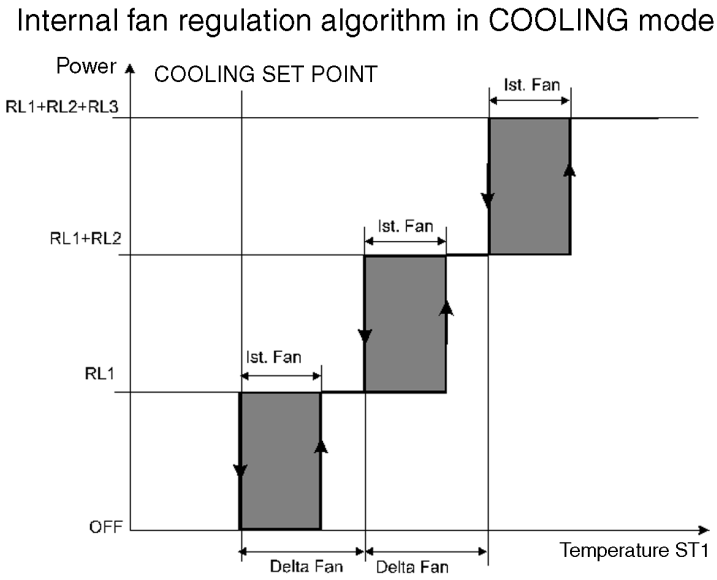
- in *cooling* mode
- on *stand-by* or OFF
- there is a *boiler* shutdown alarm (refer to *table of alarms*)

7.6.9 Internal fan control

INTERNAL FAN IN *COOLING* MODE:
The *internal fan* is turned off if:
- probe ST1 configuration parameter *Pa H05* ≠ 1
- there is a circuit shutdown alarm
- the instrument is OFF or on *stand-by*.

It is turned on at a speed depending on the difference between temperature ST1 and the *COOLING set point*. *Parameters*:
Pa F21= Fan control step differential
Pa F22= Fan control step *hysteresis*

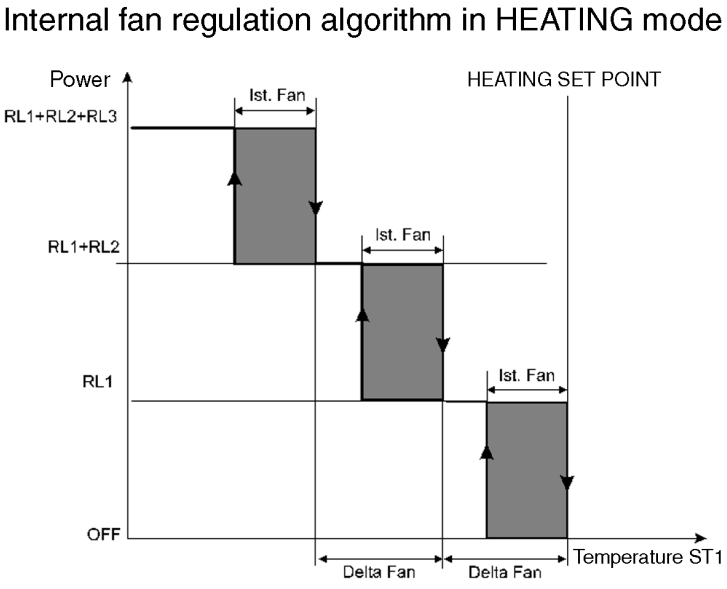
Idiagram illustrating nternal fan control in *cooling* mode



INTERNAL FAN CONTROL IN *HEATING* MODE:
The *internal fan* is turned off if:
- there is a hot start shutdown
- the heat pump is not present (*Pa H28*= 0)

Otherwise it is on, at a speed which depends on the difference between temperature ST1 and the *HEATING set point*. *Parameters*:
Pa F20= Fan control step differential
Pa F21= Fan control step *hysteresis*

Diagram illustrating *internal fan control* in *cooling* mode



For Energy 2xxB models, with anti-freeze alarm on, the *internal fan* is on

For Energy 2xxB models, with electrical heaters on, the *internal fan* is on

For Energy 2xxB models it is available parameter *Pa P01* with these meanings:
0= fan always on
1= fan stops with the compressor
2= fan always on in *cooling* mode, fan in response to a request from the regulation algorithm, in *heating* mode
3 = fan always on attivo in *cooling* mode, fan in response to a request from the regulation algorithm in *heating* mode
4 = fan always on in *heating* mode in response to a request from the regulation algorithm, in *cooling* mode

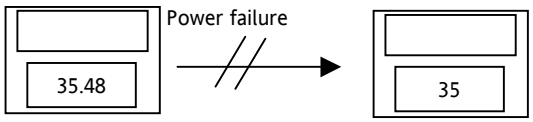
8 FUNCTIONS

8.1 Recording hours of operation

The device stores the number of hours of operation of the following in *permanent memory*:
- *hydraulic pump*
- *compressors*

It is precise to within one minute.
Hours of operation may be displayed by entering the appropriate menu with the label Ohr (refer to *menu structure*).
The whole value is displayed if it is less than 999 hours; if it exceeds this value, the hundreds of hours will be shown and the decimal point will appear:
For example, 1234 hours will be displayed as follows:

To set the number of hours to zero, hold the DOWN key (refer to *keys*) down for two seconds while displaying the number of hours of operation.



In the event of a *power failure*, the latest fraction of an hour recorded is set to 0, so that duration is rounded down

8.2 Defrosting

The defrost function is active in *heating* mode only.
It is used to prevent ice formation on the surface of the external exchanger, which can occur in locations with low temperatures and high humidity and will considerably reduce the machine's thermodynamic performance, creating a risk of damage to the machine.

Defrosting is enabled if:
- it is enabled by the parameter (*Pa d01*= 1)
- there is at least one condensation probe (*Pa H07*, for input ST3= 1 or 2, or *Pa H08*, for input ST4= 1)
- the *reversing valve* is present

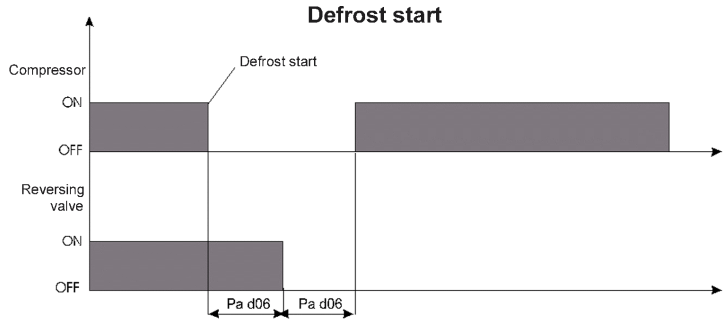
Defrosting may be controlled on the basis of temperature or pressure, depending on how the machine is configured in *Pa H49*.

Defrost start and stop commands are given on the basis of condensation probe readings and parameter settings, as described below:

8.2.1 Defrost start

- If condensation temperature/pressure drops below *Pa d02* (*Defrost start* temperature) and the compressor is ON, the response counter starts (*Pa d03*, defrost response time).
- When duration *Pa d03* has expired, the instrument begins *defrosting*.
- At this point, if *Pa d06* (compressor...valve delay time) = 0, the compressor will stay on. If not, the control illustrated in the diagram below will be applied:

diagram



This delay prevents liquid from flowing back into the compressor.
If the machine is configured with 2 *compressors*, both *compressors* (steps) will be on during *defrosting*.

This will not be the case if a thermal switch alarm has been given for one of the *compressors*.
Compressor safety times are ignored during the defrost cycle.
The pressure (or temperature) values corresponding to *defrost start* and end conditions are determined by:
- *defrost start*: parameter *Pa d02*
- *defrost end*: parameter *Pa d04*

this only applies if parameter *Pa H49*= 3 or 2.
If *Pa H49*= 1 (temperature-based operation), temperature values are determined by:
- *Pa d08*, start defrost
- *Pa d09*, stop defrost.

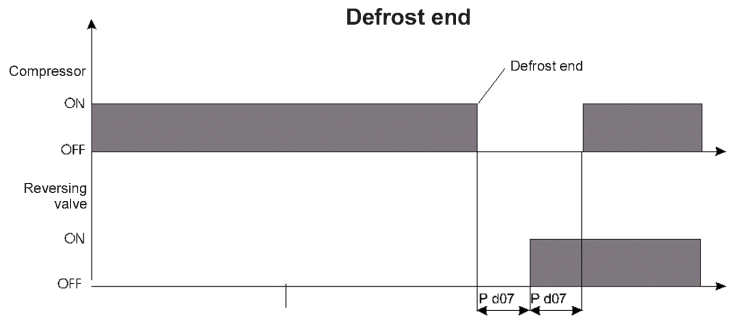
If *Pa H49*= 0, *defrosting* is not permitted (probe ST3 absent).

8.2.2 Defrost end

Defrost will end if:
- temperature/pressure rises above *Pa d04* (*defrost end* temperature/pressure).
- duration of *defrosting* reaches *Pa d05* (max defrost time)

at the end of *defrosting*, if drip time *Pa d07*= 0, the compressor will stay on; if not, the control illustrated in the figure will be applied:

diagram



8.2.3 Counter mode

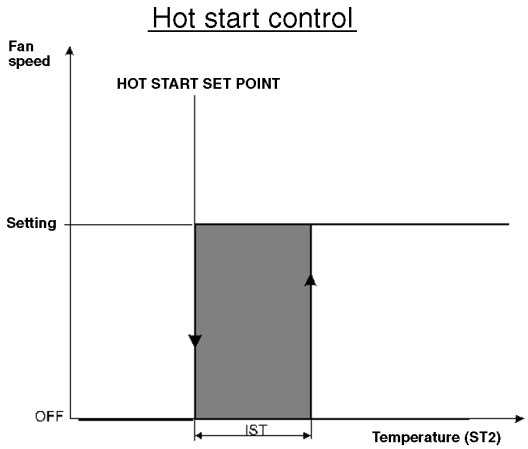
- The defrost interval counter is interrupted when temperature/pressure rises above *Pa d02* (*defrost start* temperature/pressure) or the compressor is turned off.
- The counter is set to zero after one of the following events: defrost cycle performed; power off; change in operating mode.
- The counter is also set to zero when the temperature/pressure rises above *Pa d04* (*defrost end* temperature/pressure).

8.3 Hot start function

This function is provided in *HEATING* mode only, using the *internal fan*, only when the internal exchanger is sufficiently hot. It prevents an unpleasant draft of cold air.
The function is active if:
- internal ventilation is active
- configuration parameter ST2 *Pa H06*= 1 (NTC probe outflowing water/air)
- in *heating* mode

The diagram below illustrates the function:
Regulation algorithm
ST2= water/air temperature probe
Pa F23= HOT START *set point*;
Pa F24= HOT START *hysteresis*

diagram



8.4 Machine out of coolant signal

In all *operating modes* except *boiler* in operation or *defrosting*, machine *functions* are controlled to detect leakage in the coolant circuit or breakage of the *reversing valve*s (if used as a heat pump).
The signal is given with code **E44** (refer to *table of alarms*).
The regulation algorithm is enabled by *Pa A23*= 1; and ST2 (analogue inputs) must be configured as outflowing water input (*Pa H06*= 1).
The alarm is triggered if one of the following conditions apply continuously for an amount of time exceeding *Pa A22*:

- in *heating* mode: the difference in temperature represented by ST2-ST1 (analogue inputs) is less than *Pa A20*
- in *cooling* mode: the difference in temperature represented by ST1-ST2 (analogue inputs) is less than *Pa A20*

The machien out of coolant alarm is always manually *reset*.
The timer is set to zero every time operating mode is changed and whenever the compressor is turned off. The counter is stopped for an amount of time which may be set using parameter *Pa A21* whenever the compressor is turned on.

8.5 Power failure

In the event of a *power failure*, when the power is restored the control will return to the status it had before the power went out.
If *defrosting* is underway, it will be cancelled. All timing in progress when the power goes out will be cancelled and started again.

9 PARAMETERS

Parameters make the "Energy 200" a fully configurable device.
They may be modified through:

- instrument *keyboard*
- memory card
- personal computer (with a suitable connection and "*Param manager*" software)

9.1 Description of parameters

We will now look at *parameters* in detail, divided by category.

9.1.1 Configuration parameters

Determine the features of the machine. If one or more *parameters* in this category are modified, the controller must be switched off after the modification and switched on again to ensure correct operation.

Pa H01 **Maximum *set point* during "*heating*"**
Upper limit on *set point* in "*heating*" mode

Pa H02 **Minimum *set point* during "*heating*"**
Lower limit on *set point* in "*heating*" mode

Pa H03 **Maximum *set point* during "*cooling*"**
Upper limit on *set point* in "*cooling*" mode

Pa H04 **Minimum *set point* during "*cooling*"**
Lower limit on *set point* in "*cooling*" mode

Pa H05 **ST1 configuration**
Used to configure analogue input ST1
0= No probe
1= Inflowing water/air analogue input
2= *Heating* request digital input
3= Regulation algorithm request digital input
4= NTC differential input

Pa H06 **ST2 configuration**
0= No probe
1= Outflowing water/antifreeze/inlet air analogue input
2= *Cooling* request digital input

Pa H07 **ST3 configuration**
0= No probe
1= Condensation control analogue input
2= 4...20 mA condensation input
3= 4...20 mA *dynamic set point* input
4= Antifreeze analogue input for water-water machines with gas reversal
5= Regulation algorithm input in "*heating*" mode for water-water machines with manual reversal

Pa H08 **ST4 configuration**
0= No probe
1= Condensation control NTC input
2= Multifunctional digital input
3= Outdoor temperature NTC input

Pa H09 **Bottom of scale pressure value**
Maximum inflowing value; determines the value corresponding to a current of 20 mA

Pa H10 **Polarity of digital input ID1**
Pa H11 **Polarity of digital input ID2**
Pa H12 **Polarity of digital input ID3**
Pa H13 **Polarity of digital input ID4**
Pa H14 **Polarity of digital input ID5**
0= Active when contact closed
1= Active when contact open

Pa H15 **Polarity of analogue input ST1**
Pa H16 **Polarity of analogue input ST2**
Pa H17 **Polarity of analogue input ST4**
If configured as digital inputs:
0= Active when contact closed
1= Active when contact open

Pa H18 **Configuration of digital input ID3**
Pa H19 **Configuration of digital input ID4**
Pa H20 **Configuration of digital input ID5**
0= Compressor 1 thermal switch
1= Fan thermal switch
2= Flow switch
3= Remote Heat/Cool
4= Remote ON-OFF
5= Compressor 2 thermal switch
6= Request for second compressor (step)

Pa H21 **ST4 configuration if configured as digital input (*Pa H08*=2)**
0= Compressor thermal switch
1= Fan thermal switch
2= Flow switch
3= Remote Heat/Cool
4= Remote ON-OFF
5= Compressor 2 thermal switch
6= Request for second compressor (step)

Pa H22 **Configuration of output RL2**
0= Pump
1= *Internal fan* step 1

Pa H23 **Configuration of output relay RL3**
0= Reversal
1= *Internal fan* step 3
2= second compressor (step)

Pa H24 **Configuration of output relay RL4**
0= Anti-freeze electrical heaters
1= *Internal fan* step 2
2= *Boiler*

Pa H25 **Optional analogue output configuration**
0= Open Collector output for 2nd comporessor
1= fan speed 4-20 mA output
2= fan speed 0-10 V output

Pa H26 **Serial protocol configuration (not used)**
0= Standard
1= Microtech

Pa H27 **Selection of operating mode**
May be used to select which input determines operation in *Heating*/*Cooling* mode
0= Selection from *keyboard*
1= Selection from digital input
2= Selection from analogue input (probe ST4)

Pa H28 **Heat pump**
0= Heat pump absent
1= Heat pump present

Pa H29 *Heating* **mode** *set point*
If mode selecton from analogue input is enabled, this is the value of ST4 below which the control will switch to "*heating*" mode

Pa H30 **Mode selection differential**
If mode selection from analogue input is enabled, this is the temperature differential for switching to "*cooling*" mode

Pa H31 **Enable** *dynamic set point*
Enables the function
0= *Dynamic set point* disabled
1= *Dynamic set point* enabled

Pa H32 *Dynamic set point* **offset in** *cooling* **mode**
The maximum value that may be added to the *set point* in "*cooling*" mode

Pa H33 *Dynamic set point* **offset in** *heating* **mode**
The maximum value that may be added to the *set point* in "*heating*" mode

Pa H34 **Outdoor temperature** *dynamic set point* **in** *cooling* **mode**
The temperature above which the *set point* offset is zero in *cooling* mode.

Pa H35 **Outdoor temperature** *dynamic set point* **in** *heating* **mode**
The temperature above which the *set point* offset is zero in *heating* mode.

Pa H36 **Outdoor temperature** *dynamic set point* **differential in** *cooling* **mode**
May be used to set the differential for the outdoor temperature below which the maximum *set point* offset applies

Pa H37 **Outdoor temperature** *dynamic set point* **differential in** *heating* **mode**
May be used to set the differential for the outdoor temperature above which the maximum offset applies.

Pa H38 *Reversing valve* **polarity**
relay ON in cool
relay ON in heat

Pa H39 **Offset ST1,**
Pa H40 **Offset ST2,**
Pa H42 **Offset ST4**
These *parameters* may be used to compensate the error that may occur between the temperature reading and the actual temperature or pressure.

Pa H41 **Offset ST3**
This parameter may be used to compensate the error that may occur between the temperature or pressure reading and the actual temperature or pressure.

Pa H43 **mains frequency**
0=mains frequency 50 Hz
1=mains frequency 60 Hz

Pa H44 **Family serial address,**
Pa H45 **Device serial address**
May be used to select serial address. Both normally 0.

Pa H46 **User password**
May be used to enter a parameter for access to level two *parameters*.

Pa H47 *Copy card* **write password**
The password that must be entered to copy *parameters* to the *copy card*.

Pa H48 **Number of** *compressors* **per circuit**
1= 1 compressor
2= 2 compressosi (or 2 steps)

Pa H49 **Enable pressure / temperature-based operation**
0= *parameters Pa H07*=0 (probe ST3 absent) and *Pa F01* = 3 (functioning in response to request from compressor) are forced.
1= temperature-based operation; *parameters Pa H07*,*Pa F01* are forced to: *Pa H07*= 1 (probe ST3 temperature), *Pa F01*= 3 (functioning in response to request from compressor).
2= pressure-based operation; *parameters Pa H07*, *Pa F01* are forced to: *Pa H07*= 2 (probe ST3 pressure), **F01**= 0 (proportional functioning).
3= no constraints are set on *parameters*

Pa H50 **Compressor on sequence**

0= *compressors* come on on the basis of number of hours of operation (balancing hours of operation)
1= compressor 1 is turned on first, followed by compressor (or capacity step) 2 (unvaried sequence).

Pa H51 **Compressor 2 or capacity step relay polarity**
0= relay ON if compressor 2/capacity step ON
1= relay ON if compressor 2/ capacity step OFF

Pa H52 **selection of degrees °C or °F**
0= degrees °C
1= degrees °F

Only *for Energy 2xxB* models:

Pa H53 **Displaying SET air/air devices**
To help the *User Interface*, in air-air versions, setting the parameter PAH53=1, the set regarding the selected mode, will be shown

Pa H54 **Client Code 1**
The user could assign this numberr, for internal use. Ranbge 0..999

PA H55 **Client Code 2**
The user could assign this numberr, for internal use. Ranbge 0..999

Pa H56 **Alarm output polarity**
- 0 = the output is active (close contact) when is the alarm is active & when the device is in off mode.
- 1 = in the same conditions, open contact

PA H57 **Activation Alarm output in off mode**
- 0= alarm output not activated in OFF or *stand-by* mode
- 1= active alarm output in OFF or *stand-by* mode

9.1.2 Alarm parameters

Pa A01 **Low pressure pressure switch bypass time.**
Determines the delay between starting up the compressor and starting up the low pressure digital alarm *diagnostics*. Expressed in seconds.

Pa A02 **Low pressure** *alarm events per hour*
Used to set the number of low pressure digital *alarm events per hour* beyond which the system will switch from automatic *reset* to *manual reset*.

Pa A03 **Bypass flow switch after pump on**
Determines the delay between activation of the *hydraulic pump* and activation of the flow switch alarm *diagnostics*. Expressed in seconds.

Pa A04 **Duration of active flow switch input**
May be used to set the amount of time for which the flow switch digital input must remain *active* to generate a flow switch alarm. The timer starts after the flow switch by-pass time. Expressed in seconds.

Pa A05 **Duration of inactive flow switch input**
May be used to set the time for which the flow switch digital input must remain *inactive* to be included in the corresponding alarm. Expressed in seconds.

Pa A06 **Number of flow switch** *alarms*/**hour**
May be used to set the number of flow switch *digital alarms* per hour after which the alarm is switched from automatic to *manual reset*. When this occurs, the *hydraulic pump* is deactivated.

Pa A07 **Compressor thermal switch bypass following compressor on**
Determines the delay between compressor activation and activation of the compressor thermal switch digital *diagnostics* alarm. Expressed in seconds.

Pa A08 **Compressor 1/2 thermal switch** *alarm events per hour*
May be used to set a number of compressor thermal switch *alarm events per hour* beyond which the alarm is switched from automatic to *manual reset*..

Pa A09 **Fan thermal switch** *alarm events per hour*
May be used to set a number of fan thermal switch *alarm events per hour* beyond which the alarm is switched from automatic to *manual reset*.

Pa A10 **Anti-freeze alarm by-pass**
Determines the delay between turning on the machine and activation of the anti-freeze alarm. Active only in *heating* mode.Expressed in minutes.

Pa A11 **Anti-freeze alarm** *set point*
May be used to set the temperature below which the anti-freeze alarm is triggered.

Pa A12 **Anti-freeze alarm differential**
May be used to set the anti-freeze alarm differential.

Pa A13 **Anti-freeze** *alarm events per hour*
May be used to set a number of anti-freeze *alarm events per hour* beyond which the alarm is switched from automatic to *manual reset*.

Pa A14 **Analogue input high pressure** *set point*
May be used to set a condensation pressure/temperature value beyond which the high pressure alarm will be triggered.

Pa A15 **Analogue input high pressure** *hysteresis*
May be used to set the differential for the analogue high pressure alarm.

Pa A16 **Analogue input low pressure bypass**
Determines the delay after turning on the compressor before activation of the analogue input low pressure alarm. Expressed in seconds.

Pa A17 **Analogue input low pressure** *set point*
May be used to set a temperature/pressure value below which the low pressure alarm will be triggered.

Pa A18 **Analogue input low pressure** *hysteresis*
May be used to set the differential for the analogue low pressure alarm.

Pa A19 **Analogue input low pressure alarm events/hour**
May be used to set a number of low pressure analogue *alarm events per hour* beyond which the alarm will be switched from automatic to *manual reset*.

Pa A20 **Machine out of coolant differential**
If the difference, in absolute value, between ST2 and ST1 is lower, in *heating* mode, or exceeds in *cooling* mode, the machine out of coolant timer will be count..

Pa A21 **Machine out of coolant bypass**
Determines the delay between the turning on of the first compressor in the corresponding *cooling* circuit and activation of the machine out of coolant alarm *diagnostics*. Expressed in minutes.

Pa A22 **Machine out of coolant duration**
Determines the amount of time beyond which the machine out of coolant alarm will be triggered.

Pa A23 **Machine out of coolant alarm activation**
Enables machine out of coolant alarm

Pa A24 **Enable low pressure alarm during** *defrosting*
Enables the minimum alarm during *defrosting*. If 0, the low pressure alarm is disabled during *defrosting*.

Pa A25 **Over-temperature** *set point*
Temperature value ST1 above which the over-temperature alarm E46 is triggered.

Pa A26 **Over-temperature ON duration**
Determines the duratoni of the condition ST1>A25 beyond which alarm E46 is triggered.

9.1.3 Compressor parameters

Pa C01 **OFF-ON safety time**
The minimum amount of time that must pass between turning off the compressor and turning it on again. Expressed in tens of seconds.

Pa C02 **ON-ON safety time**
The minimum amount of time that must pass between turning the compressor on and turning it on again. Expressed in tens of seconds.

Pa C03 *Cooling* **regulation algorithm** *hysteresis*
May be used to select intervention differential in *cooling* mode.

Pa C04 *Heating* **regulation algorithm** *hysteresis*
May be used to select intervention differential in *heating* mode.

Pa C05 **Regulation algorithm step intervention differential**
May be used to set a temperature differential in relation to the *set point* beyond which the second step is activated.

Pa C06 **Compressor 1 - compressor 2 (step) on interval**
May be used to set a delay between turning on of two steps.

Pa C07 **Compressor 1 - compressor 2 (step) off interval**
May be used to set a delay between turning off of two steps.

9.1.4 Fan control parameters

Pa F01 **Fan output configuration**
0: proportional condensation control TK output
1: ON-OFF TK output
2: anti-freeze electrical heater output for water-water machines with gas reversal
3: TK ON-OFF output on compressor

Pa F02 **Fan** *pick-up* **time**
Time for which fan runs at maximum speed after starting up. Expressed in seconds/10.

Pa F03 **Fan** *phase shift*
May be used to adapt output to various types of fans.

Pa F04 *Impulse duration* **of triac on**
May be used to vary the length of the impulse from the triac.

Pa F05 **Functioning in response to compressor request**
0: if compressor is off, fan is off
1: condensation control independent of compressor

Pa F06 **Minimum speed during** *cooling*
Minimum value of proportional fan control during *cooling*. Expressed as a percentage of the maximum permitted voltage, from 0 to 100%,.

Pa F07 **Maximum** *silent speed* **during** *cooling*
Maximum value of proportional fan control during *cooling*. Expressed as a percentage of the maximum permitted voltage, from 0 to 100%,.

Pa F08 **Minimum fan speed temperature/pressure** *set point* **during** *cooling*
Condensation pressure/temperature value below which the fan runs at minimum *cooling* speed.

Pa F09 **Proportional band during** *cooling*
Temperature/pressure differential corresponding to change from minimum to silent maximum fan speed during *cooling*.

Pa F10 *Cut-off* **differential**
Condensation temperature/pressure differential within which fan continues to run at low speed.

Pa F11 *Cut-off hysteresis***.**
Condensation temperature/pressure differential for fan *cut-off*.

Pa F12 *Cut-off* **bypass time**
Determines the amount of time after fan start-up during which fan *cut-off* is excluded. Expressed in seconds.

Pa F13 **Maximum speed during** *cooling*
May be used to set a speed step corresponding to a given temperature/pressure value during *cooling*.

Pa F14 **Maximum fan speed temperature/pressure** *set point* **in** *cooling* **mode**
Condensation temperature/pressure corresponding to the fan speed determined by par. F13.

Pa F15 **Minimum speed during** *heating*
Minimum proportional fan control value in *heating* mode. Expressed as a percentage of the maximum permitted voltage, from 0 to 100%,.

Pa F16 **Maximum** *silent speed* **during** *heating*
Maximum value of proportional fan control during *heating*. Expressed as a percentage of the maximum permitted voltage, from 0 to 100%,.

Pa F17 **Minimum fan speed temperature/pressure** *set point* **during** *heating*
Condensation temperature/pressure value above which the fan operates at minimum speed in *heating* mode.

Pa F18 **Proportional band during** *heating*
Temperature/pressure differential corresponding to a change from minimum to maximum silent fan speed during *heating*.

Pa F19 **Maximum speed during** *heating*
May be used to set a speed step corresponding to a given temperature/pressure value during *heating*.

Pa F20 **Maximum fan speed temperature/pressure** *set point* **during** *heating*
Condensation temperature/pressure value corresponding to the fan speed set for par. F19.

Pa F21 *Internal fan* **step differential**
May be used to set a temperature differential between one step of fan control and the next for *internal fan control*.

Pa F22 *Internal fan* **step** *hysteresis*
May be used to set a *hysteresis* for each fan control step *cut-off*.

Pa F23 **Hot start** *set point*
May be used to set a temperature value for probe ST2 below which *internal fan control* is shut down.

Pa F24 **Hot start** *hysteresis*
May be used to set a *hysteresis* for the *hot start function*.

Pa F25 **Preventilation in** *cooling* **mode**
May be used to set a preventilation time in *cooling* mode before the compressor is turned on.

9.1.5 Pump parameters

Pa P01 **Pump operating mode**
May be used to determine pump operating mode:
0=continuous operation
1=operation in response to a request from the regulation algorithm
2=*cyclic operation*

Pa P01 **Pump operating mode**
For Energy 2xxB
May be used to determine pump or fan operating mode:
0=(pump) continuous operation |(fan) fan always on
1=(pump) operation in response to a request from the regulation algorithm | (fan) fan stops with the compresor
2=*cyclic operation* | (fan) fan always on in *cooling* mode, in response to a request from the regulation algorithm in *heating* mode
3 = (fan) fan always on in *cooling* mode, in response to a request from the regulation algorithm in *heating* mode
4 = (fan) fan always on in *heating* mode, in response to a request from the regulation algorithm in *cooling* mode

Pa P02 **Delay between pump ON and compressor ON**
May be used to set a delay between starting a pump and starting a compressor, expressed in seconds.

Pa P03 **Delay between compressor OFF and pump OFF**
May be used to set a delay between turning off a compressor and turning off a pump, expressed in seconds.

9.1.6 Anti-freeze/boiler parameters

Pa r01 **Configuration of electrical heaters in defrost mode**
Determines electrical heater operation during *defrosting*
0=come on only in response to a request from the regulation algorithm
1=always on during *defrosting*

Pa r02 **Configuration of electrical heaters on in** *cooling* **mode**
Determines electrical heater operation in *cooling* mode
0=off during *cooling*
1=on during *cooling* (in response to anti-freeze electrical heater regulation algorithm)

Par 03 **Configuration of electrical heaters on in** *heating* **mode**
Determines electrical heater operation in *heating* mode
0=off during *heating*
1= on during *heating* (in response to anti-freeze electrical heater regulation algorithm)

Par 04 **Configuration of anti-freeze electrical heater control probe in** *heating* **mode**
Determines electrical heater control probe in *heating* mode
0=Controls on the basis of probe ST1
1= Controls on the basis of probe ST2

Pa r05 **Configuration of anti-freeze electrical heater control probe in** *cooling* **mode**
Determines electrical heater control probe in *cooling* mode
0= Controls on the basis of probe ST1
1= Controls on the basis of probe ST2

Pa r06 **Configuration of electrical heaters when OFF or on** *stand-by*
Determines the status of electrical heaters when the instrument is OFF or on *stand-by*
0=Always off when OFF or on *stand-by*
1=On when OFF or on *stand-by* (in response to anti-freeze electrical heater control algorithm)

Pa r07 *Set point* **of anti-freeze electrical heaters in** *heating* **mode**
Temperature value below which anti-freeze electrical heaters come on in *heating* mode.

Pa r08 *Set point* **of anti-freeze electrical heaters in** *cooling* **mode**
Temperature value below which anti-freeze electrical heaters come on in *cooling* mode.

Pa r09 **Maximum** *set point* **of anti-freeze electrical heaters**
Determines the maximum setting of the anti-freeze electrical heater *set point*.

Pa r10 **Minimum** *set point* **of anti-freeze electrical heaters**
Determines the minimumsetting of the anti-freeze electrcial heater *set point*s.

Pa r11 **Anti-freeze heater** *hysteresis*
Anti-freeze electrical heater control algorithm *hysteresis*.

Pa r12 *Set point* **of** *external anti-freeze electrical heaters*
Temperature below which *external anti-freeze electrical heaters* come on.

Pa r13 **Outdoor temperature** *set point* **for** *boiler* **on**
The temperature below which the *boiler* is turned on and the heat pump is turned off.

Pa r14 *Boiler* **off differential**
Boiler off differential. If outdoor temperature exceeds *Pa r14*+*Pa r13*, the *boiler* will be turned off and the heat pump will be turned on.

Pa r15 **Configuration of** *Supplementary Electrical Heaters*
If this parameter =1 The electrical heaters will have the double function of anti-freeze and supplementary heaters
Otherwise (*Pa r15*=0) the electrical heaters will have anti-freeze function only

9.1.7 Defrost parameters

Pa d01 **Defrost enabled**
0= defrost function disabled
1= defrost function enabled

Pa d02 *Defrost start* **temperature / pressure**
Temperature/pressure below which the defrost cycle is started.

Pa d03 **Defrost interval (response time)**
Duration for which probe remains below *defrost start* temperature/pressure, expressed in minutes.

Pa d04 *Defrost end* **temperature/pressure**
Temperature/pressure above which *defrost end*s.

Pa d05 **Maximum defrost time (time-out)**
Maximum duration of defrost in minutes.

Pa d06 **Compressor-***reversing valve* **wait time (anti-bleeding)**
Wait time between compressor going off and reversal of the 4-way valve at the beginning of the defrost cycle.

Pa d07 **Drip time**
Wait time at the end of the defrost cycle between turning off the compressor and reversing the 4-way valve.

Pa d08 **Temperature at which** *defrost start***s if** *Pa H49***= 1**
Temperature below which the defrost cycle is started.

Pa d09 **Temperature at which** *defrost end***s if** *Pa H49***=1**
Temperature above which the defrost cycle is ended.

Only *for Energy 2xxB* models:

Pa d10 **Defrost enabled compensation**
See temperature *defrost start*

Pa d11 **Offset Defrost compensation temperature/pressure**
See temperature *defrost start* The user could assign this numberr, for internal use. Ranbge 0..999

Pa d12 **Set compensation temperature/pressure**
See temperature *defrost start*

Pa d13 **Delta compensation temperature/pressure**
See temperature *defrost start*

9.2 Table of parameters

All "Energy 200" *parameters* are listed in the table below.

Configuration parameters

*CONFIGURATION PARAMETERS**				
Par.	Description	Value	Limits	Unit of measurement
Pa H01	Maximum *set point* during *heating*		*Pa H02* ÷ 90.0	°C
Pa H02	Minimum *set point* during *heating*		-40.0 ÷ *Pa H01*	°C
Pa H03	Maximum *set point* during *cooling*		*Pa H04* ÷ 90.0	°C
Pa H04	Minimum *set point* during *cooling*		-40.0 ÷ *Pa H03*	°C
Pa H05	Configuration ST1		0 ÷ 4 (5)	Num
Pa H06	Configuration ST2		0 ÷ 3	Num
Pa H07	Configuration ST3		0 ÷ 5	Num
Pa H08	Configuration ST4		0 ÷ 3 (4)	Num
Pa H09	Bottom of scale pressure value		0-350	kPa*10
Pa H10	Polarity ID1		0 ÷ 1	Flag
Pa H11	Polarity ID2		0 ÷ 1	Flag
Pa H12	Polarity ID3		0 ÷ 1	Flag
Pa H13	Polarity ID4		0 ÷ 1	Flag
Pa H14	Polarity ID5		0 ÷ 1	Flag
Pa H15	Polarity ST1		0 ÷ 1	Flag
Pa H16	Polarity ST2		0 ÷ 1	Flag
Pa H17	Polarity ST4		0 ÷ 1	Flag
Pa H18	Configuration ID3		0 ÷ 6	Num
Pa H19	Configuration ID4		0 ÷ 6	Num
Pa H20	Configuration ID5		0 ÷ 6	Num
Pa H21	Configuration ST4 if digital input		0 ÷ 6	Num
Pa H22	Configuration relay 2		0 ÷ 1	Num
Pa H23	Configuration relay 3		0 ÷ 2	Num
Pa H24	Configuration relay 4		0 ÷ 2	Num
Pa H25	Configuration of *optional output*		0 ÷ 2	Num
Pa H26	Configuration of serial protocol (not used)		0 ÷ 1	Num
Pa H27	Selection of operating mode		0 ÷ 2	Num
Pa H28	Presence of heat pumpt		0 ÷ 1	Flag
Pa H29	*Heating* mode *set point*		0 ÷ 255	°C
Pa H30	Mode selection differential		0 ÷ 25.5	°C
Pa H31	Enable *dynamic set point*		0 ÷ 1	Flag
Pa H32	*Dynamic set point* offset in *cooling* mode		-12.7 ÷ 12.7	°C
Pa H33	*Dynamic set point* offset in *heating* mode		-12.7 ÷ 12.7	°C
Pa H34	Outdoor temperature *set point* in *cooling* mode		0 ÷ 255	°C

Pa H35	Outdoor temperature *set point* in *heating* mode		0 ÷ 255	°C
Pa H36	Outdoor temp. *dynamic set point* differential in *cooling*		-12.7 ÷ 12.7	°C
Pa H37	Outdoor temp. *dynamic set point* differential in *heating*		-12.7 ÷ 12.7	°C
Pa H38	*Reversing valve* polarity		0 ÷ 1	Flag
Pa H39	Offset ST1		-12.7 ÷ 12.7	°C
Pa H40	Offset ST2		-12.7 ÷ 12.7	°C
Pa H41	Offset ST3		-127 ÷ 127	°C/10-kPa*10
Pa H42	Offset ST4		-12.7 ÷ 12.7	°C
Pa H43	Mains frequency		0 ÷ 1	Flag
Pa H44	Family serial address		0 ÷ 14	Num.
Pa H45	Device serial address		0 ÷ 14	Num.
Pa H46	User password		0 ÷ 255	Num.
Pa H47	*Copy card* write password		0 ÷ 255	Num.
Pa H48	Number of *compressors* per circuit		1 ÷ 2	Num.
Pa H49	Enable pressure/temperature based operation		0÷2	Num.
Pa H50	Compressor on sequence		0÷1	Num.
Pa H51	Compressor 2 or capacity step polarity		0÷1	Num.
Pa H52	Selection of degrees °C or °F		0÷1	Num.
Pa H53	Displaying SET air/air devices		0÷1	Num.
Pa H54	Client Code 1		0÷999	Num.
Pa H55	Client Code 2		0÷999	Num.
Pa H56	Alarm Otuput Polarity		0÷1	Num.
Pa H57	Activation Alarm output in off mode		0÷1	Num.

* If *parameters* in this category are modified, the controller must be turned off after the modification and turned on again to guarantee correct functioning.

Table of parameters: alarm parameters

ALARM PARAMETERS				
Par.	Description	Value	Limits	Unit of measurement
Pa A01	Low pressure pressure switch bypass time after comp. on		0 ÷ 255	Seconds
Pa A02	Low pressure *alarm events per hour*		0 ÷ 255	Num
Pa A03	Bypass flow switch after pump on		0 ÷ 255	Seconds
Pa A04	Duration of active flow switch input		0 ÷ 255	Seconds
Pa A05	Duration of inactive flow switch input		0 ÷ 255	Seconds
Pa A06	Number of flow switch *alarm events per hour*		0 ÷ 255	Num
Pa A07	Compressor thermal switch bypass following comp. on		0 ÷ 255	Seconds
Pa A08	Compressor 1/2 thermal switch *alarm events per hour*		0 ÷ 255	Num
Pa A09	Fan thermal switch *alarm events per hour*		0 ÷ 255	Num
Pa A10	Anti-freeze alarm bypass after ON-OFF		0 ÷ 255	Minutes
Pa A11	Anti-freeze alarm *set point*		-127 ÷ 127	°C
Pa A12	Anti-freeze alarm *hysteresis*		0 ÷ 25.5	°C
Pa A13	Anti-freeze *alarm events per hour*		0 ÷ 255	Num
Pa A14	Analogue input high pressure *set point*		0 ÷ 900	°C/10-kPa*10
Pa A15	Analogue input high pressure *hysteresis*		0 ÷ 255	°C/10 – kPa*10
Pa A16	Analogue input low pressure bypass		0 ÷ 255	Seconds
Pa A17	Analogue input low pressure *set point*		-500 ÷ 800	°C/10–kPa*10
Pa A18	Analogue input low pressure *hysteresis*		0 ÷ 255	°C/10-kPa*10
Pa A19	Analogue input low pressure *alarm events per hour*		0 ÷ 255	Num
Pa A20	Machine out of coolant differential		0 ÷ 255	°C
Pa A21	Machine out of coolant bypass		0 ÷ 255	Minutes
Pa A22	Machine out of coolant duration		0 ÷ 255	Minutes
Pa A23	Machine out of coolant alarm activation		0 ÷ 1	Flag
Pa A24	Enable low pressure alarm during *defrosting*		0 ÷ 1	Flag
Pa A25	Over-temperature *set point*		0 ÷ 255	°C
Pa A26	Over-temperature ON duration		0 - 255	Seconds10

Table of parameters: compressor parameters

COMPRESSOR PARAMETERS				
Par.	Description	Value	Limits	Unit of measurement
Pa C01	ON-OFF safety time	3	0 ÷ 255	Seconds*10
Pa C02	ON-ON safety time	3	0 ÷ 255	Seconds*10
Pa C03	*Cooling* regulation algorithm *hysteresis*	1.5	0 ÷ 25.5	°C
Pa C04	*Heating* regulation algorithm *hysteresis*	1.5	0 ÷ 25.5	°C
Pa C05	Regulation algorithm step intervention differential	CC	0 ÷ 25.5	°C
Pa C06	Compressor 1 – compressor 2 (step) on interval		0 ÷ 255	Seconds
Pa C07	Compressor 1 – compressor 2 (step) off interval		0 ÷ 255	Seconds

Table of parameters: fan control parameters

FAN CONTROL PARAMETERS				
Par.	Description	Value	Limits	Unit of measurement
Pa F01	Fan output configuration	0	0 ÷ 3	Num.
Pa F02	Fan *pick-up* time	50	0 ÷ 255	Seconds/10
Pa F03	Fan *phase shift*	5	0 ÷ 100	µseconds*200
Pa F04	*Impulse duration* of triac on	3	0 ÷ 255	µseconds*200

Pa F05	Functioning in response to compressor request	1	0 ÷ 1	Flag
Pa F06	Minimum speed during *cooling*	22	0 ÷ 100	%
Pa F07	*Silent speed* during *cooling*	70	0 ÷ 100	%
Pa F08	Minimum fan speed temperature/pressure *set point* during *cooling*	400	-500 ÷ 800	°C/10 – kPa*10
Pa F09	Prop. band during *cooling*	100	0 ÷ 255	°C/10 – kPa*10
Pa F10	*Cut-off* differential	30	0 ÷ 255	°C/10 – kPa*10
Pa F11	*Cut-off hysteresis*	10	0 ÷ 255	°C/10 – kPa*10
Pa F12	*Cut-off* bypass time	20	0 ÷ 255	Seconds
Pa F13	Maximum speed during *cooling*	89	0 ÷ 100	%
Pa F14	Maximum fan speed temperature/pressure *set point* in *cooling* mode	700	-500 ÷ 800	°C/10 – kPa*10
Pa F15	Minimum speed during *heating*	30	0 ÷ 100	%
Pa F16	*Silent speed* during *heating*	70	0 ÷ 100	%
Pa F17	Minimum fan speed temperature/pressure *set point* during *heating*	100	-500 ÷ 800	°C/10 – kPa*10
Pa F18	Proportional band during *heating*	50	0 ÷ 255	°C/10 – kPa*10
Pa F19	Maximum speed during *heating*	90	0 ÷ 100	%
Pa F20	Maximum fan speed temperature/pressure *set point* during *heating*	50	-500 ÷ 800	°C/10 – kPa*10
Pa F21	*Internal fan* step differential	20	0 ÷ 25.5	°C
Pa F22	*Internal fan* step *hysteresis*	10	0 ÷ 25.5	°C
Pa F23	Hot start *set point*	50	0 ÷ 255	°C
Pa F24	Hot start *hysteresis*	10	0 ÷ 25.5	°C
Pa F25	Preventilation in *cooling* mode	20	0 ÷ 255	Seconds

Table of parameters: pump parameters

PUMP PARAMETERS				
Par.	Description	Value	Limits	Unit of measurement
Pa P01	Pump operating mode Pump or fan operating mode	1	0 ÷ 2 0 ÷ 4	Num.
Pa P02	Delay between pump ON and compressor ON	200	0 ÷ 255	Seconds
Pa P03	Delay between compressor OFF and pump OFF	230	0 ÷ 255	Seconds

Table of parameters: anti-freeze/boiler parameters

ANTI-FREEZE/*BOILER PARAMETERS*				
Par.	Description	Value	Limits	Unit of measurement
Pa r01	Configuration of electrical heaters in defrost mode	1	0 ÷ 1	Flag
Pa r02	Configuration of electrical heaters on in *cooling* mode	1	0 ÷ 1	Flag
Pa r03	Configuration of electrical heaters on in *heating* mode	1	0 ÷ 1	Flag
Pa r04	Configuration of anti-freeze electrical heater control probe in *heating* mode	1	0 ÷ 1	Flag
Pa r05	Configuration of anti-freeze electrical heater control probe in *cooling* mode	1	0 ÷ 1	Flag
Pa r06	Configuration of electrical heaters when OFF or on *stand-by*	1	0 ÷ 1	Flag
Pa r07	*Set point* of anti-freeze electrical heaters in *heating* mode	2	*Pa r09*÷Pa **r10**	°C
Pa r08	*Set point* of anti-freeze electrical heaters in *cooling* mode	1	*Pa r09*÷*Pa r10*	°C
Pa r09	Maximum *set point* of anti-freeze electrical heaters	90	*Pa r10*÷127	°C
Pa r10	Minimum *set point* of anti-freeze electrical heaters	-10	-127÷*Pa r09*	°C
Pa r11	Anti-freeze heater *hysteresis*	1.0	0 ÷ 25.5	°C
Pa r12	*Set point* of *external anti-freeze electrical heaters*	5	*Pa r09*÷*Pa r10*	°C
Pa r13	Outdoor temperature *set point* for *boiler* on	10	-127 ÷ 127	°C
Pa r14	Outdoor temperature differential for *boiler* off	20	0 ÷ 25.5	°C
Pa r15	Configuration of *Supplementary Electrical Heaters*	0	0 ÷ 1	°C

Table of parameters: defrost parameters

DEFROST PARAMETERS				
Par.	Description	Value	Limits	Unit of measurement
Pa d01	Defrost enabled		0 ÷ 1	Flag
Pa d02	*Defrost start* temperature/pressure		-500 ÷ 800	°C/10 - kPa*10
Pa d03	Defrost interval (response time)		0 ÷ 255	Minutes
Pa d04	*Defrost end* temperature/pressure		-500 ÷ 800	°C/10 - kPa*10
Pa d05	Maximum defrost time		0 ÷ 255	Minutes
Pa d06	Compressor-*reversing valve* wait time		0 ÷ 255	Seconds
Pa d07	Drip time		0 ÷ 255	Seconds
Pa d08	Temperature at which *defrost start*s if *Pa H49*= 1		-50.0 ÷ 80.0	°C/10
Pa d09	Temperature at which *defrost end*s if *Pa H49*= 1		-500 ÷ 80.0	°C/10
Pa d10	Defrost enabled compensation		0 ÷ 1	Flag

Pa d11	Offset Defrost compensation temperature/pressure		-255 ÷ 255	°C/10 - kPa*10
Pa d12	Set compensation temperature/pressure		-127 ÷ 127	°C
Pa d13	Delta compensation temperature/pressure		-255 ÷ 255	°C

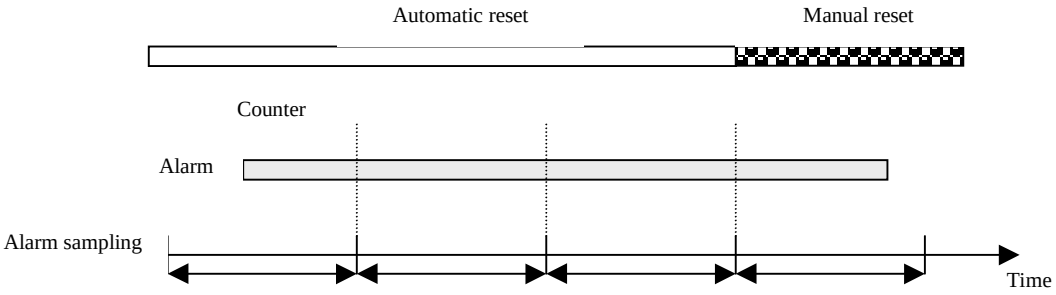
10 DIAGNOSTICS

Alarms

"Energy 200" can perform full systems *diagnostics* and signal a series of *alarms*.
Alarm trigger and *reset* modes are set using *parameters Pa A01 – Pa A26*.

Alarm events per hour

For some *alarms* the signal will not be given for a certain amount of time, determined by a parameter.
For some *alarms* the number of alarm events is counted; if the number of alarm events in the past hour exceeds a certain threshold set by a parameter, the alarm will switch from automatic to *manual reset*.
Alarms are sampled every 225 seconds;
Example: if the number of events/hour is set to 3, the duration of an alarm must fall between 2*225 seconds and 3*225 seconds for the alarm to be switched from automatic to *manual reset*.



If an alarm is triggered more than once within one sampling period (225 seconds), only one alarm will be counted.

Alarms with *manual reset* are *reset* by pressing the ON-OFF button and releasing.

Manual reset shuts down corresponding *loads* and requires an operator to intervene (*reset* the alarm using the ON-OFF control).
Manual reset alarms are used mainly to identify problems which could result in damage to the system.

10.1 List of alarms

When an alarm is triggered, two things occur:
- The corresponding *loads* are shut down
- The alarm appears on the *keyboard display*

The alarm message consists of a code with the format "Enn" (where nn is a 2-digit number identifying the type of alarm, such as: E00, E25, E39....).
All possible *alarms* are listed in the table below, along with their codes and the corresponding *loads* that will be shut down:

Table of alarms

CODE	SIGNAL	DESCRIPTION	*LOADS* SHUT DOWN						
			COMP.1	COMP.2	EXT. FAN	INT. FAN	PUMP	RES.1	RES.2
E00	Remote Off	• All *loads* will be shut down; • Triggered by the digital input configured as "Remote ON-OFF " (refer to digital inputs)	YES	YES	YES	YES	YES	YES	YES
E01	High pressure (digital)	• *Compressors* in the circuit will be shut down; • Triggered by digital input ID1 (refer to digital inputs) • Always manually *reset*	YES	YES					
E02	Low pressure (digital)	• *Compressors* and... will be shut down • Triggered by digital input ID2 (refer to digital inputs); • Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A02*, after which manually *reset*; • Inactive during timer *Pa A01* after a compressor is turned on or the 4-way valve (*reversing valve*) is reversed. • Inactive during *defrosting* if Pa 24=0.	YES	YES	YES	YES			
E03	Thermal switch protection compressor 1	• Compressor 1 will be shut down; • Triggered by the digital input configured as "Compressor 1 thermal switch" (refer to digital inputs); • Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A08*, after which manually *reset*; • Inactive during timer *Pa A07* after compressor is turned on.	YES						
E04	Thermal switch protection condenser fan	• *Compressors* and fans will be shut down; • Triggered by the digital input configured as "Fan thermal switch" (refer to digital inputs); • Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A09*, after which manually *reset*;	YES	YES	YES	YES			
E05	Anti-freeze	• External fans and *compressors* will be shut down; • Active if analogue probe ST2 (refer to analogue inputs) is configured as an anti-freeze probe (*Pa H06* = 1); • Triggered when probe ST2 detects a value below *Pa A11*; • Goes off if ST2 detects a value greater than *Pa A11* + *Pa A12*; • Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A13*, after which manually *reset*; • In *heating* mode,inactive during timer *Pa A10* after Energy 200 is turned on using the On-OFF key (refer to *keyboard*) or digital ON-OFF input (refer to digital inputs)	YES	YES	YES				
E06	Probe ST2 fault	• All *loads* will be shut down; • Triggered if probe ST2, configured as an analogue input, shorts or is cut off or probe limits are exceeded (-50°C.. 100°C).	YES	YES	YES	YES	YES	YES	YES
E07	Probe ST3 fault	• All *loads* will be shut down; • Triggered if probe ST3, configured as an analogue input, shorts or is cut off or probe limits are exceeded (-50°C.. 100°C).	YES	YES	YES	YES	YES	YES	YES
E11	High pressure / high temperature (analogue)	• *Compressors* will be shut down; • Active if at least one probe is configured for condensation control (refer to analogue inputs) • Triggered when the condensation probe detects a value in excess of *Pa A14* • Turned off if temperature/pressure falls below *Pa A14* – *Pa*	YES	YES					

		A15. • Always manually *reset*							
E12	Low pressure / low temperature (analogue)	• *Compressors* and fans will be shut down; • Active if at least one probe is configured for condensation control (refer to analogue inputs) • Triggered when the condensation probe detects a value below *Pa A17* • Goes off if temperature/pressure exceeds *Pa A17* – *Pa A18*. • Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A19*, after which manually *reset*; • Inactive during timer *Pa A16* after compressor is turned on or 4-way valve (*reversing valve*) is reversed	YES	YES	YES	YES			
E13	Thermal switch protection compressor 2	• Compressor 2 will be shut down; • Triggered by the digital input configured as "Compressor 2 thermal switch" (refer to digital inputs); • Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A08*, after which manually *reset*; • Inactive during timer *Pa A07* after compressor is turned on.		YES					
E41	Flow switch	• All *compressors*, external fans and pumps will be turned off if the alarm is to be manually *reset*; • Triggered if the digital input configured as "flow switch" (refer to digital inputs) remains active for an amount of time equal to *Pa A04*; • Goes off if the digital input configured as "flow switch" (refer to digital inputs) remains inactive for an amount of time equal to *Pa A05*; • Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A06*, after which manually *reset*; • Inactive during timer *Pa A03* after pump (*hydraulic pump*) is turned on • *For Energy 2xxB* models the *internal fan* is blocked	YES	YES	YES	YES *for Energy 2xxB* models	YES[3]		
E42	Probe ST4 fault	• All *loads* will be shut down; • Triggered if probe ST4, configured as an analogue input, shorts or is cut off or probe limits are exceeded (-50°C.. 100°C).	YES	YES	YES	YES	YES	YES	YES
E43	Anti-freeze alarm (water-water machine with gas reversal)	• *Compressors* will be shut down; • Active if probe ST3 is configured as an anit-freeze probe for water-water machines with gas reversal (refer to analogue inputs) • Triggered if probe ST3 detects a value below *Pa A11* • Goes off if temperature detected by ST3 exceeds *Pa A11* + *Pa A12*. • Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A13*, after which manually *reset*; • Inactive during timer *Pa A10* after Energy 200 is turned on using the On-OFF key (refer to *keyboard*) or by a digital ON-OFF input (refer to digital inputs) or after switching to *heating* mode.	YES	YES					
E44	Machine out of coolant	• *Compressors* and fans will be shut down; • In all *operating modes* except *boiler* use or *defrosting*, the machine is checked for leakage in the gas circuit or breakage of the reversal valves (heat pump operation).	YES	YES	YES	YES			
E45	Configuration error	• All *loads* will be shut down;	YES	YES	YES	YES	YES	YES	YES

		• If ST1 is configured as a request for *heating* digital input and ST2 as a request for *cooling* input (refer to analogue inputs), the alarm will be triggered if both inputs are active.							
E46	Over-temperature	• *Compressors* will be shut down • Triggered if probe ST1 (refer to analogue inputs) has a value over *Pa A25* for an amount of time in excess of *Pa A26*;	YES	YES					

[3] Only if manually *reset*

outputs defined as capacity steps will be off if there is an alarm for the compressor to which they belohg.

The tables below list *alarms* by type (digital or analogue).

Digital alarms

TABLE OF *DIGITAL ALARMS*:

Alarm name	Bypass trigger event	Bypass time	Trigger duration	Deactivation duration	N. alarm events/hour
High pressure alarm	None	absent	absent	absent	*Manual reset*
Low pressure alarm	A compressor coming on in the circuit or reversal of 4-way valve	*Pa A01*	absent	absent	*Pa A02*
Flow switch alarm	Pump coming on	*Pa A03*	*Pa A04*	*Pa A05*	*Pa A06*
Compressor 1,2 thermal switch alarm	Compressor coming on	*Pa A07*	absent	absent	*Pa A08*
Fan thermal switch alarm	None	absent	absent	absent	*Pa A13*

Analogue alarms

TABLE OF *ANALOGUE ALARMS*:

Alarm name	Event	Bypass time	Trigger *set point*	*Hysteresis*	N. alarm events/hour	Regulation probe
Anti-freeze alarm	On Off, input in *heating* mode, remote on off	*Pa A10*	*Pa A11*	*Pa A12* positive	*Pa A13*	ST2 if configuration parameter *Pa H06* = 1, otherwise alarm is inactive
Low condensation pressure/temperature alarm	Compressor turned on or reversal of 4-way valve	Par A16	*Pa A17*	*Pa A18* positive	*Pa A19*	Probe configured for condensation control
High condensation pressure/temperature alarm	None	absent	*Pa A14*	*Pa A15* negative	*Manual reset*	Probe configured for condensation control
Over-temperature alarm	None	Trigger duration must exceed *Pa A26*	*Pa A25*	*Pa A12* negative	Automatic *reset*	ST1
Anti-freeze external alarm	None	None	*Pa A11*	*Pa A12* positive	*Pa A13*	ST3 if *Pa H07*=4

11 TECHNICAL FEATURES

11.1 Technical data

	Typical	Min.	Max.
Power supply voltage	12V~	10V~	14V~
Power supply frequency	50Hz/60Hz	---	---
Power	5VA	---	---
Insulation class	1	---	---
Protection grade	Front panel IP0	---	---
Operating temperature	25°C	0°C	60°C
Operating humidity (non-condensing)	30%	10%	90%
Storage temperature	25°C	-20°C	85°C
Storage humidity (non-condensing)	30%	10%	90%

11.2 Electromechanical features

120/240 V digital outputs	• n. 4 (n. 5 for Energy 215B)- 2A ¼ hp 240V~ *relays*; 1/8 hp 120V~ • 1 TRIAC 2 A (all models execpt Energy 215B)
24 V~ outputs	• 1 TRIAC output, no optic insulation; max. 500 mA.
Analogue inputs	• 3 temperature sensors, *range* -30°C ÷ 90°C; • 1 configurable input: 4...20 mA transducer or temperature sensor, *range* -30°C ÷ 90°C;
Digital inputs	• n° 5 voltage-free digital inputs
Terminals and connectors	• 1 9-way snap-on high voltage connector AWG 16-28 • 1 16 way snap-on low voltage connector, thread 4.2, AWG 16-28 • 1 p2,5 5–way remote control and *copy card* connector, AWG 24-30 • 1 p 2 3-way *remote keyboard* or optional relay connector, AWG 22-30;
Display and leds	• 3 digits + sign; • 5 red leds
Keys	• 2 *keys*
Serials	• n° 1 serial 9600 • n° 1 serial 2400

current transformer

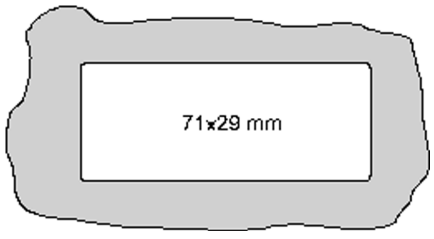
The instrument must be powered with a suitable *current transformer* with the following features:

- Primary voltage: 230V~-10%; 110V~±10%
- Secondary voltage: 12V~
- Power supply frequency: 50Hz; 60Hz
- Power: 5VA;

11.3 Dimensions

Dimensions: Front panel 76x34, depth 58mm
Container: PC+ABS plastic resin with V0 extinguishing classification
Assembly: Panel, on 71x29mm hole

dimensions



11.4 Regulations

The product complies with the following European Community Directives:
- **Council Directive 73/23/CEE and subsequent modifications**
- **Council directive 89/336/CEE and subsequent modifications**

and complies with the following harmonised *regulations*:
- **LOW VOLTAGE: EN60730**
- **EMISSION: EN50081-1 (EN55022)**
- **IMMUNITY: EN50082-2 (IEC 1000-4-2/3/4/5)**

12 USE OF THE DEVICE

12.1 Permitted use

This product is used to control single circuit chillers and heat pumps.

To ensure safety, the controller must be installed and operated in accordance with the instructions supplied, and access to high voltage *components* must be prevented under regular operating conditions. The device shall be properly protected against water and dust and shall be accessible by using a tool only. The device is suitable for incorporation in a household appliance and/or similar air conditioning device.
According to the reference *regulations*, it is classified:

- In terms of construction, as an automatic electronic control device to be incorporated with independent assembly or integrated;
- In terms of automatic operating features, as a type 1 action control device, with reference to manufacturing tolerances and drifts;
- As a class 2 device in relation to protection against electrical shock;
- As a class A device in relation to software structure and class.

12.2 Forbidden use

Any use other than the *permitted use* is forbidden.
Please note that relay contacts supplied are functional and are subject to fault (in that they are controlled by an electronic component and may be shorted or remain open); protection devices recommended by product standards or suggested by common sense in response to evident safety requirements shall be implemented outside of the instrument.

13 RESPONSIBILITY AND RESIDUAL RISKS

Microtech shall not be held liable for any damage incurred as a result of:

- *installation*/use other than those intended, and, in particular, failure to comply with the safety instructions specified by applicable *regulations* and/or provided in this document;
- use with equipment which does not provide adequate protection against electric shocks, water and dust under the effective conditions of *installation*;
- use with equipment which permits access to hazardous parts without the use of tools;
- *installation*/use with equipment which does not comply with current *regulations* and legislation.

14 GLOSSARY

Logical OR
Multiple inputs with an OR relationship to one another are equivalent to a single input with the following status:
- Active if at least one input is active
- Inactive if no input is active

Scroll up
To "*Scroll up*" a menu means listing the various *parameters* from the bottom up (Pa10 -> Pa 09 -> Pa 08 ....)

Stand-by
Indicates that the instrument is waiting, in *stand-by* mode; all *functions* are suspended.

Reset
Set to zero.

Reset alarm
Resetting an alarm means reactivating it ready for a new signal.

Manual reset
A *manual reset alarm* must be *reset* using the *keyboard*.

Scroll down
To "*Scroll down*" in a menu is to list *parameters* from the top down (Pa08 -> Pa 09 -> Pa 10 ....)

BLINK
Means flashing; normally refers to leds

Average number of hours
Average number of hours is the ratio between the total number of hours for which the *compressors* are available and the number of *compressors* in the circuit

Loads
Devices in the system, including *compressors*, fans, *hydraulic pump*, electrical anti-freeze heaters...

Set Point
A reference value (set by the user) defining the system's operating status, such as the thermostat that controls temperature in the home: if we want to maintain a temperature of 20 °C we set the *set point* to 20°C (the *heating* system will come on if the temperature in the house falls below 20°C, and go off if it exceeds this value).

Range
Values falling within a given interval; *Range* 1...100 indicates all values between 1 and 100

Hysteresis
A *hysteresis* is normally defined around a *set point* to prevent frequent oscillation of the change of status of the load being controlled;
Example: suppose we have a *set point* of 20 °C on a probe for measurement of room temperature, above which a compressor will be started up;
When room temperature nears the *set point* (20 °C) there will be an unstable phase during which the relay which starts up the compressor will frequently switch from ON to OFF and vice versa, which could result in serious damage to the system.
To prevent this problem a *hysteresis* is defined: an interval of tolerance within which there will be no change in status; in our example, we could set a *hysteresis* of 1 °C, in which case the compressor would be started up at 21 °C (*set point* + *hysteresis*) and turned off at 19 °C (*set point* – *hysteresis*)

Permanent memory
Memory in which data is maintained even when the device is turned off (as distinct from temporary memory, the data in which is lost when the device is turned off.)

Cut-off
Temperature/pressure below or above which proportional output is cut off.

15 ANALITIC INDEX

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