ECH 200BD "*Adaptive*" Electronic Controller for mono and bi-compressor Chillers with *Adaptive* Algorithm

1 SUMMARY

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

Ech 200 is a compact device that permits control of air conditioning units of the following types:

- air-air
- air-water
- water-water
- condensing units

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.

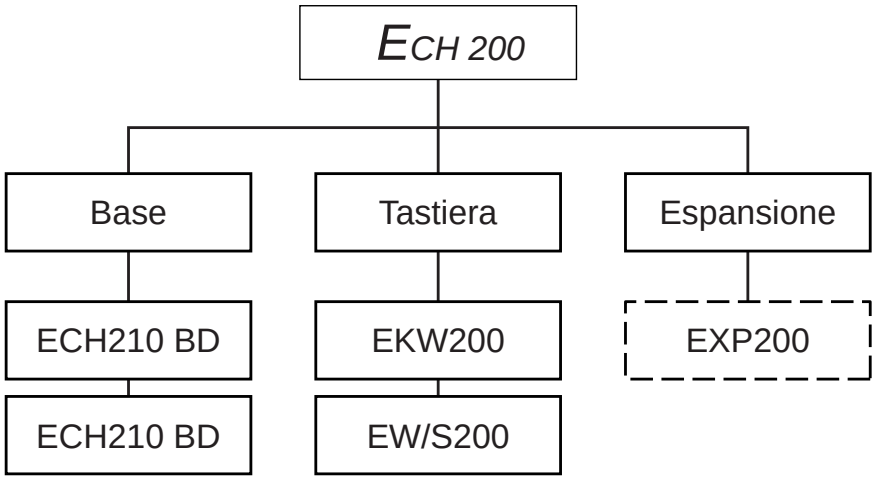
Main characteristics:

- Temperature control based on inlet or outlet 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.

3.1 Models available

The *ECH 200 family*'s models (base, *keyboard* and expansion) and a reference tabel containing the base *parameters* are illustrated below:

Ech 200 Family



Models available

Expansion EXP200 is available for only model Ech 211.

Base parameters tabel

	Model	ECH 210 BD	ECH 215 BD
Application	Circuits	1	1
	Compressors (in chiller)	2	2
	Compressors (in heat pump)	1	2
	Stages	1	1
Input/output	*Relays* (2A 230 V~)	4	5
	Triac (2A 230 V~)	1	
	Digital input	5	5
	Analog output		
	Analog input	4	4
Features	Srew connectors	•	•
	Remote keyboard	•	•
	Remote on-off	•	•
	Heat pump control	•	•
	Defrost	•	•
	Condensing pressure control	•	•
	Water pump control	•	•
	Electric heater	•	•
	Dynamic set point	•	•
	Water free *cooling*	•	•
Diagnostic	Water flow *alarm*	•	•
	High pressure *alarm*	•	•
	Low pressure *alarm*	•	•
	Thermal compressor *alarm*	•	•
	Thermal fan *alarm*	•	•
	Antifreeze *alarm*	•	•
	High water temperature *alarm*	•	•

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:

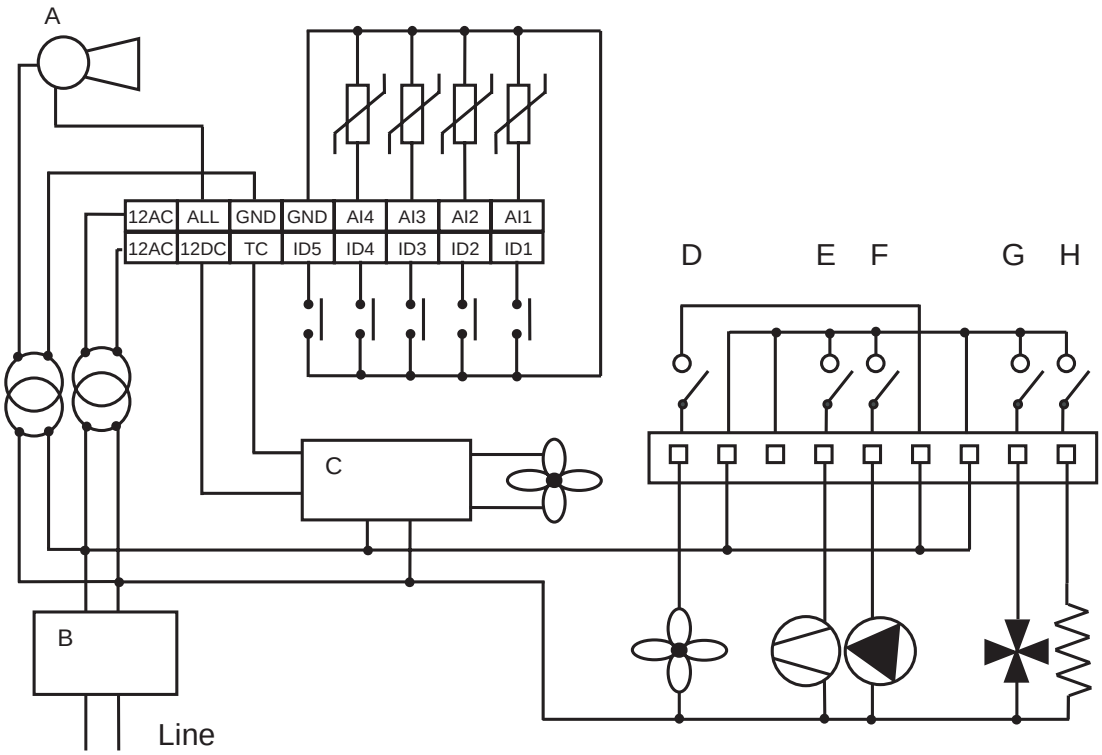
- **Never apply *loads* which exceed the limits set forth in these specifications to *outputs*;**
- **Always comply with *connection diagrams* when connecting up *loads*;**
- **To prevent electrical couplings, always wire low voltage *loads* separately from high voltage *loads*;**

4.1 Connection diagrams

There are 2 ECH 200 BD models:

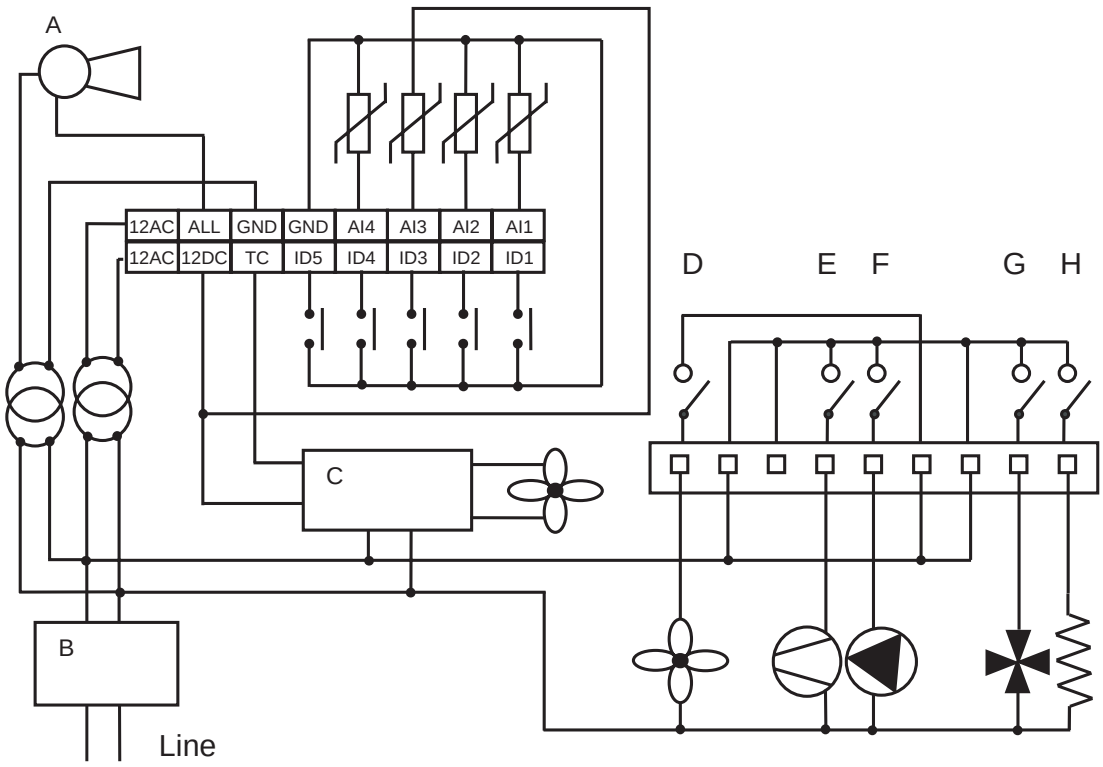
- ECH 210 BD: 2 step chiller + modbus
- ECH 215 BD: 2 step chiller + modbus

Connection to probe AI3 configured as NTC



A: *alarm* output	E: relay 1
B: LC filter	F: relay 2
C: CF control	G: relay 3
D: TK/relay 5 (only for 215B)	H: relay 4

Connection to probe AI3 configured as 4..20mA C



A: *alarm* output	E: relay 1
B: LC filter	F: relay 2
C: CF control	G: relay 3
D: TK/relay 5 (only for 215 BD)	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 AI1...AI4, 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 AI1	Probe absent	NTC input Inlet water/air	Digital input Request for *heating*	Digital input Request for regulation algorithm	NTC input Differential	Not permitted
Pa H06	Configuration of analogue input AI2	Probe absent	NTC input Outlet water/air, anti-freeze	Digital input, Request for *cooling*	Digital input for antifreeze *alarm*	Not permitted	Not permitted
Pa H07	Configuration of analogue input AI3	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 AI4	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

If input AI3 is defined as a 4...20 mA input, the scale bottom value of the pressure input is also signfiicant: *Pa* ***H09***, maximum input value; sets the corresponding value to a current of 20 mA

4.3 Configuration of digital inputs

Digital inputs

There are 5 voltage-free *digital inputs*, which will henceforth be identified as ID1...ID5.
AI1, AI2 e AI4 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 AI1 (configured as digital)	Active if closed	Active if open
Pa H16	Polarity of input AI2 (configured as digital)	Active if closed	Active if open
Pa H17	Polarity of input AI4 (configured as digital)	Active if closed	Active if open

Inputs ID1 and ID2 cannot be configured and fulfill the following *functions*:

- ID1 : High pressure input
- ID2 : Low pressure input

The *functions* of the other inputs may be configured using *parameters*:

- AI1, AI2: (Refer to *Analogue inputs: configuration table*)
- ID3, ID4, ID5 and AI4: as shown in the table below

Digital inputs: configuration table

Digital input ***configuration parameters***	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 AI4	*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.

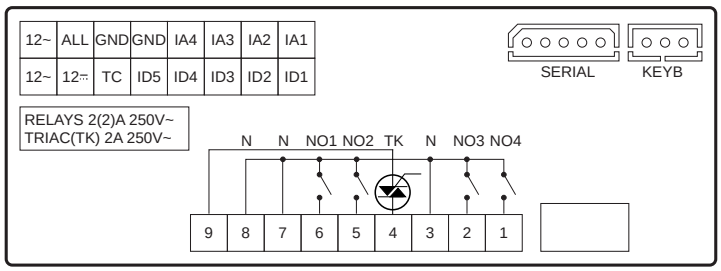
4.4 Configuration of outputs

Outputs

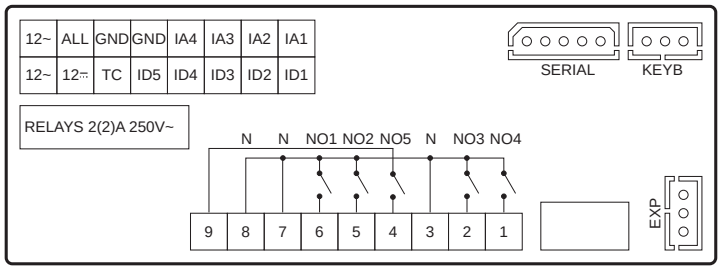
The table below shows the *outputs* depending on the model with the symbols used in the labels that are associated to the instrument and that will be shown next to the tabel.

Model	***Relays***			***Triac***			**Optional**		***Keyboard***		**Serial**		***Alarm***		**Fan modules piloting**	
	N°	Symbol	Capacity	N°	Symbol	Capacity	N°	Symbol	N°	Symbol	N°	Symbol	N°	Symbol	N°	Symbol
ECH 210 BD	4	NO1..NO4	2A	1	TK	2A	--	--	1	KEYB	1	SERIAL	1	ALL	1	TC
ECH 215 BD	5	NO1..NO5	2A	0	--	--	1	EXP (digital)	1	KEYB	1	SERIAL	1	ALL	--	--

Labels



Model Ech 210 BD



Model Ech 215 BD

4.4.1 Relays

- NO1 - compressor, 2A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~)
- NO2 - configurable, 2A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~)
- NO3 - configurable, 2A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~)
- NO4 - configurable, 2A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~)
- NO5 – fan on-off, 2A resistive 250V~ (¼ HP at 240V~ , 1/8 HP 120V~) (for model ECH 215BD only)

Outputs NO2, NO3, NO4 may be configured as shown in the table below:

Relays: configuration table

Pa.	Description	Value			
		0	1	2	3
Pa H22	Relay NO2 configuration	Pump	Internal fan speed 1	Not permitted	Not permitted
Pa H23	Relay NO3 configuration	*Reversing valve*	Internal fan speed 3	Second compressor or capacity step	Not permitted
Pa H24	Relay NO4 configuration	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.

The maximum load present on the different *outputs* simultaneously must NOT exceed 8A

4.4.2 Triac

- TK – control of *condensation fan* or supplementary anti-freeze electric heaters.

For model Ech 210 BD the maximum current is 2A-250V~.
For model Ech 210 BD NO downstream remote control of *triac* is permitted

For model Ech 215B NO *triac* is expected.

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 electric heaters for water-water machines with gas reversal	ON-OFF fan control in response to compressor

4.4.3 Alarm

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

For models Ech 2xx BD the following *parameters* are available:
Pa H56 = determines the polarity of the *alarm* output:
- 0 = output is active (closed contact) when an *alarm* is active and when the machine is switched off.
- 1 = in the same conditions, the contact is open

Pa H57 = determines if the *alarm* is on with the machine on off from *keyboard*, with remote off and on *stand-by*
- 0 = *alarm* output not enabled in OFF or standby
- 1 = *alarm* output enabled in OFF or standby

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

4.4.4 Fan module pilot output

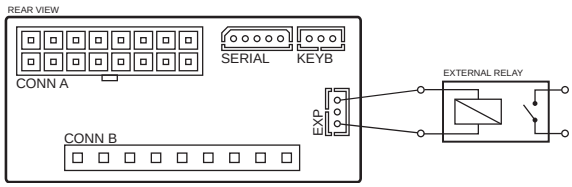
TC - low voltage output piloting external fan control modules.

4.4.5 Optional output

EXP – optional internal output with configurable output.

Open collector output

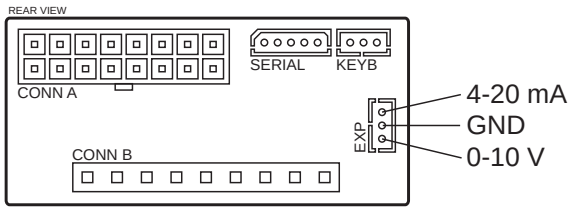
For model Ech 210 BD the *optional output* is digital type and is open collector for piloting the second compressor's relay:



Rear view: rear view of the control module
External relay: external relay

4-20 mA or 0-10 V output

For model Ech 215 BD the *optional output* is ANALOGUE type and can be used for piloting 4-20mA or 0-10V fans (through parameter *Pa H25*)



Rear view: rear view of the control module

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

Optional output: configuration table

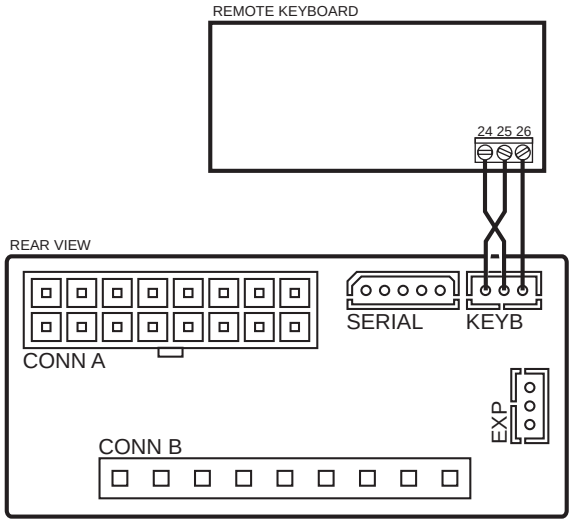
Pa.	Description	Value		
		0	1	2
Pa H25	*Optional output* configuration parameter	*Open Collector output* for compressor 2	Proportional *condensation fan control*, 4-20 mA	Proportional *condensation fan control*, 0-10 V

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

4.4.6 Remote keyboard output

- KEYB - The *keyboard* output may be used for a *remote keyboard*.

Connect as shown in the diagram below:



REMOTE KEYBOARD: *Remote keyboard*
REAR VIEW: Rear view
24: blue
25: white
26: black

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, *parameters Pa H07*=0 (probe AI3 absent), *Pa F01* = 3 are forced (operation in response to a request from the compressor) .

Temperature-based operation

- if *Pa H49*= 1 (*temperature-based operation*), *parameters* Pa HO7, F01 are forced as follows: H07= 1 (probe AI3 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 AI3 operating on the basis of pressure), F01= 0 (proportional operation). During *defrosting* the following *parameters* are used: *Pa d02* 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 AI3 absent	**3** operation in response to a request from the compressor
1	**1** probe AI3 temperature	**3** operation in response to a request from the compressor
2	**2** probe AI3 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.

Please remember the connection between the two measurement units: °F = °C x 9/5 + 32

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

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

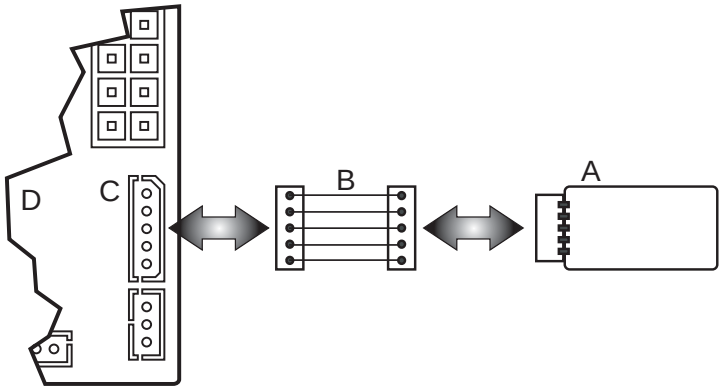
4.6 Serial outputs

There are 2 asynchronous *outputs* on the control:
- channel for serial communication with a personal computer through an Eliwell interface module
- channel for serial communication with a standard Eliwell *keyboard*. Power supply 12 VDC (2400, e, 8, 1).

4.6.1 Copy card device

Copy Card is a device that, if connected to the TTL serial port, allows to quickly program the instrument *parameters*. The connection diagram is shown below:

Connection of Copy Card



A: *Copy Card device*
B: connection through TTL cable
C: channel for serial communication
D: basic module

Uploading and downloading data is made as follows:

UPLOAD (copy from INSTRUMENT TO *COPY CARD*)

This operation allows to download programming *parameters* to *Copy Card*.

Operations to be performed are:
- Insert the *Copy Card* when the instrument is on
- A password will be requested to perform this operation
- On the *display*, it is shown - - -
- Type the password value corresponding to the parameter value *Pa H47*
- Hold down both *keys*
- On uploading , a *display* appears - - -
- Disconnect *Copy Card*

Before performing UPLOAD, *Copy Card* is formatted.
This operation causes all data entered in the *Copy Card* to be cleared.
The formatting operation cannot be cancelled.

DOWNLOAD (copy from *COPY CARD* to INSTRUMENT)

This operation allows to upload programming *parameters* to instrument.

Operations to be performed are:
- Insert the *Copy Card* when the instrument is off
- Turn on the instrument
- Start uploading *parameters* into the instrument
- On uploading, *Occ* appears on the *display*
- If the copy fails, *Err* appears on the *display*
- Turn off the instrument
- Disconnect *Copy Card*
- Turn on the instrument

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

Keyboard

- Check the state of resources

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 and on-off combinations

: set

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 (AI1 or AI2 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 SET display for air-air machines (for models Ech 2xxB only)

To make easier the *user interface* in air-air versions, if iyou place parameter *Pa H53* = 1, the set for the selected mode will be displayed; pressing UP e DOWN *keys* on the *remote keyboard* directly modifies the set of the current mode. You cannot directly modify the set in the local *keyboard*.

5.2.3 Led

Led compressor 1.

- ON if compressor 1 is active
- OFF if compressor 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*

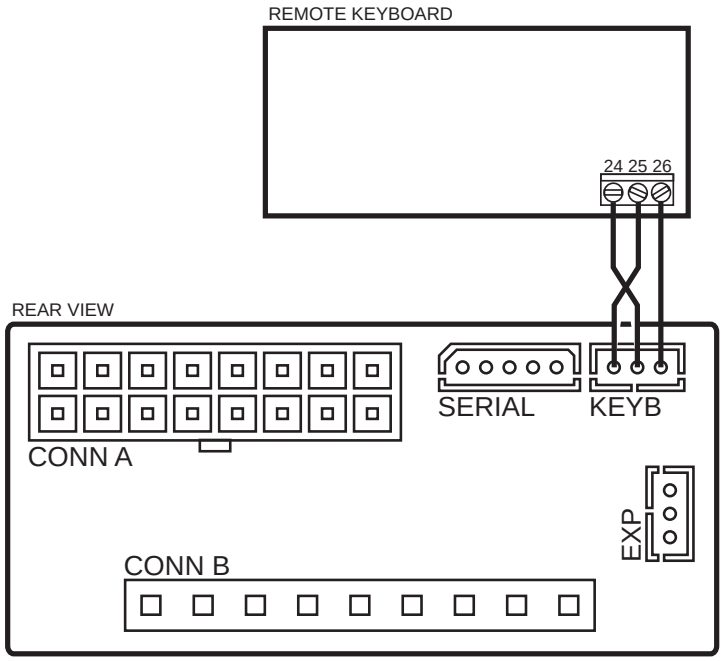
If neither the *HEATING led* nor the *COOLING led* is on, the controller is in *STAND-BY* mode

5.3 Remote keyboard

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:



REMOTE KEYBOARD: Remote keyboard
REAR VIEW: rear view of the control module

The terminals of the *remote keyboard* are associated with the following colours:

- 24 → blue
- 25 → red
- 26 → black

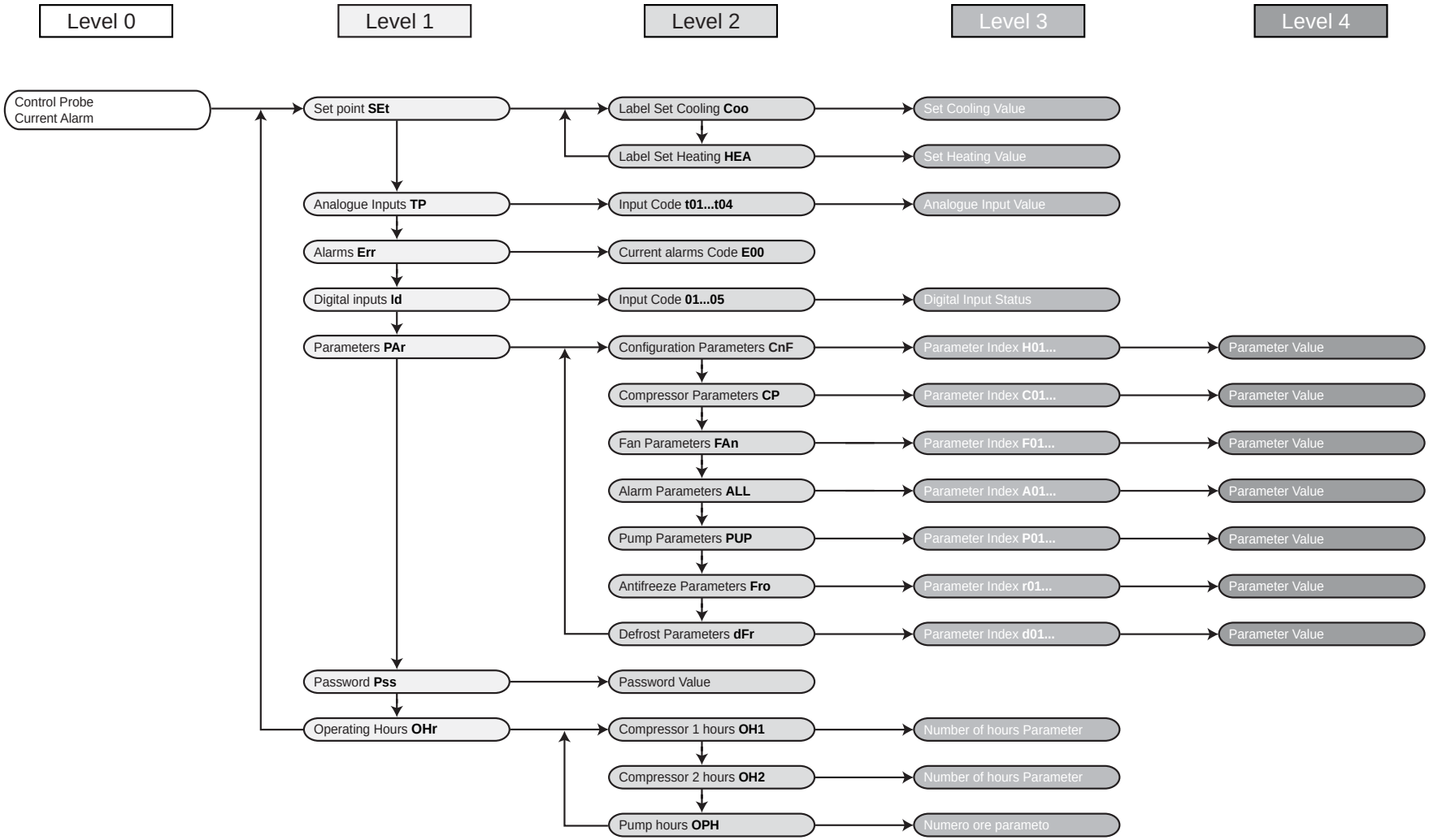
Be cautious when connecting these terminals because they are reversed against the connector's terminals.

5.4 Parameter programming – Menu levels

Device *parameters* may be modified using a Personal Computer (with the required software, interface module and cables), or using the *keyboard*.
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*.

Menu structure

The structure is set up as shown in the diagram below:



5.4.1 Visibility of parameters and sub-menus

With a personal computer, interface key (*copy card*), 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:

Label

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

Ech 200 BD 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 NO1;

The second compressor, if there is one, must be connected to output NO3, with the following parameter settings:

- *Pa H48*=2 (2 *compressors* per circuit)
- *Pa H23*=2 (output NO3 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 NO3

If NO3 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 NO1 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, followed by 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:

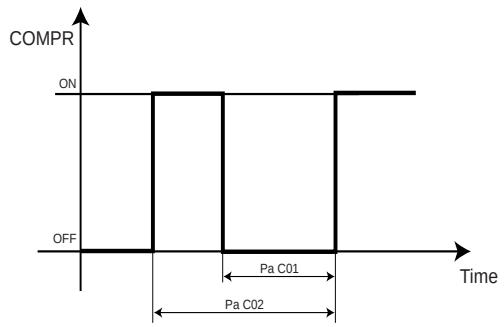
Off-on timing

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 "ECH 200 BD" 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

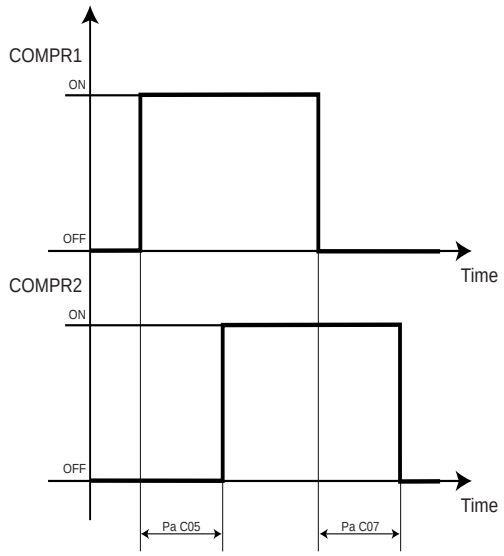


COMPR: compressor	Time: seconds x 10
Pa C01: ON-OFF safety time	*Pa C02*: ON-ON safety time

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.



COMPR1: compressor 1
COMPR2: compressor 2
Time: time in seconds
Pa C05: on time interval between *compressors*
Pa C07: off time interval between *compressors*

6.2 Condensation fan

Various fan piloting modules can be connected to “Ech 200”, based on the *models available*
Look at the following table:

	TK	TC	4-20mA	0-10V
Ech 210	*	*		

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

- On model Ech 210 BD, the fan may be controlled with a proportionate output with a maximum load of 2A.

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 TC)**:
- 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 also 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 in microseconds x 200.

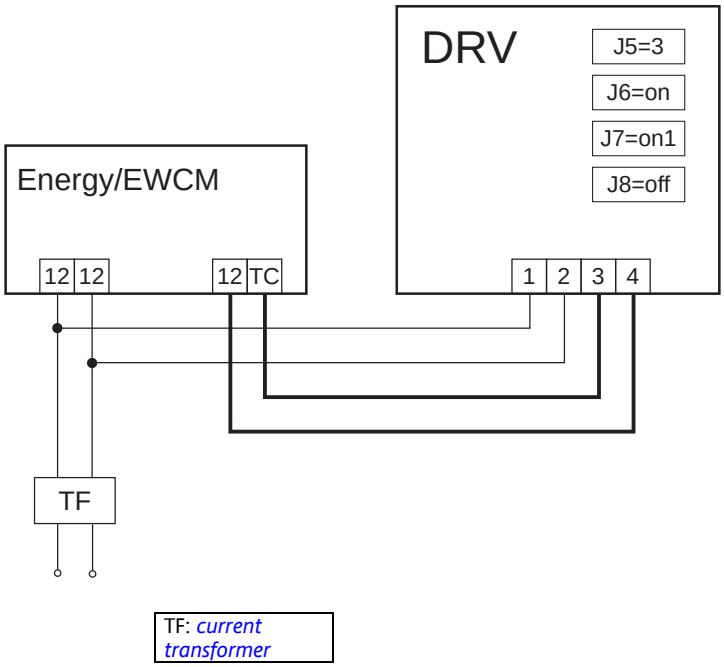
Impulse duration

Determines the duration of the TK output piloting impulse in microseconds x 200
Pa F04**=** *triac* piloting *impulse duration*

6.2.2 DRV module

If a DRV three-phase fan module is used, follow the diagram below:

Connection diagram of the DRV module



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 NO2 (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*

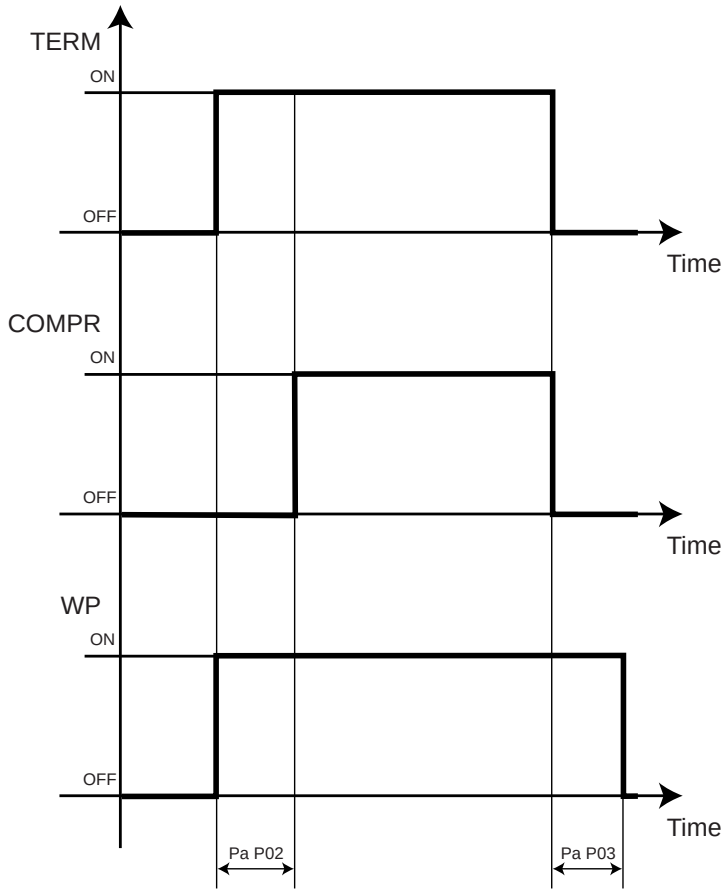
Continuous operation

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.



TERM: regulation algorithm	COMPR: compressor
WP: pump	Time: time in seconds
Pa P02: delay compressor-pump off	*Pa P03*: delay pump-compressor 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 shutdown, 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*..

6.5 Internal anti-freeze/supplementary electrical heaters

Anti-freeze/supplementary heaters are connected up to relay output NO4 (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 AI1 (refer to *connection diagrams*) if *Pa* ***H05*** (config. AI1)= 1 otherwise off	Controlled on the basis of AI2 (refer to *connection diagrams*) if *Pa* ***H06*** (config. AI2)= 1 otherwise off
Pa r05	Configuration of control probe in *cooling* mode	controlled on the basis of AI1 (refer to *connection diagrams*) if *Pa* ***H05*** (config. AI1)= 1 otherwise off	Controlled on the basis of AI2 (refer to *connection diagrams*) if *Pa* ***H06*** (config. AI2)= 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*

6.5.1 Supplementary electrical heaters

If *Pa r15* =1 electrical heaters become anti-freeze/*supplementary electrical heaters*.
Their operating mode is described in the paragraph on the *supplementary electrical heater control*

6.6 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 AI3 (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)
- AI3 is configured as an NTC anti-freeze input on a water-water machine with gas reversal (*Pa* ***H07***= 4)

6.7 Boiler

The output for *boiler controll*er is relay NO4 (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.
- AI4 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 turned 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*)

7 ADAPTIVE

ECH 200BD is a special model of the ECH 200 line that features extremely versatile characteristics and features, particularly suited for small plants.

These are:
- *Adaptive function*
- *Fan control in Defrosting mode*

Antifreeze function with heat pump, depending on water pump and heat pump.

7.1 Adaptive function

Chillers are generally equipped with water accumulation tanks.
These provide the thermal inertia required to prevent the *compressors* from being frequently started or switched off when the request of heat for the rooms to be cooled is low (frequent start and switching off operations influence the lifecycle of *compressors*).
In some cases, the setting of safety limits for the start and switching off operations can delay the start of the *compressors* as compared to the requests of the regulation algorithm, thus reducing the efficiency of the whole system.
Example: if a chiller is designed to supply 10 fan coils and only one of these chillers is running in *Cooling mode*, the interval of time during which the compressor is expected to stay on is low; in addition the need of complying with the safety limits would cause an increase of the water temperature above the *set point* determined by *hysteresis*.
Accumulation tanks would increase the thermal capacity and provide the inertia required to increase the running time, though resulting in higher costs and in the need for increasing even the minimum size of the unit.
The *Adaptive function*, which changes the *set point*s and *hysteresis*, electronically simulates the inertia of a water accumulation container, thus also limiting its use.

7.1.1 Adaptive function: regulator

It is useful to remember that the start and switching off operations of *compressors* must comply with the standards of safety limits.

The function analyses the actual running time of the compressor (ET) comparing it with the minimum running time that has been set (MT).

Parameters
- C01 Compressor OFF-ON time
- C02 Compressor ON-ON time
- C08 Enables the *Adaptive function*
- C09 Set block in *Cooling mode*
- C10 Set block in *Heating mode*
- C11 Offset constant
- C12 *Reset* time for increases
- C13 Proportional Part Offset Coefficient

Minimum time

The *minimum time* (MT) is represented by the difference between the ON/ON (C02) and the OFF/ON parameter (C01):

- **MT = C02 – C01**

Actual time

The actual running time (ET) is automatically registered by the unit.

7.1.2 Set point offset (for ET<MT)

Adaptive offsets

The ON *set point* is changed by a value equivalent to the *adaptive* offset (AO) according to the formula shown below, when the compressor is switched off:

- **AO=((MT – ET)* C13) + C11**

That is

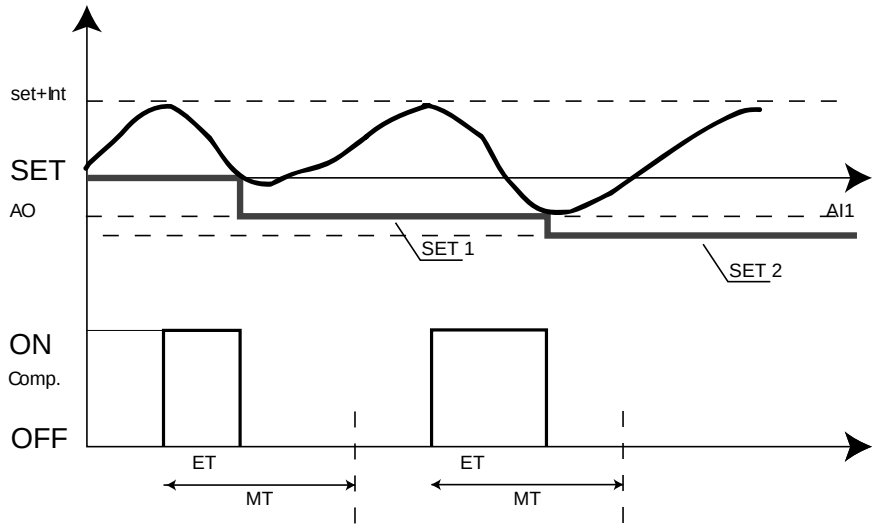
- **AO=((C02– C01 – ET)* C13) + C11**

- The *set point* is reduced in "*Cooling*" mode: SET(1) = SET(COO) – AO(1);
  SET(2) = SET(1) – AO(2)
  and so on

- The *set point* is increased in "*Heating*" mode: SET(1) = SET(HEA) + AO(1);
  SET(2) = SET(1) + AO(2)
  and so on

The index associated to the *set point* and offset values refers to the compressor cycle, after which all variables are updated. The updated values are then used for the next cycle.
"SET(COO)" and "SET(HEA)" are the original *set point* values (for *example* those entered from the *keyboard* with menus SET/COO and /HEA).

Examples:



Cooling Mode

Cycle 0:
- *Set point*: SET(COO)
- *Hysteresis*: SET(COO) + C03

Cycle 1:
- *Set point* for cycle 1: SET(1) = SET (COO) – AO(1)
- *Hysteresis* for cycle 1: SET(1) + C03 + AO(1) = SET(COO) - ~~AO(1)~~ + C03 + ~~AO(1)~~ = SET(COO) + C03

Cycle 2:
- *Set point* for cycle 2: SET(2) = SET (COO) – AO(1) – AO(2)
- *Hysteresis* for cycle 2: SET(COO) + C03

Heating Mode

Cycle 0:
- *Set point*: SET(HEA)
- *Hysteresis*: SET(HEA) - C04

Cycle 1:
- *Set point* for cycle 1: SET(1) = SET (HEA) + AO(1)
- *Hysteresis* for cycle 1: SET(HEA) - C04 + AO(1) = SET(HEA) - ~~AO(1)~~ + C04 + ~~AO(1)~~ = SET(HEA) + C04

Cycle 2:
- *Set point* for cycle 2: SET(2) = SET (HEA) + AO(1) + AO(2)
- *Hysteresis* for cycle 2: SET(HEA) - C04

It is useful to notice that the start temperature in both modes remains constant for each cycle even when the *adaptive function* is enabled.
This increases the *range* between the *set point* and start temperatures, reducing the number of starts/stops of the compressor.

7.1.3 Set point regression (for ET≥MT)

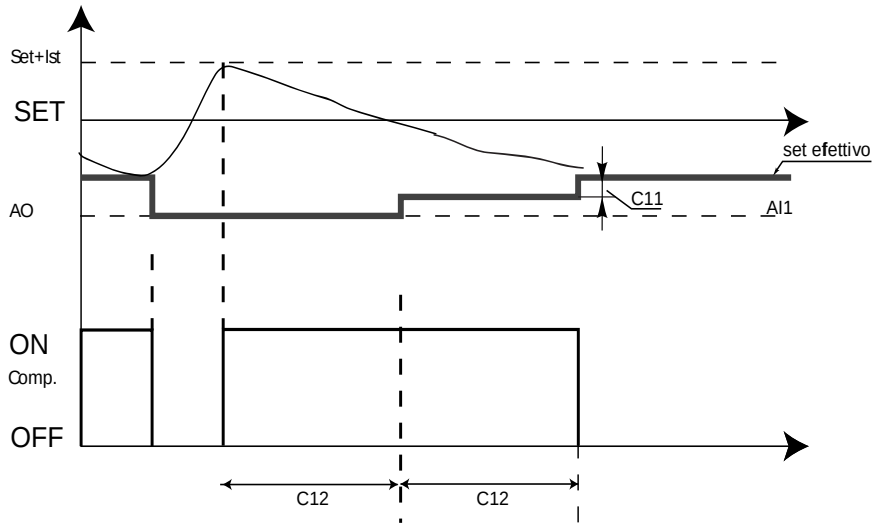
If the cycle time is long enough (and not above MT), the regression of the actual *set point* occurs: the *set point* is changed by C11 for each C12 *range* (starting from the beginning of the cycle).

- In *Cooling mode*, the *set point* (applicable to cycle N) is increased:
  After C12: SET(N) + C11
  After 2*C12: SET(N) + 2*C11
  And so on, up to limit value of SET(COO)

- In *Heating mode*, the *set point* is reduced, as explained above, down to the limit value of SET(HEA).

This produces a balancing of the "*adaptive*" function with long cycle times because longer cycle times are compatible with those of the compressor.

Example: *cooling*



7.1.4 Protection in Cooling mode

If the output temperature is AI2 < C09 during a generic cycle n, the controller performs the following operations:

- Switches the compressor(s) off.

This adjustment can be considered a pre-threshold of the anti-freeze *alarm* (the cycle ends without generating *alarms*) if the *adaptive function* yields a very low actual *set point*.
It is advisable to use C09 > A11.

7.1.5 Protection in Heating mode

If the output temperature is AI2 > C10 during a generic cycle n, the controller performs the following operations:

- Switches the compressor(s) off.

This adjustment can be considered a pre-threshold of the anti-freeze *alarm* (the cycle ends without generating *alarms*) if the *adaptive function* yields a very low actual *set point*.
The setting of C10 should be chosen according to the high pressure protections in use (pressure switch calibration, type of coolant used...).

7.1.6 Notes

- The *adaptive* algorithm is *reset* (i.e. the original *set point* is restored) in the conditions listed above and when the controller is switched off (i.e. not after a manual or remote off or standby condition).
- If the compressor switches off due a thermal switch or equivalent *alarm* and ET<MT, the actual offset and *set point* are updated as if the cycle had been completed (the cycle that follows this *alarm* will adopt a different *set point*).
- If the compressor switches off due to the transition between modes, for *example* from standby to remote off (from digital input), and ET<MT, the offset is updated as if the cycle had been completed . The cycle that follows this *alarm* will adopt the *set point* selected for the mode +/- offset, depending on the mode).

7.1.7 Example

- Set heat = 45.0 °C
- Set cool = 12.0 °C
- C01 = 18 S*10 (3 minutes)
- C02 = 36 S*10 (6 minutes)
- C08 =1
- C09 = 4 °C
- C10 = 50 °C
- C11 = 0.5 °C
- C12 = 30 S*10 (5 minutes)
- C13 = 0.2 °C/(10*s)

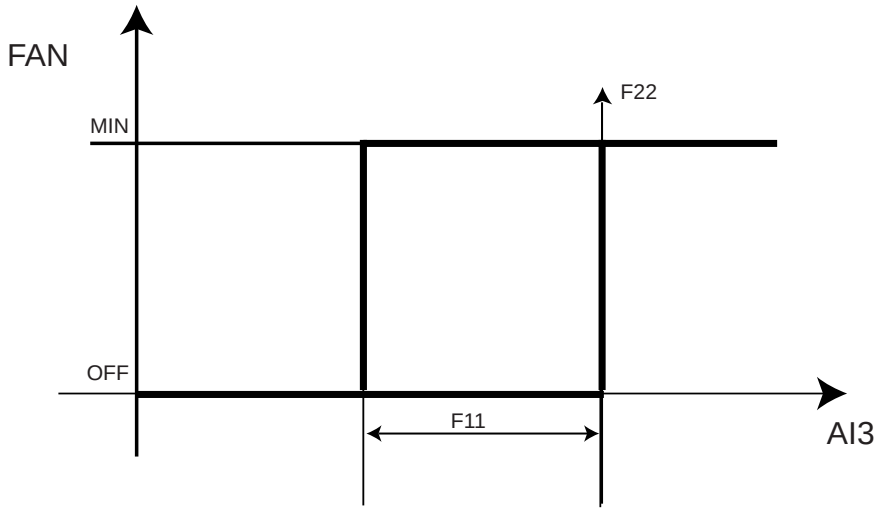
The running of the compressor for two minutes will yield the following values:

- *Minimum time*:
  MT = C02 –C01 = 36-18 = 18*10*s (3 minutes)
- *Actual time*:
  ET = 12 (12*10*s = 2 minutes)
- *Adaptive* offset
  AO = (MT – ET) * C13 + C11 = (18-12)*0.2 + 0.5 = 1.7°C
- If *Heating Mode*:
  SET(1) = SET(HEA) + AO(1) = 45 + 1.7 = 46.7°C
- If *Cooling Mode*:

SET(1) = SET(COO) – AO(1) = 12 –1.7 = 10.3

7.2 Fan control in Defrosting mode

During the *defrosting* phase, the condensing pressure may sometimes reach *alarm* levels before the heat exchanger has defrosted all the ice.
To prevent this condition from tripping the high pressure *alarm*, the unit starts fans at minimum speed if the pressure/temperature read by probe AI3 is above value F22.
The *hysteresis* of the regulator is above parameter F11.



The function can be enabled with parameter F21.

FAN : fan	AI3: probe AI3
MIN: minimum speed of the fan	

7.3 Antifreeze function for units with heat pump

This function enables the water pump to be used in Antifreeze mode.
If the water temperature is low and the unit is not running in *Heating mode*, the *hydraulic pump* starts followed by the compressor.
The function is always active if **A23=1**.
If the water pump is off and temperature is **AI1< A20**, the unit starts the water pump.
If the temperature is **AI1<A21**, the unit starts the heat pump (if it is off).
This operating is carried out in modes: Off, Standby and *Heating* with active remote Off.
When the unit *displays* the *Heating mode*, it is no longer possible to change the operating mode from the *keyboard* or by means of a digital input.
The control resumes normal operation if **AI1> A22**.

8 TEMPERATURE CONTROL FUNCTIONS

Once Ech 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 AI1 (Pa H05) (refer to *Analogue inputs: configuration table*)
- Configuration parameter AI2 (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 AI4)

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 NO4 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 AI1 *Pa H05***	**Configuration parameter AI2 *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 AI1 is on, operating mode is *heating*; if not, *stand-by*	Any	2	Other than 2
If input AI2 is on, operating mode is *cooling*; if not, *stand-by*	Any	Other than 2	2
If input AI1 is on, operating mode is *heating*; if AI2 is on, operating mode is *cooling*; if AI1 and AI2 are both on, there is a configuration error; if neither is on, operating mode is *stand-by*	Any	2	2

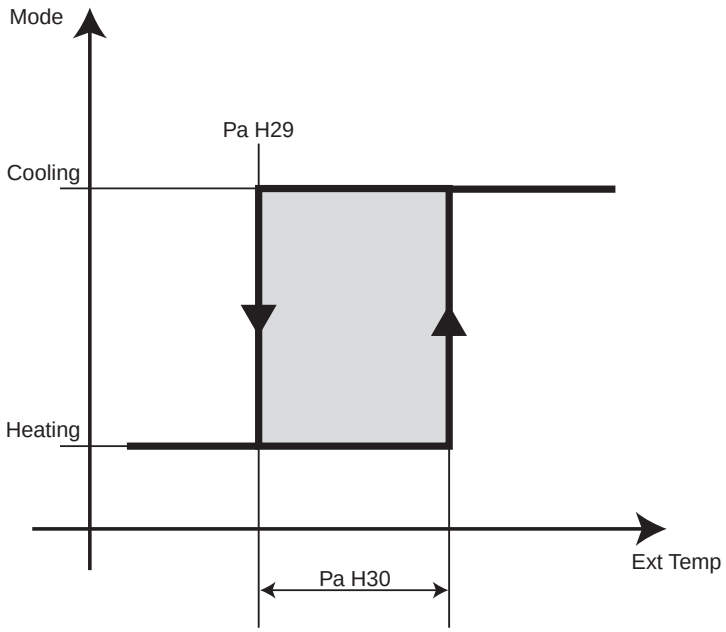
8.1 Selection of operating mode from analogue input

The controller permits selection of operating mode on the basis of the temperature detected and supplied by input AI4 (refer to *analogue inputs*).
This is permitted if both of the following conditions apply:

- probe AI4 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*.

Diagram

An *example* of operation is shown in the diagram below:



Pa H29: *Heating mode set point*
Pa H30: Mode selection differential
Ext temp: outdoor temperature

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 more than *Pa **H29*** + *Pa **H30***, the instrument will operate in *cooling mode*.

8.2 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 referenced *set point* when the device is in *cooling mode*
- *Heating set point*: this is the referenced *set point* when the device is in *heating 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*).

8.3 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 AI3 (*analogue inputs*) is configured as a current input for a *dynamic set point* (*Pa H07* = 3) or probe AI4 (*analogue inputs*) is configured as an outdoor temperature probe (*Pa H08* = 3)

Control parameters

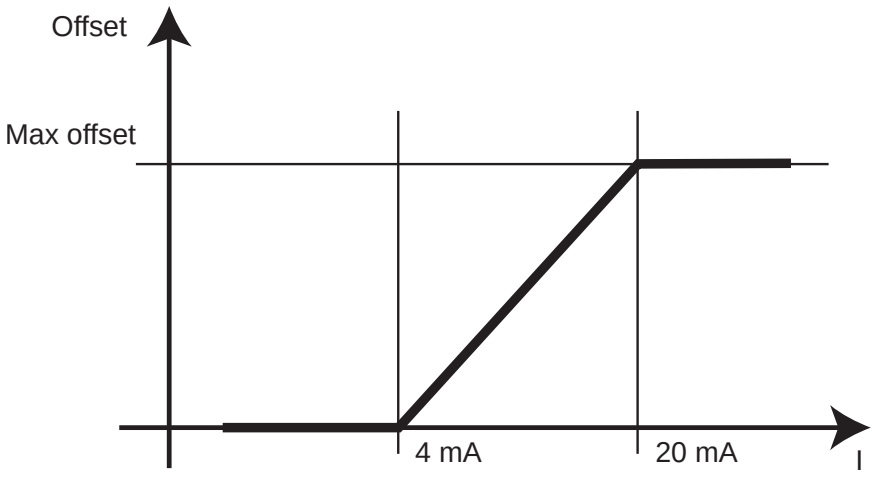
Dynamic set point control *parameters*:

- *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

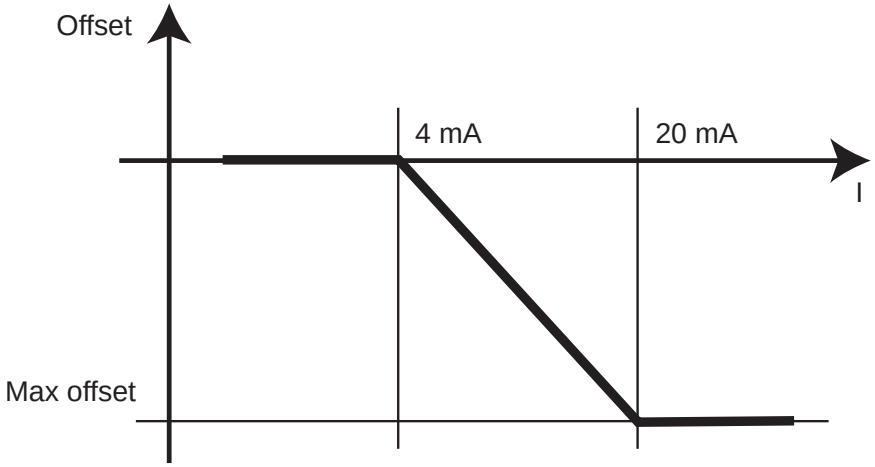
Positive Offset (H32>0 or H33>0)



I: current

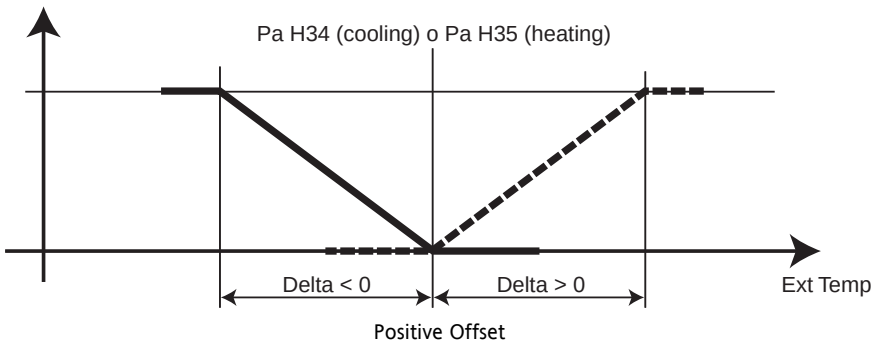
Modification depending on current input with negative offset

Negative Offset (H32<0 or H33<0)



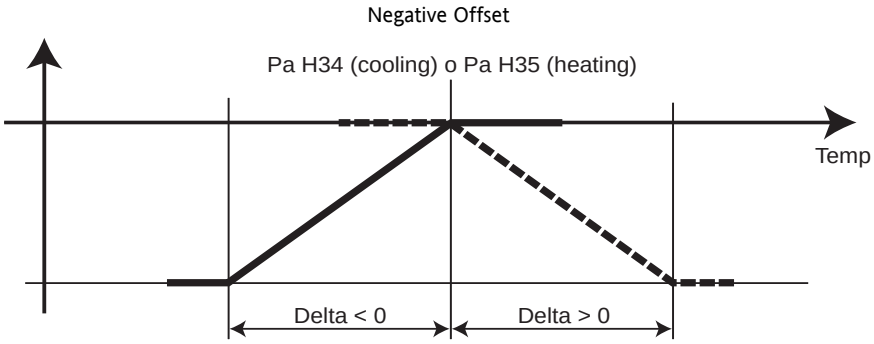
I: current

Modification depending on outdoor temperature with positive offset



Pa H34: outdoor temperature *set point* during *cooling*
Pa H35: outdoor temperature *set point* during *heating*
Ext Temp: outdoor temperature

Modification depending on outdoor temperature with negative offset



Pa H34: outdoor temperature *set point* during *cooling*
Pa H35: outdoor temperature *set point* during *heating*
Ext Temp: outdoor temperature

8.4 Switching from digital input

Digital inputs ID3, ID4, ID5 and AI4 (*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*.

8.5 Load control

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

8.5.1 Compressor control – regulation algorithm

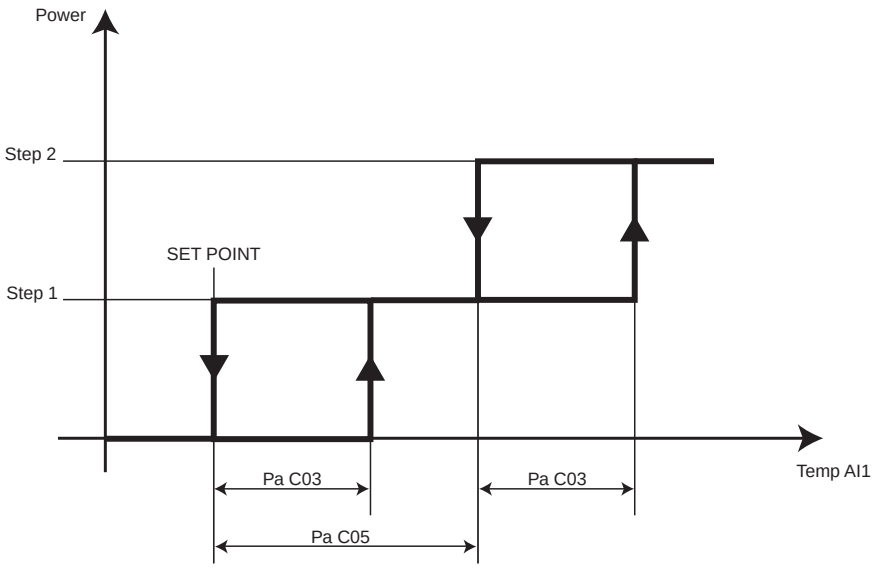
The regulation algorithm calculates the load to be supplied through the *compressors* for both *heating* and *cooling*.

Regulation algorithm in cool mode

REGULATION ALGORITHM IN COOL MODE
If probe AI2 (*analogue inputs*) is not configured as a digital input for requests for *cooling* (*Pa H06*=2) or probe AI1(*analogue inputs*) as a digital input for regulation algorithm requests (*Pa H05*=3), compressor management will depend on environment temperature and a *SET POINT* which may be entered using the *keyboard*.

- **AI1 =** temperature of inlet 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



Power: power
Step 1: Step 1
Step 2: Step 2
Temp AI1: temperature from probe linked in AI1
Pa C03: *hysteresis* of *cooling* thermostat
Pa C05: Power algorithm step intervention differential

If *Pa* ***H05***= 3, the compressor will be turned off and on depending on the status of input AI1.
If *Pa* ***H06***= 2, the compressor will be turned off and on depending on the status of input AI2.
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.

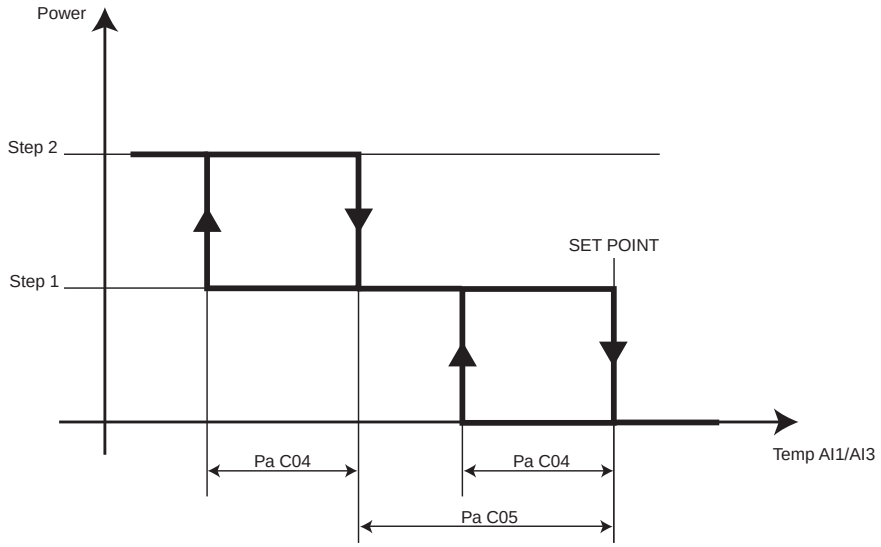
Regulation algorithm in heat mode

REGULATION ALGORITHM IN HEAT MODE
If probe AI1 (*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 AI3 (*analogue inputs*), if configuration parameter ST3 *Pa H07*= 5 (for water-water machines with water reversal)
- otherwise, temperature AI1(*analogue inputs*)
- a *HEATING SET POINT* which may be set from the *keyboard*

- **AI1 =** temperature of inlet 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



Power: power	Step 1: Step 1
Step 2: Step 2	Temp AI1/AI3: temperature from probe linked in AI1or in AI3
Pa C04: *hysteresis* of *heating* thermostat	*Pa C05*: Power algorithm step intervention differential

If *Pa* ***H05***= 2 or 3, the compressor will be turned off and on depending on the status of input AI1.
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 *outputs*)
- 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*
- Ech 200 is on *stand-by* or off
- The parameter for configuration of probe AI1 *Pa H05* = 0 (probe absent)

8.5.2 Condensation fan control

Condensation control depends 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 *compressors*;
Operating mode is determined by parameter *Pa F05*:

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

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*).
- Ech 200 is on *stand-by* or off

Cool mode

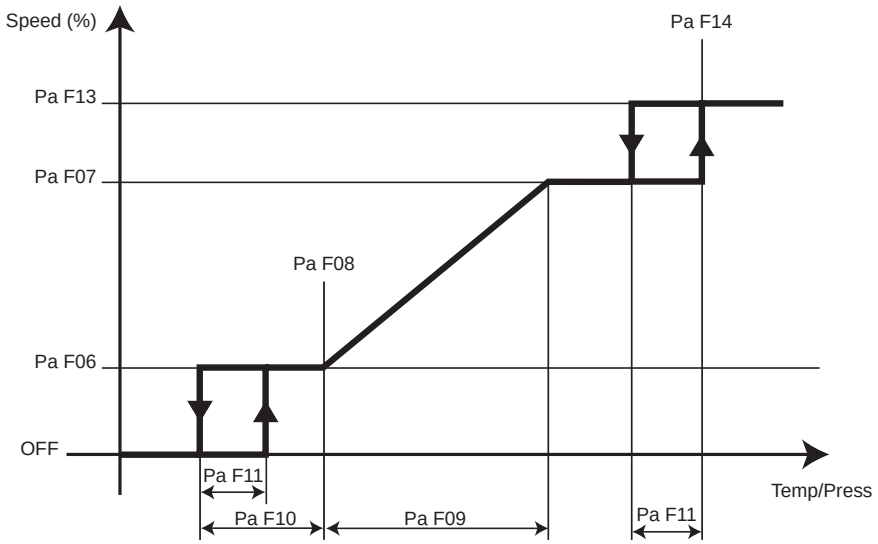
CONDENSATION FAN CONTROL IN COOL MODE

- ***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*** = Prop band. Fan 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

External fan in COOL mode



Speed: fan speed	Temp: temperature
Press: pressure	

Heat mode

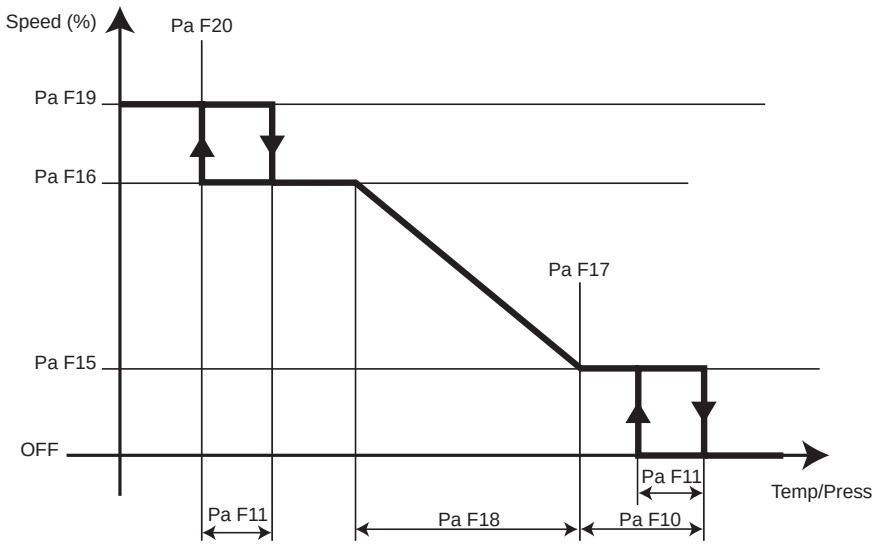
CONDENSATION FAN CONTROL IN HEAT MODE

- ***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 F09*** = Prop band. Fan 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

Outdoor fan in HEAT mode



Speed: fan speed
Temp: temperature
Press: pressure

Control is not active if:

- *defrosting* is in progress
- the *boiler* is on

8.5.3 Reversing valve control

Refer to section on *reversing valve*s.

8.5.4 Hydraulic pump control

Refer to section on the *hydraulic pump*.

8.5.5 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

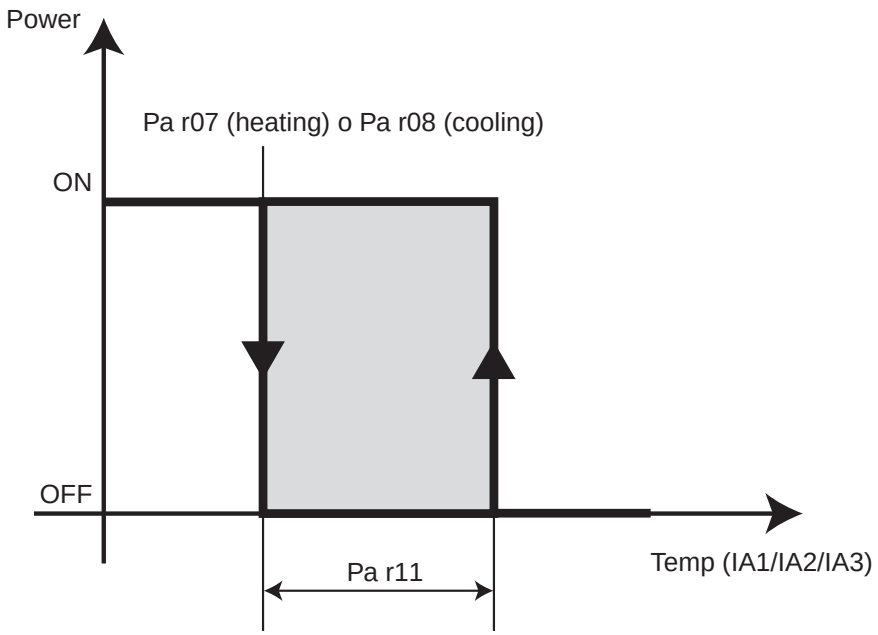
When off or on *stand-by*, control is based on the *cooling set point*, using the control probe used in the *heating mode*.

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*



Power: power
Temp: temperature

8.5.6 External anti-freeze electrical heater control

Control is based on probe AI3 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.

8.5.7 Supplementary electrical heater control

If *Pa r15*=1 in heat mode, electrical heaters are activated on their control, and are activated even if AI1 < (SET *Heating Pa r14*).
Control *hysteresis* is *Pa C04* (*hysteresis* of *heating* control).

8.5.8 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* is achieved using 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*)

9 FUNCTIONS

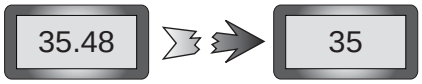
9.1 Recording hours of operation

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

9.2 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 temperature and high humidity.
It 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 AI3= 1 or 2, or *Pa* ***H08***, for input AI4= 1)
- the *reversing valve* is present

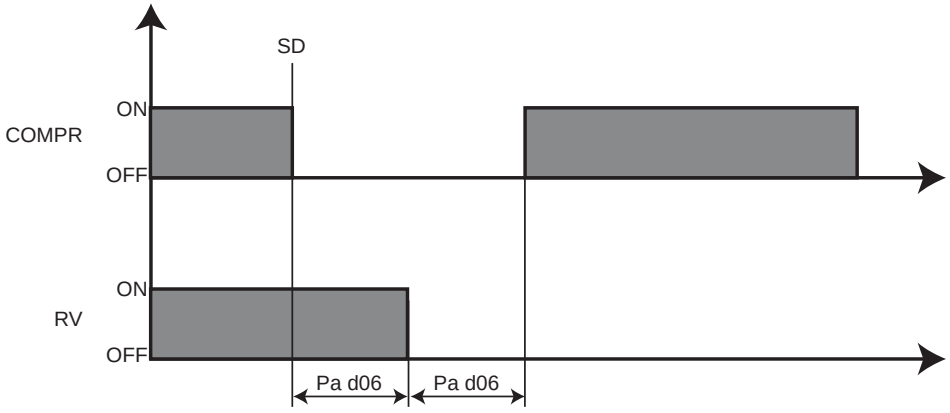
Defrosting may be controlled on the basis of temperature or pressure, depending on how the machine is configured in *Pa* ***H49***.

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

9.2.1 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



SD: *defrost start*	COMPR: compressor
RV: *reversing valve*	*Pa d06*: compressor/valve delay time

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.

Start *defrosting* and end *defrosting* pressure (or temperature) values 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.

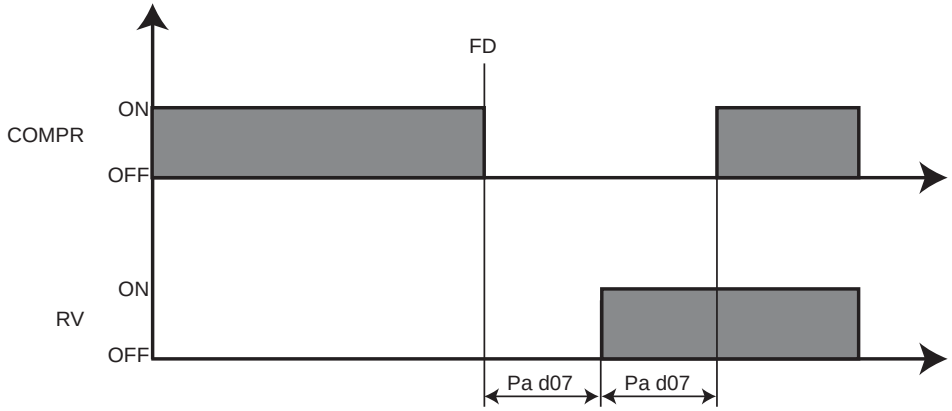
If *Pa* ***H49***= 0, *defrosting* is not permitted (probe AI3 absent).

9.2.2 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



FD: *defrost end*
COMPR: compressor
RV: *reversing valve*
Pa d07: drip time

9.2.3 Counter mode

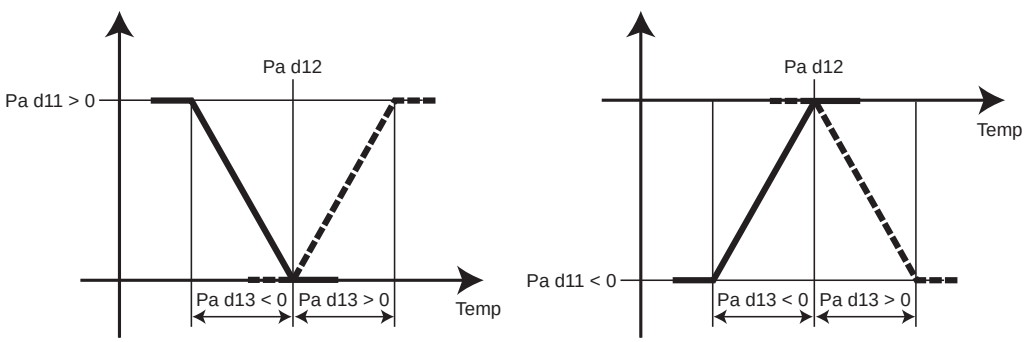
- The defrost interval counter is interrupted when temperature/pressure rises above ***Pa d02*** (*defrost start* temperature/pressure) or the compressor is turned off.
- The counter is set to zero after one of the following events: defrost cycle performed; power off; change in operating mode.
- The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

9.2.4 Start defrost temperature compensation

In dry and cool climates, the start defrost temperature is not corresponding to the effective icing temperature of the battery. The following control allows to linearly compensate the start defrost temperature/pressure, by adding negative or positive values depending on the outdoor temperature.
Fan control will be on if:
- Activation parameter *Pa H31* = 1
- Probe AI4 is configured as an outdoor temperature probe (*Pa* ***H08***= 3)

Control *parameters*:
- *Pa d11* = compensation offset for temperature/pressure *defrosting*
- *Pa d12* = compensation *set point* for temperature/pressure *defrosting*
- *Pa d13* = compensation delta for temperature/pressure *defrosting*

Decalibrating defrost start setpoint according to T ext



Temp: temperature

9.3 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.

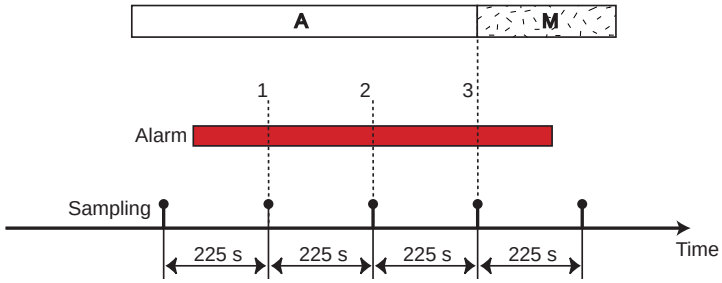
10 DIAGNOSTICS

Alarms

"Ech 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*.



A: Automatic *reset*
M: *Manual reset*
Alarm: *alarm*
Sampling: *alarm* sampling
Time: time

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	BLOCCO UTENZE							BY PASS	*RESET*
			COMPRESSOR 1	COMPRESSOR 2	EXTERNAL FAN	INTERNAL FAN	PUMP	ELECTRICAL HEATER 1	ELECTRICAL HEATER 2		
E00	Remote Off	Triggered by the digital input configured as "Remote ON-OFF " (refer to *digital inputs*)	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
E01	High pressure (digital)	Triggered by digital input ID1 (refer to *digital inputs*)	OFF	OFF							Always manually *reset*
E02	Low pressure (digital)	Triggered by digital input ID2 (refer to *digital inputs*);	OFF	OFF	OFF	OFF				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.	Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A02*, after which manually *reset*;
E03	Thermal switch protection compressor 1	Triggered by the digital input configured as "Compressor 1 thermal switch" (refer to *digital inputs*);	OFF							Inactive during timer *Pa A07* after compressor is turned on.	Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A08*, after which manually *reset*;
E04	Thermal switch protection condenser fan	Triggered by the digital input configured as "Fan thermal switch" (refer to *digital inputs*);	OFF	OFF	OFF	OFF					Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A09*, after which manually *reset*;
E05	Anti-freeze	Active if analogue probe AI2 (refer to *analogue inputs*) is configured as an anti-freeze probe (*Pa H06* = 1); Triggered when probe AI2 detects a value below *Pa A11*;	OFF	OFF	OFF					Inactive during timer *Pa A10* after Ech 200 is turned on using the On-OFF key (refer to *keyboard*) or by a digital ON-OFF input (refer to *digital inputs*).	Goes off if AI2 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

CODE	SIGNAL	DESCRIPTION	BLOCCO UTENZE							BY PASS	*RESET*
			COMPRESSOR 1	COMPRESSOR 2	EXTERNAL FAN	INTERNAL FAN	PUMP	ELECTRICAL HEATER 1	ELECTRICAL HEATER 2		
											manually *reset*;
E06	Probe AI2 fault	Triggered if probe AI2, configured as an analogue input, shorts or is cut off or probe limits are exceeded (-50°C.. 100°C).	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
E07	Probe AI3 fault	Triggered if probe AI3, configured as an analogue input, shorts or is cut off or probe limits are exceeded (-50°C.. 100°C).	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
E13	Thermal switch protection compressor 2	Triggered by the digital input configured as "Compressor 2 thermal switch" (refer to *digital inputs*);		OFF						Inactive during timer *Pa A07* after compressor is turned on.	Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A08*, after which manually *reset*;
E40	Probe AI1 fault	Triggered if probe AI1, configured as an analogue input, shorts or is cut off or probe limits are exceeded (-50°C.. 100°C).	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
E41	Flow switch	Triggered if the digital input configured as "flow switch" (refer to *digital inputs*) remains active for an amount of time equal to *Pa A04*;	OFF	OFF	OFF		OFF[3]			Inactive during timer *Pa A03* after pump (*hydraulic pump*) is turned on	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*;
E42	Probe AI4 fault	Triggered if probe	OFF	OFF	OFF	OFF	OFF	OFF	OFF		

CODE	SIGNAL	DESCRIPTION	BLOCCO UTENZE							BY PASS	*RESET*
			COMPRESSOR 1	COMPRESSOR 2	EXTERNAL FAN	INTERNAL FAN	PUMP	ELECTRICAL HEATER 1	ELECTRICAL HEATER 2		
		AI4, configured as an analogue input, shorts or is cut off or probe limits are exceeded (-50°C.. 100°C).									
E43	Anti-freeze *alarm* (water-water machine with gas reversal)	Active if probe AI3 is configured as an anit-freeze probe for water-water machines with gas reversal (refer to *analogue inputs*) Triggered if probe AI3 detects a value below *Pa A11*	OFF	OFF						Goes off if temperature detected by AI3 exceeds *Pa A11* + *Pa A12*.	Automatically *reset* unless *alarm events per hour* reaches the value of parameter *Pa A13*, after which manually *reset*;
E45	Configuration error	If AI1 is configured as a request for *heating* digital input and AI2 as a request for *cooling* input (refer to *analogue inputs*), the *alarm* will be triggered if both inputs are active.	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
E46	Over-temperature	Triggered if probe AI1 (refer to *analogue inputs*) has a value over *Pa A25* for an amount of time in excess of *Pa A26*;	OFF	OFF							

[3] Only if manually *reset*

Outputs defined as capacity steps will be off if there is an *alarm* for the compressor to which they belong.

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

Digital alarms

10.1.1 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*
Thermal switch compressor 1.2	Compressor coming on	*Pa A07*	absent	absent	*Pa A08*
Thermal switch fan	None	absent	absent	absent	*Pa A13*

Analogue alarms

10.1.2 TABLE OF ANALOGUE ALARMS:

Alarm **name**	**Event**	**Time. Bypass**	**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*	AI2 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*	AI1
External anti-freeze *alarm*	None	None	*Pa A11*	*Pa A12* positive	*Pa A13*	AI3 if *Pa H07*= 4

11 PARAMETERS

Parameters make the ”Ech 200” a fully configurable device.
They may be modified through:

- instrument *keyboard*
- *copy card*
- personal computer (with a suitable connection and “*Param manager*” software)

11.1 Description of parameters

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

11.1.1 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.

Values marked with a (*) are valid only for Ech 2xxB

Pa G01 **“*Cooling*” *set point***
Allows the *set point* to be set on “*cooling*” mode.

Pa G02 **“*Heating*” *set point***
Allows the *set point* to be set on “*heating*” mode

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 **AI1 Configuration**
Used to configure analogue input AI1

- 0= No probe
- 1= Inlet water/air analogue input
- 2= *Heating* request digital input
- 3= Regulation algorithm request digital input
- 4= Differential NTC input
- 5= On *remote keyboard* (*)

Pa H06 **AI2 Configuration**

- 0= No probe
- 1= Outlet water/antifreeze/inlet air analogue input
- 2= *Cooling* request digital input
- 3= Anti-freeze *alarm* digital input

Pa H07 **AI3 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 **AI4 Configuration**

- 0= No probe
- 1= Condensation control NTC input
- 2= Multifunctional digital input
- 3= Outdoor temperature NTC input
- 4= Antifreeze analogue input for water-water machines with gas reversal

Pa H09 **Bottom of scale pressure value**
Maximum inlet 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 AI1**
Pa H16 **Polarity of analogue input AI2**
Pa H17 **Polarity of analogue input AI4**
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 **Configuration of AI4 if configured as a 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 NO2**
- 0= Pump
- 1= Internal fan step 1

Pa H23 **Configuration of output relay NO3**
- 0= Reversal
- 1= Internal fan step 3
- 2= second compressor (step)

Pa H24 **Configuration of output relay NO4**
- 0= Anti-freeze electrical heaters
- 1= Internal fan step 2
- 2= *Boiler*

Pa H25 **Optional analogue output configuration**
- 0= *open Collector output* for second compressor
- 1= fan speed 4-20 mA output
- 2= fan speed 0-10 V output

Pa H26 **Configuration of serial protocol (not used)**
- 0= Standard
- 1= INVENSYS

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 AI4)

Pa H28 **Presence of heat pumpt**
- 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 AI4 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 AI1,**
Pa H40 **Offset AI2,**
Pa H42 **Offset AI4**
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 AI3**
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 *compressors* (or 2 steps)

Pa H49 **Enable pressure / *temperature-based operation***
- 0= *parameters Pa* ***H07***=0 (probe Al3 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 Al3 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 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

Pa H53 **SET *display* for air'/air macchine**
In order to facilitate the *user interface* in the air/air version, the set associated with the selected mode is normally displayed by setting th parameter PS H53

Pa H54 **Customer Code 1**
A number between 0 and 999 that the user can assign for internal use

Pa H55 **Customer Code 2**
A number between 0 and 999 that the user can assign for internal use

Pa H56 **Polarity of relay *alarm***
- 0 = output is active (closed contact) when an *alarm* is active and when the machine is switched off.
- 1 = in the same conditions, the contact is open

Pa H57 **Enable relay *alarm* in off position**
- 0 = *alarm* output not enabled in OFF or standby
- 1 = *alarm* output enabled in OFF or standby

11.1.2 Compressor parameters (CP)

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.

Pa C08 **Enables the *Adaptive function*.**
0=disabled function;1=enabled function;

Pa C09 **Set block in *Cooling mode***
Enables to configure a *set point* that disables the *Adaptive function* in *Cooling mode*.

Pa C10 **Set block in *Heating mode***
Enables to configure a *set point* that disables the *Adaptive function* in *Heating mode*.

Pa C11 **Offset constant**
Constant value of *Adaptive* algorithm

Pa C12 ***Reset*** **time for increases**

Pa C13 **Function proportional constant**
Value used to multiply the difference between the minimum and actual running time.

11.1.3 Fan control parameters (FAN)

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 compressor *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 value corresponding to the fan speed set for 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 **Not used**

Pa F24 **Not used**

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

11.1.4 Alarm parameters (ALL)

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*; it is enabled only in the *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 **Not used**

Pa A15 **Not used**

Pa A16 **Not used**

Pa A17 **Not used**

Pa A18 **Not used**

Pa A19 **Not used**

Pa A20 **Machine out of coolant differential**
If the difference between the absolute value of Al2 and is lower than this parameter when in *heating* and higher when in *cooling*, the machine out of coolant timer will start.

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 Al1 above which the over-temperature *alarm* E46 is triggered.

Pa A26 **Over-temperature ON duration**
Determines the duratoni of the condition Al1>A25 beyond which *alarm* E46 is triggered.
Pump *parameters* (PUP)

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 or fan operating mode**
May be used to determine pump or fan operating mode:
- 0=(pump) continuous operation | (fan) the fan is never switched off
- 1= (pump) operation in response to a request from regulation algorithm | (fan) the fan is turned off with the compressor

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.

11.1.5 Anti-freeze/boiler parameters (FRO)

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)

Pa r03 **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)

Pa r04 **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 Al1
- 1= Controls on the basis of probe Al2

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 Al1
- 1= Controls on the basis of probe Al2

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 ***Supplementary electrical heater control***
If this parameter =1 the electrical heaters have the double function of anti-freeze electrical heaters and supplementary heaters
Otherwise (*Pa r15*=0) the electrical heaters have only the anti-freeze function

11.1.6 Defrost parameters (DFR)

Pa d01 **Defrost enabled**
0= defrost function enabled
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 *defrosting*. Expressed 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.

Pa d10 **Enable defrost compensation**
See compensation temperature at *defrost start*

Pa d11 **Defrost temperature/pressure compensation offset**
See compensation temperature at *defrost start*

Pa d12 **Defrost temperature/pressure compensation *set point***
See compensation temperature at *defrost start*

Pa d13 **Defrost temperature/pressure compensation delta**
See compensation temperature at *defrost start*

11.2 Table of parameters

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

The *parameters* in gray are valid only for the models Ech 2xxB

Configuration parameters

CONFIGURATION PARAMETERS*			
Par.	Description	Limits	Unit of measurement
Pa G01	"*Cooling*" *set point*		
Pa G02	"*Heating*" *set point*		
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	AI1 Configuration	0 ÷ 5	Num
Pa H06	AI2 Configuration	0 ÷ 3	Num
Pa H07	AI3 Configuration	0 ÷ 5	Num
Pa H08	AI4 Configuration	0 ÷ 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 AI1	0 ÷ 1	Flag
Pa H16	Polarity AI2	0 ÷ 1	Flag
Pa H17	Polarity AI4	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 AI4 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	Optional analogue output configuration	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*	-25.5 ÷ 25.5	°C
Pa H37	Outdoor temp. *dynamic set point* differential in *heating*	-25.5 ÷ 25.5	°C
Pa H38	*Reversing valve* polarity	0 ÷ 1	Flag
Pa H39	Offset AI1	-12.7 ÷ 12.7	°C
Pa H40	Offset AI2	-12.7 ÷ 12.7	°C
Pa H41	Offset AI3	-127 ÷ 127	°C/10 - kPa*10
Pa H42	Offset AI4	-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÷3	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	SET *display* for air'/air macchine	0÷1	Num.
Pa H54	Customer Code 1	0÷999	Num.
Pa H55	Customer Code 2	0÷999	Num.
Pa H56	Polarity of relay *alarm*	0÷1	Num.
Pa H57	Enable relay *alarm* in off position	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 compressor parameters (CP)

COMPRESSOR *PARAMETERS*			
Par.	Description	Limits	Unit of measurement
Pa C01	ON-OFF safety time	0 ÷ 255	Seconds*10
Pa C02	ON-ON safety time	0 ÷ 255	Seconds*10
Pa C03	*Cooling* regulation algorithm *hysteresis*	0 ÷ 25.5	°C
Pa C04	*Heating* regulation algorithm *hysteresis*	0 ÷ 25.5	°C
Pa C05	Regulation algorithm step intervention differential	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
Pa C08	Start function on units without accumulation tank	0 ÷ 1	Flag
Pa C09	Set block in *Cooling mode*	0 ÷ 255	°C
Pa C10	Set block in *Heating mode*	0 ÷ 255	°C
Pa C11	Offset constant	0 ÷ 25.5	°C
Pa C12	*Reset* time for increases	0 ÷ 255	Seconds*10
Pa C13	Proportional Part Offset Coefficient	0 ÷ 25.5	°C/(10*sec)

Table of parameters: fan control parameters (FAN)

FAN PARAMETES			
Par.	Description	Limits	Unit of measurement
Pa F01	Fan output configuration	0 ÷ 3	Num.
Pa F02	Fan *pick-up* time	0 ÷ 255	Seconds/10
Pa F03	Fan *phase shift*	0 ÷ 100	µs*200
Pa F04	*Impulse duration* of *triac* on	0 ÷ 255	µs*200
Pa F05	Functioning in response to compressor request	0 ÷ 1	Flag
Pa F06	Minimum speed during *cooling*	0 ÷ 100	%
Pa F07	*Silent speed* during *cooling*	0 ÷ 100	%
Pa F08	Minimum fan speed temperature/pressure *set point* during *cooling*	-500 ÷ 800	°C/10–kPa*10
Pa F09	Prop. band during *cooling*	0 ÷ 255	°C/10–kPa*10
Pa F10	*Cut-off* differential	0 ÷ 255	°C/10–kPa*10
Pa F11	*Cut-off hysteresis*	0 ÷ 255	°C/10–kPa*10
Pa F12	*Cut-off* bypass time	0 ÷ 255	Seconds
Pa F13	Maximum speed during *cooling*	0 ÷ 100	%
Pa F14	Maximum fan speed temperature/pressure *set point* in *cooling mode*	-500 ÷ 800	°C/10–kPa*10
Pa F15	Minimum speed during *heating*	0 ÷ 100	%
Pa F16	*Silent speed* during *heating*	0 ÷ 100	%
Pa F17	Minimum fan speed temperature/pressure *set point* during *heating*	-500 ÷ 800	°C/10–kPa*10
Pa F18	Proportional band during *heating*	0 ÷ 255	°C/10–kPa*10
Pa F19	Maximum speed during *heating*	0 ÷ 100	%

Pa F20	Maximum fan speed temperature/pressure *set point* during *heating*	-500 ÷ 800	°C/10–kPa*10
Pa F21	Internal fan step differential	0 ÷ 25.5	°C
Pa F22	Internal fan step *hysteresis*	0 ÷ 25.5	°C
Pa F23	Not used	/	/
Pa F24	Not used	/	/
Pa F25	Preventilation in *cooling mode*	0 ÷ 255	Seconds

Table of parameters: alarm parameters (ALL)

ALARM PARAMETERS			
Par.	Description	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	Not used	/	/
Pa A15	Not used	/	/
Pa A16	Not used	/	/
Pa A17	Not used	/	/
Pa A18	Not used	/	/
Pa A19	Not used	/	/
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	Seconds*10

Table of parameters: pump parameters (PUP)

PUMP *PARAMETERS*			
Par.	Description	Limits	Unit of measurement
Pa P01	Pump operating mode	0 ÷ 1	Num.
Pa P02	Delay between pump ON and compressor ON	0 ÷ 255	Seconds
Pa P03	Delay between compressor OFF and pump OFF	0 ÷ 255	Seconds

Table of parameters: Anti-freeze/boiler parameters (FRO)

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

Table of parameters: defrost parameters (DFR)

DEFROST *PARAMETERS*			
Par.	Description	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	Enable defrost compensation	0 ÷ 1	Flag
Pa d11	Defrost temperature/pressure compensation offset	-255 ÷ 255	°C/10 - kPa*10
Pa d12	Defrost temperature/pressure compensation *set point*	-127 ÷ 127	°C
Pa d13	Defrost temperature/pressure compensation delta	-25.5 ÷ 25.5	°C

12 TECHNICAL FEATURES

12.1 Technical information

	Tipical	Min.	Max.
Power supply tension	12V~	10V~	14V~
Power supply frequency	50Hz/60Hz	---	---
Power	5VA	---	---
Isolation class	1	---	---
Use environment temperature	25°C	-10°C	60°C
Use environment humidity (non-condensing)	30%	10%	90%
Stocking environment temperature	25°C	-20°C	85°C
Stocking environment humidity (non-condensing)	30%	10%	90%

12.2 Electromagnetic characteristic

Digital exits 120/240 V	• n° 4 relais 2A ¼ hp 240V~; 1/8 hp 120V~ **WARNING**: The TOTAL current on relay must NOT exceed 8A • 1 *TRIAC* 2 A
Exits 24 V~	• 1 *TRIAC* non optic insulation entry maximum 500 mA.
Analogue inputs	• 3 temperature sensors, reading field -30°C ÷ 90°C; • 1 configurable input: 4...20 mA transducer or temperature sensor, reading field -30°C ÷ 90°C;
Digital inputs	• n° 5 Voltage-free *digital inputs*
Terminals and connectors	• 1 quick coupling 9-ways connector high voltage AWG 16-28 • 1 quick coupling 16-ways connector low voltage pitch 4,2, AWG 16-28 • 1 5-ways p2,5 connector remote control and foreign key scheduling, AWG 24-30 • 1 3-ways p2 3 connector *remote keyboard* or optional relay, AWG 22-30;
Display and *led*	• 3 digit + sign; • 5 red leds
Keys	• 2 *keys*
Serials	• n° 1 9600 serial • n° 1 2400 serial (*keyboard* output)

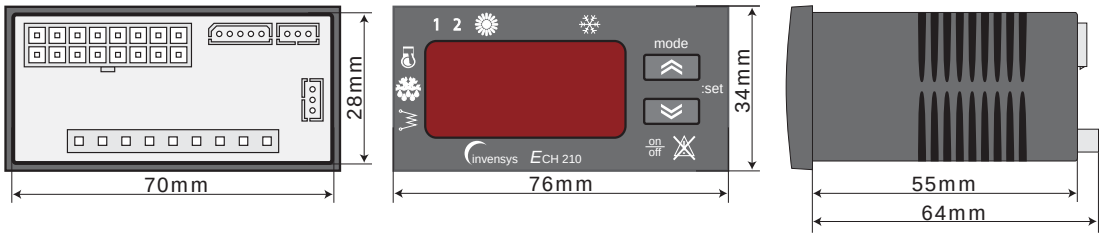
Current transformer

Turn the power on to the instrument using an appropriate *current transformer* with the following features:

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

12.3 Dimensions

- *Dimensions*: 76x34x58mm
- Container: PC+ABS plastic resin with V0 extinguishing classification
- Assembly: Panel , on 71x29mm hole



12.4 Regulations

The product meets the following CEE Directives:

- 73/23/CEE Council directive and subsequent modifications
- 89/336/CEE Council directive and subsequent modifications

and meets the requirements of the following Armonised *regulations*

- LOW VOLTAGE: EN60730
- EMISSION : EN50081-1 (EN55022)
- IMMUNITY : EN50082-2 (IEC 1000-4-2/3/4/5)

13 USE OF THE DEVICE

13.1 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.

13.2 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 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.

14 RESPONSIBILITY AND RESIDUAL RISKS

Eliwell & Controlli srl. 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.

15 DISCLAIMER

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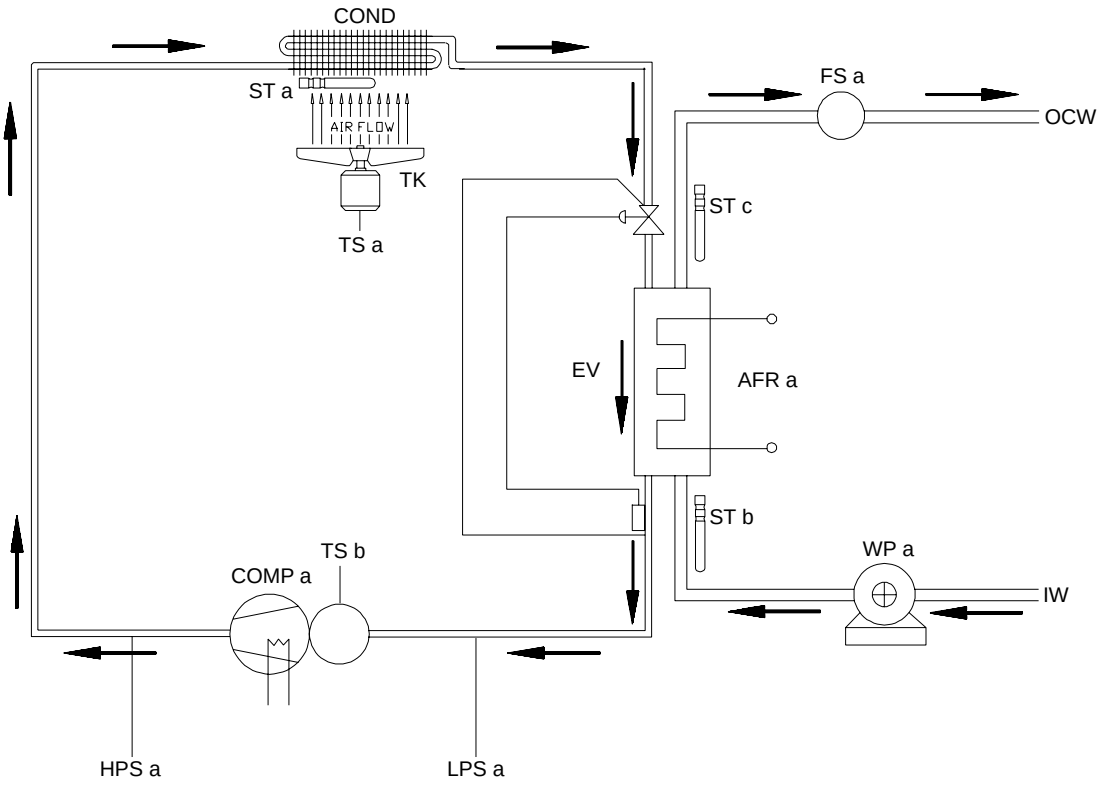
16 EXAMPLES OF AIR CONDITIONING CIRCUITS

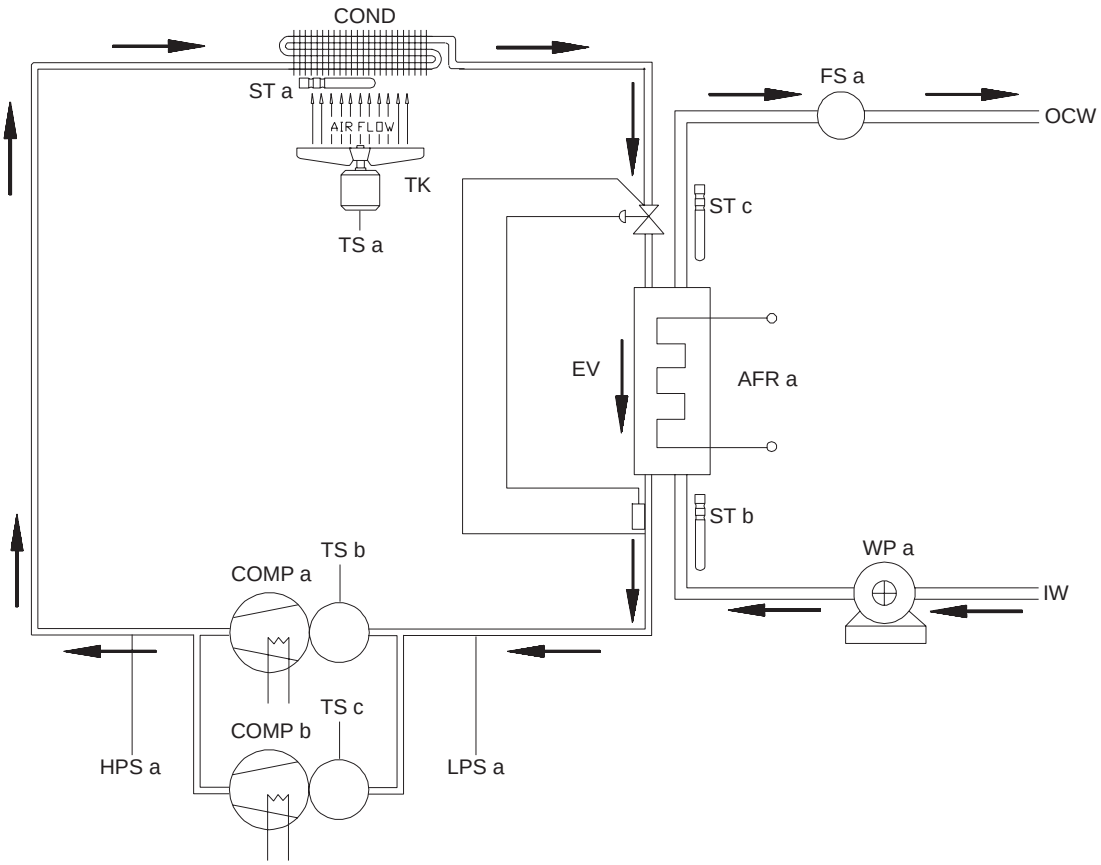
The following chapter reports the main air-conditioning diagrams in their standard configuration.
Obviously the manufacturer can decide to set the system in customed way.

16.1 Air-water chiller 1 compressor



SYMBOL	ELEMENT	CONNECTION
COND	condenser	
EV	evaporator	
AFR a	primary circuit anti-freeze resistance	NO4
HPS a	high pressure switch	ID1
LPS a	low pressure switch	ID2
TS a	fan thermal switch	ID4
TS b	compressor thermal switch	ID3
ST a	secondary circuit anti-freeze probe	AI3
ST b	primary circuit inflowing water probe	AI1
ST c	primary circuit outflowing water probe	AI2
FS a	primary circuit flow switch	ID5
COMP a	compressor	NO1
WP a	primary circuit water pump	NO2
OCW	outflowing cold water	
IW	inflowing water	

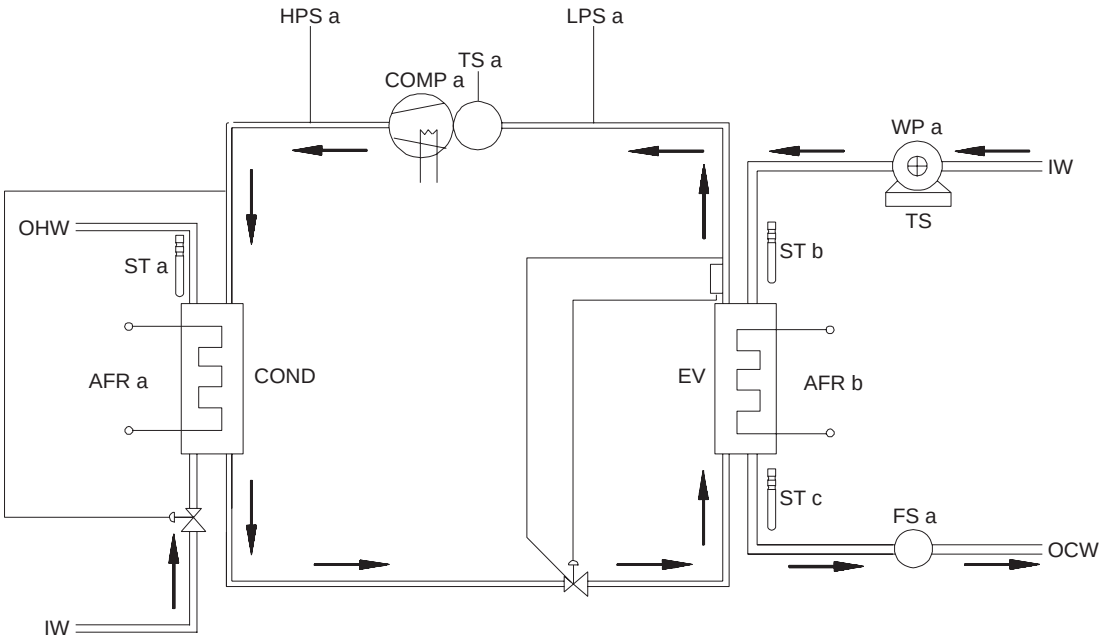
16.2 Air-water chiller 2 compressor



SYMBOL	ELEMENT	CONNECTION
COND	condenser	
EV	evaporator	
AFR a	primary circuit anti-freeze resistance	NO4
HPS a	high pressure switch	ID1
LPS a	low pressure switch	ID2
TS a	fan thermal switch	ID4
TS b	compressor 1 thermal switch	ID3
TS c	compressor 2 thermal switch	AI4(*)
ST a	secondary circuit anti-freeze probe	AI3
ST b	primary circuit inflowing water probe	AI1
ST c	primary circuit outflowing water probe	AI2
FS a	primary circuit flow switch	ID5
COMP a	Compressor 1	NO1
COMP b	Compressor 2	NO3
WP a	primary circuit water pump	NO2
OCW	outflowing cold water	
IW	inflowing water	

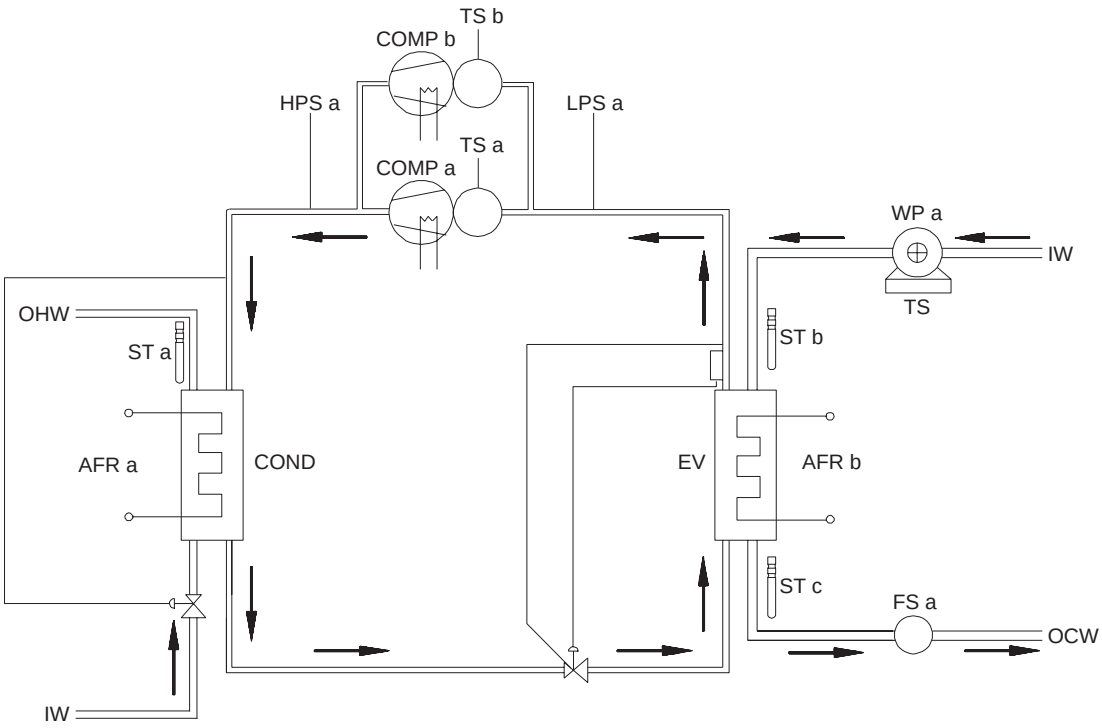
(*) With AI4 configured as digital input.

16.3 Water-water Chiller 1 compressor



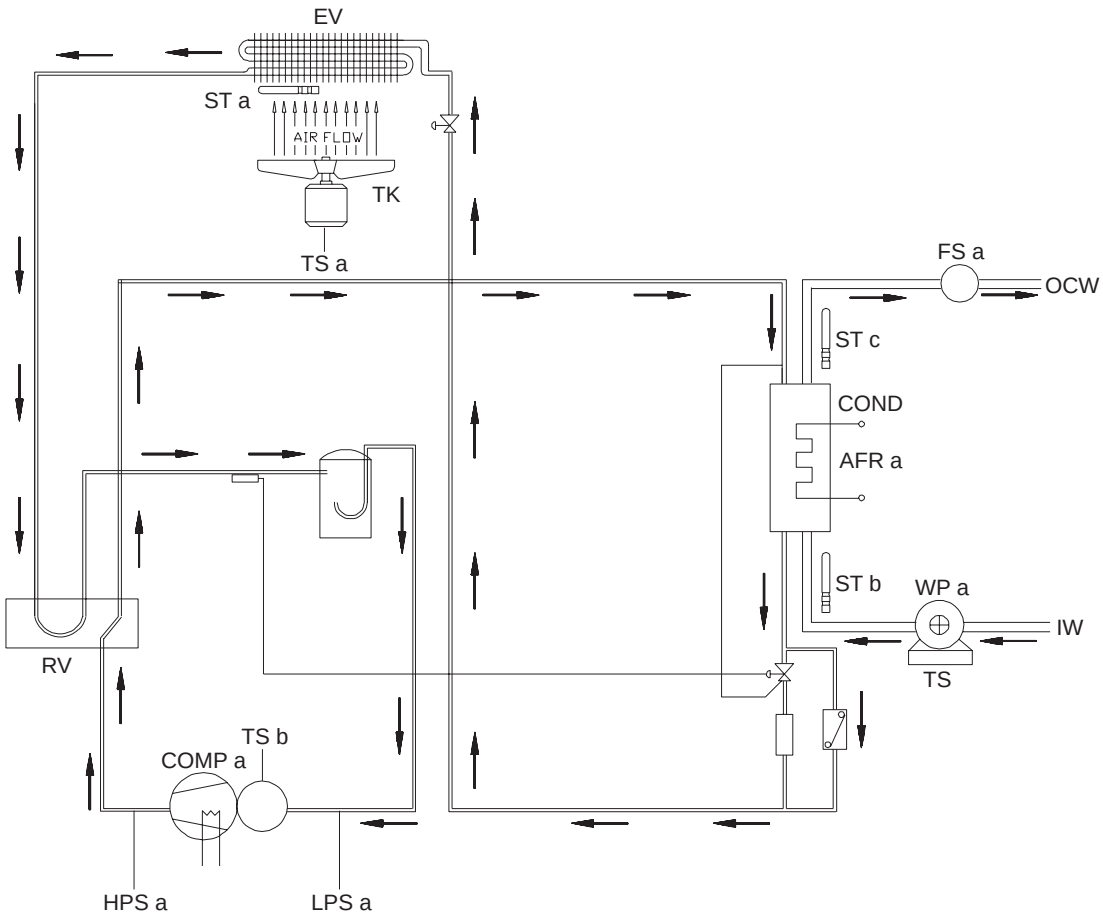
SYMBOL	ELEMENT	CONNECTION
COND	condenser	
EV	evaporator	
AFR a	secondary circuit anti-freeze resistance	NO5 (TK)
AFR b	primary circuit anti-freeze resistance	NO4
HPS a	high pressure switch	ID1
LPS a	low pressure switch	ID2
TS a	compressor thermal switch	ID3
TS	thermal switch	
ST a	secondary circuit anti-freeze probe	AI3
ST b	primary circuit inflowing water probe	AI1
ST c	primary circuit outflowing water probe	AI2
FS a	primary circuit flow switch	ID5
COMP a	compressor	NO1
WP a	primary circuit water pump	NO2
IW	inflowing water	
OCW	outflowing cold water	
OHW	outflowing hot water	

16.4 Water-water Chiller 2 compressor



SYMBOL	ELEMENT	CONNECTION
COND	condenser	
EV	evaporator	
AFR a	secondary circuit anti-freeze resistance	NO5 (TK)
AFR b	primary circuit anti-freeze resistance	NO4
HPS a	high pressure switch	ID1
LPS a	low pressure switch	ID2
TS a	compressor 1 thermal switch	ID3
TS b	compressor 2 thermal switch	ID4
TS	thermal switch	
ST a	secondary circuit anti-freeze probe	AI3
ST b	primary circuit inflowing water probe	AI1
ST c	primary circuit outflowing water probe	AI2
FS a	primary circuit flow switch	ID5
COMP a	compressor 1	NO1
COMP b	compressor 2	NO3
WP a	primary circuit water pump	NO2
OCW	outflowing cold water	
IW	inflowing water	
OHW	outflowing hot water	

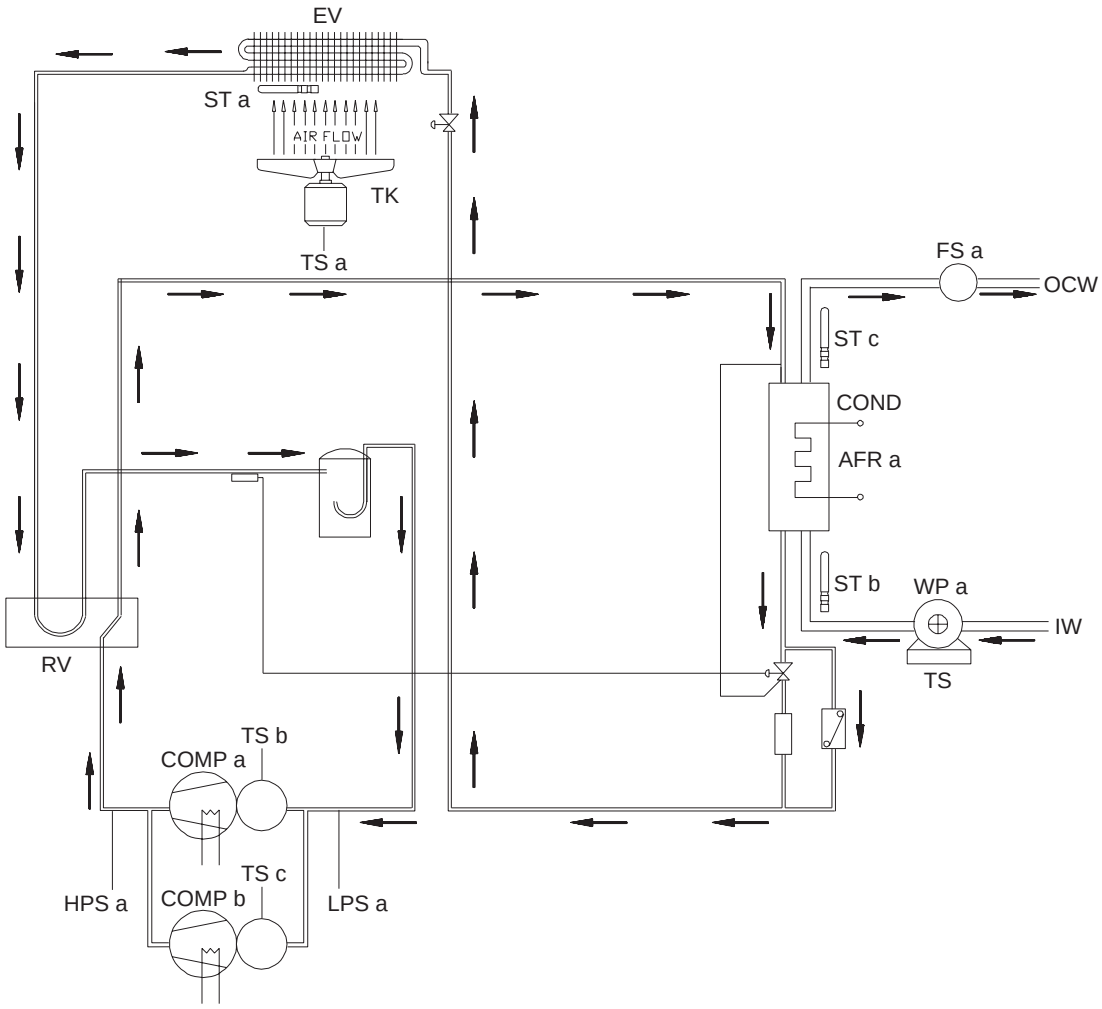
16.5 Air-water heat pump 1 compressor



SYMBOL	ELEMENT	CONNECTION
COND	condenser	
EV	evaporator	
AFR a	primary circuit anti-freeze resistance	NO4
HPS a	high pressure switch	ID1
LPS a	low pressure switch	ID2
TS a	fan thermal switch	ID4
TS b	compressor thermal switch	ID3
TS(*)	thermal switch	
ST a	secondary circuit probe	AI3
ST b	primary circuit inflowing water probe	AI1
ST c	primary circuit outflowing water probe	AI2
FS a	primary circuit flow switch	ID5
COMP a	compressor	NO1
RV	*reversing valve*	NO3
WP a	primary circuit water pump	NO2
IW	inflowing water	
OCW	outflowing cold water	

(*) Interposing this digital input to the pump feeding is recommended. In case of thermal *alarm*, the flow switch will stop the machine.

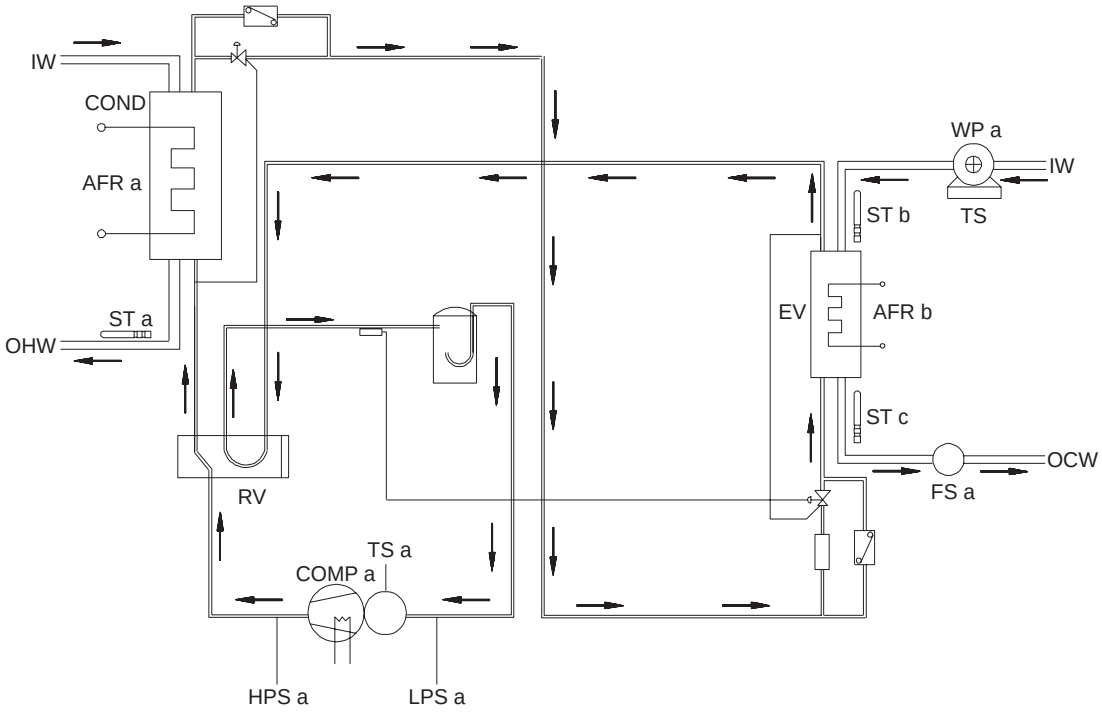
16.6 Air-water heat pump 2 compressors



SYMBOL	ELEMENT	CONNECTION
COND	condenser	
EV	evaporator	
AFR a	primary circuit anti-freeze resistance	NO4
HPS a	high pressure switch	ID1
LPS a	low pressure switch	ID2
TS a	fan thermal switch	ID4
TS b	compressor 1 thermal switch	ID3
TS c	compressor 2 thermal switch	AI4(*)
TS	thermal switch	
ST a	secondary circuit probe	AI3
ST b	primary circuit inflowing water probe	AI1
ST c	primary circuit outflowing water probe	AI2
FS a	primary circuit flow switch	ID5
COMP a	compressor 1	NO1
COMP b	compressor 2	EXP(**)
RV	*reversing valve*	NO3
WP a	primary circuit water pump	NO2
IW	inflowing water	
OCW	outflowing cold water	

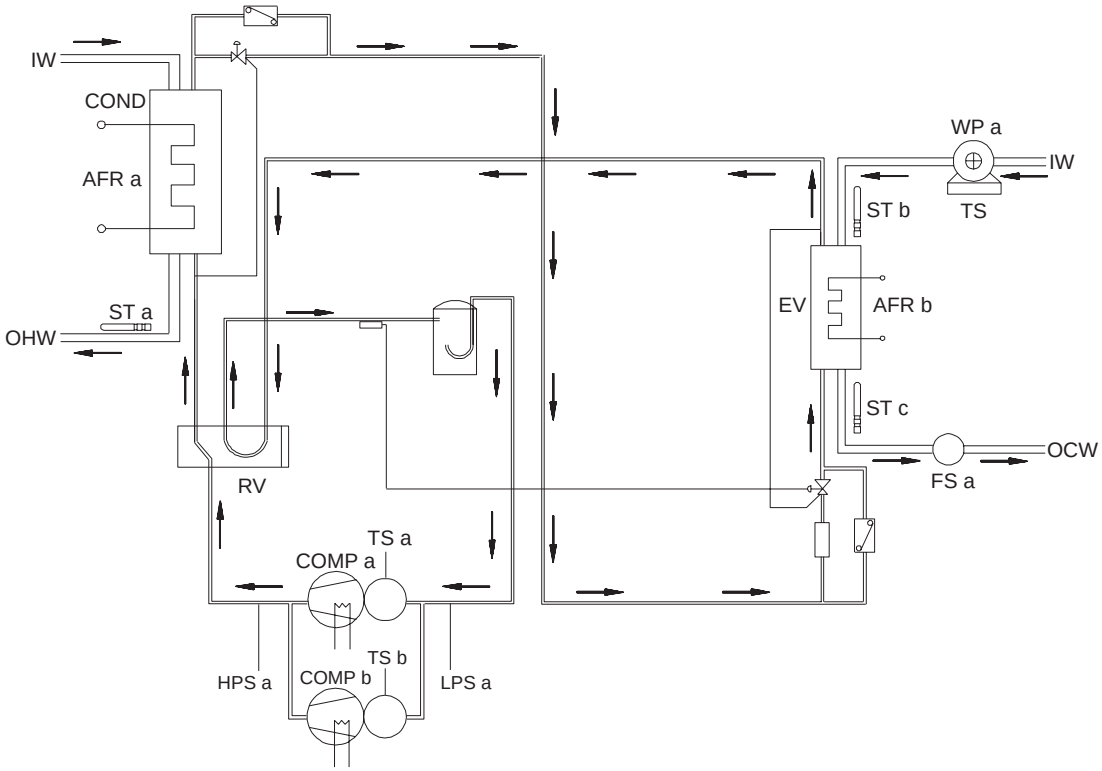
(*) With AI4 configured as digital input.
(**) Connection on extension.

16.7 Water-water heat pump 1 compressor



SYMBOL	ELEMENT	CONNECTION
COND	condenser	
EV	evaporator	
AFR a	secondary circuit anti-freeze resistance	NO5 (TK)
AFR b	primary circuit anti-freeze resistance	NO4
HPS a	high pressure switch	ID1
LPS a	low pressure switch	ID2
TS a	compressor thermal switch	ID3
TS	thermal switch	
ST a	secondary circuit probe	AI3
ST b	primary circuit inflowing water probe	AI1
ST c	primary circuit outflowing water probe	AI2
FS a	primary circuit flow switch	ID5
COMP a	compressor	NO1
RV	*reversing valve*	NO3
WP a	primary circuit water pump	NO2
IW	inflowing water	
OHW	outflowing hot water	
OCW	outflowing cold water	

16.8 Water-water heat pump 2 compressors



SYMBOL	ELEMENT	CONNECTION
COND	condenser	
EV	evaporator	
AFR a	secondary circuit anti-freeze resistance	NO5 (TK)
AFR b	primary circuit anti-freeze resistance	NO4
HPS a	high pressure switch	ID1
LPS a	low pressure switch	ID2
TS a	compressor 1 thermal switch	ID3
TS b	compressor 2 thermal switch	AI4(*)
TS	thermal switch	
ST a	secondary circuit probe	AI3
ST b	primary circuit inflowing water probe	AI1
ST c	primary circuit outflowing water probe	AI2
FS a	primary circuit flow switch	ID5
COMP a	compressor 1	NO1
COMP b	compressor 2	EXP(**)
RV	*reversing valve*	NO3
WP a	primary circuit water pump	NO2
IW	inflowing water	
OHW	outflowing hot water	
OCW	outflowing cold water	

(*) With AI4 configured as digital input.
(**) Connection on extension.

17 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 (Pa08 -> Pa 09 -> Pa 10 ....)

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 up*" in a menu is to list *parameters* from the top down (Pa10 -> Pa 09 -> Pa 08 ....).

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).

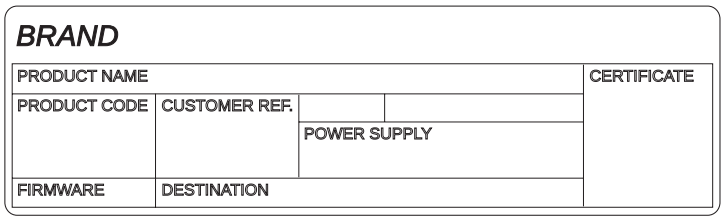
Range Values falling within a given interval; *Range* 1...100 indicates all values between 1 and 100

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 It is the change of the operating mode (for *example*: from *Cooling* to *heating*).

Label The structure of the *label* shown on an internal face of the device is illustrated below:



The various entries indicated are :

- BRAND : producer's brand
- PRODUCT NAME : name of product
- PRODUCT CODE : asset number of product
- CUSTOMER REF. : customer ID
- POWER SUPPLY : device power supply
- FIRMWARE : software version
- DESTINATION : device's usage destination
- CERTIFICATE : product's certification

18 APPENDIX

Name	Code	Description
Ech 210 BD	MW320212	Machines management heat pump 1 step or only chiller 2 steps maximum: • power supply 12V~ 50/60Hz; • probe input. NTC or 4...20mA configurable condensation input; • plastic container 32x74 mm ;

		• panel drilling 29x71 mm; • integrated fan speed control up to 2A maximum without CF additional module. • PWM • MODBUS communication protocol • Antifreeze function with heat pump • *Adaptive Function* • Fan *Defrosting*
Ech 215 BD	MW320040	The same as ECH 210BD except for: • 5 internal *relays* with ONLY ON/OFF *condensation fan* speed management.
FRONTAL PROTECTION	PR111120	Rubber frontal sheath for high protection from external environment.
CF-05 MODULE	MW991000	Open board (back-of-board mounting) for fan speed control (for fans with current higher than 2A) through phase cut. Characteristics of the model: • power 500W; • Faston connectors.
CF-15 MODULE	MW991100	Open board (back-of-board mounting) for fan speed control (for fans with current higher than 2A) through phase cut. Characteristics of the model: • power 1500W; • Faston connectors.
CF-22 MODULE	MW991200	Open board (back-of-board mounting) for fan speed control (for fans with current higher than 2A) through phase cut. Characteristics of the model: • power 2200W; • Faston connectors.
CF-REL MODULE	MW991300	Open board for the *condensation fan* ON-OFF control. Characteristics of the model: • maximum current 6A.; • faston connectors.
ECH 211 EXP	MW320100	Relay module (230V~, 10A) with DIN guide mounting base for heat pump step 2 control. To be used in heat pump 2 steps configurations together with ECH 211.
KEYBOARD TS-W ECH 200	MW320600	*Keyboard* for remote machine control for wall mounting.
KEYBOARD TS-W/ND ECH 200	MW320601	*Keyboard* for remote machine control for wall mounting without *display*.
KEYBOARD TS-W/S ECH 200	MW320602	*Keyboard* for remote machine control for wall mounting with internal temperature sensor.
TRANSFORMER	TF411200	Transformer 230V~/12A 5,6VA
COPY CARD	MW320500	Parameter scheduling key (for hard storage device *parameters*)
ELECTRICAL WIRING	COHV0100	Harness for user control (connector + 1 m cables).
	COLV0100	Harness (connector + 1 m cables) to connect low voltage inputs and *outputs*.
	CORK0100(*)	3-way harness (connector + 1 m cables) for: • TS-W ECH 200; • ECH 210A.
	COER0100(*)	2-way harness (connector + 1 m cables) for: • ECH 211 EXP.
FILTER	FT111201	LC mains filter for ECH 200.
PROBE	SN691150	Temperature probe NTC 103AT 1,5MT .
	SN8P2X1502	Temperature probe NTC 103AT 1,5MT rapid.
	SN8S0A1500	Temperature probe NTC 6X40 1.5 MT SILICONE.
	SN8S0A3000	Temperature probe NTC 6X40 3 MT SILICONE.
EWRS485	T6V53C0700	Serial interface module RS485-TTL for mounting on DIN/4 guide
PARAM MANAGER	SPPM000100	Scheduling software for Invensys instruments in WINDOWS environment (with EWTK-PT only).
EWTK-PT	T6V51C0750	Interface module for *PARAM MANAGER* (RS232 - TTL/RS485) software for mounting on DIN/4 guide.
EWTK-NET	T6V51C0760	Serial Interface Module with Invensys protocol (RS232 - TTL/RS485) for mounting on DIN/4 guide.
MULTI NETWORK INTERFACE	MW318933	Passive serial interface module for mounting on DIN/4 guide. • RS232-TTL • RS232-RS485 • TTL-RS485
RS 232 cable	1500128	1,8 m length (**)
TTL cable	1500180	0,3 m (30 cm) length (***)

((*) These electrical harnesses are already provided in the instrument package they are to be connected with.
(**) Other lengths available. Recommended 1,8 m. Maximum length depends on transmission data speed
(***) Other lengths available. Recommended 0,3 m. Other lengths allowed due to magnetic disturbance in environment .

GENERAL *NOTES*:

- COHV e COLV harnesses are not necessary if directly made up by the manufacturer.
- *Remote keyboard* connections through 3-way harness without using optional modules.
- Invensys also has multiple NTC probes with different kind of cables (PVC or silicone) and different cable lenght.

18.1 CF Modules

CF series instruments are optional modules that if connected to the main control systems allow the adjustment of fans with current from 2 A to 10 A.
They have an “open board” form and are available in several models:

- CF-REL for simple ON/OFF control;
- CF-05 to control through phase cut in a maximum power of 500 W;
- CF-15 to control through phase cut in a maximum power of 1.500 W;
- CF-22 to control through phase cut in a maximum power of 2.200 W.

18.1.1 CF modules: technical data

Power supply voltage: 230V~.

type of current on charge:

- CF-05: 500 W maximum.
- CF-15: 1500 W maximum.
- CF-22: 2200 W maximum.

Maximum absorption current:

- CF-05: 2,5 A maximum current at 230 V~.
- CF-15: 8 A maximum current at 230 V~.
- CF-22: 12 A maximum current at 230 V~.

Values and fuse type:

- CF-05: 5x20 2,5 A delayed.
- CF-15: 5x20 8 A delayed.
- CF-22: 5x20 12 A delayed.

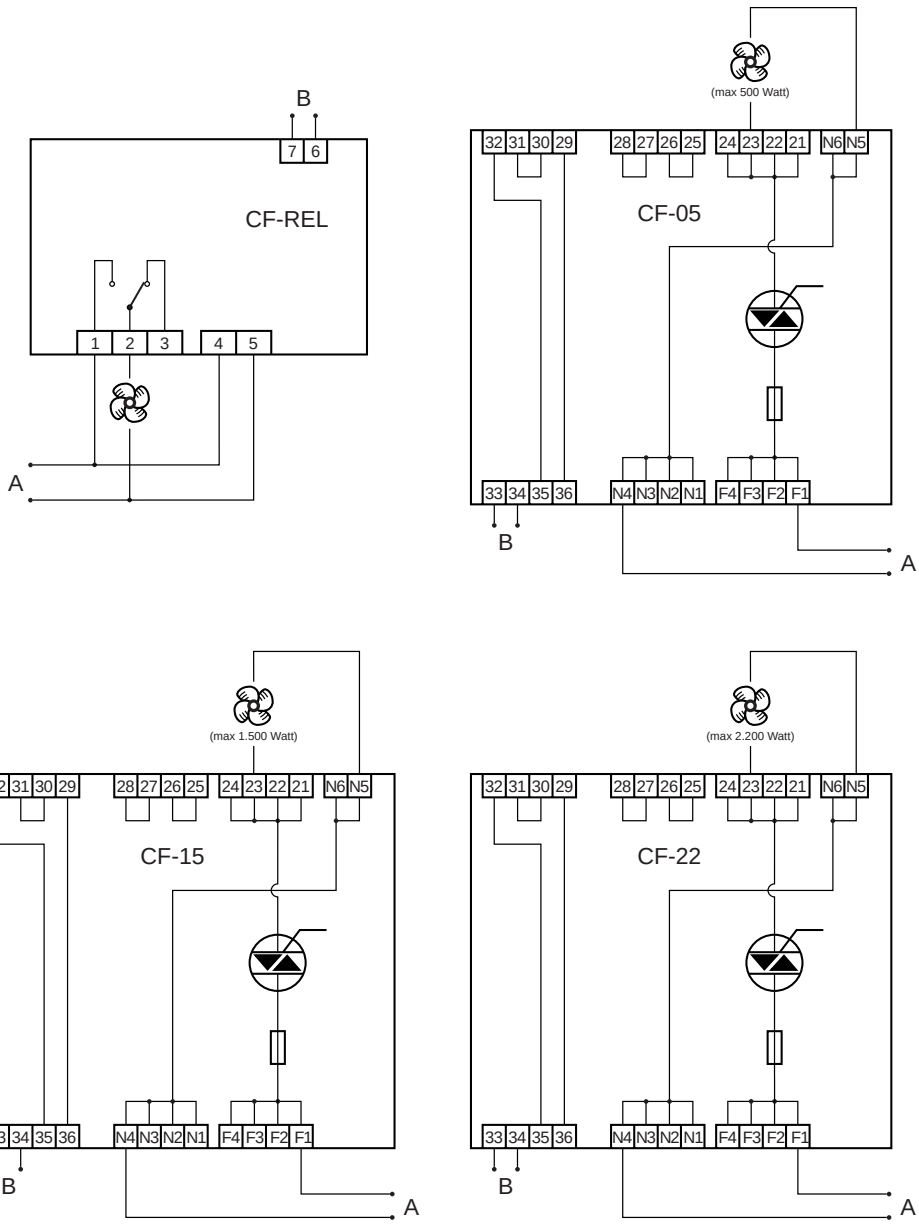
the fuse considered is related to the maximum charge hypothesis (it is the fuse supplied). It is designed to protect the fan module power component. In no case a fuse of a superior capacity must be assembled. However, the fuse value has to be dimensioned on the charge to be piloted through the fan module (the resulting value must be lower than the maximum value). If dimensioned appropriately it also protects the charge.

- Supplied power: varying according to the model (500W/1500W/2200W).
- Control signal type: pulse modulation.
- Protection coefficient: IP00 (open board).

18.1.2 CF modules: connections

CF modules connection is performed by using Fast-on connectors assembled on boards.
Below a list of the *connection diagrams* for every type of module is shown:

Connection diagram



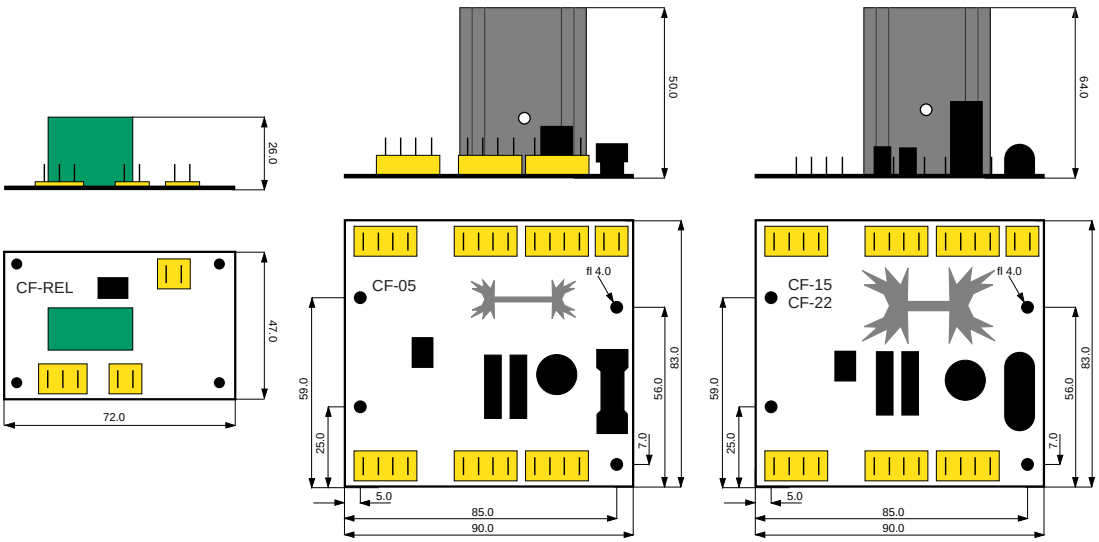
A: power supply
B: control signal

Always work on connections using a NOT powered instrument. Operations must be performed by qualified personnel.

18.1.3 CF modules: mechanical assembly

Power boards are supplied for the back-of-board *installation*.
The different board model *dimensions* are listed in the following diagram:

Module dimensions



18.2 Copy Card

Copy Card photo

This device is used to upload and download the device parameter map.

copy Card

A: *Copy Card* viewed from below: *dimensions* 4x2x1.3 cm
B: *Copy Card* and TTL cable (length 30 cm)
C: *Copy Card*, viewed from 3/4

The following conventions are usually applicable:

- **UPLOAD means copying *parameters* from a unit to COPYCARD**
- **DOWNLOAD means copying the *parameters* from a *COPY CARD* to a unit**

18.3 EMC filter

If the fans are regulated by means of the cutting phase, it is necessary to install a noise filter upstream from the power supply. This filter removes the electromagnetic noise this control emits into the mains.

18.4 Param Manager

If you have an adequate Personal Computer running Windows 95 or a higher version, the *Param Manager* software, and an adequate interface module and proper wiring, it is possible to control all the device *parameters* by means of a Personal Computer.
The unit is easy to program thanks to a series of interfaces that offer a logical, controlled, fast and simple approach.

→ **For further information, see the *Param Manager* manual.**

18.4.1 PCInterface interface module

This device enables the controller to interface with the PC.

→ **For information on how to connect the device, see the *Param Manager* Manual.**

→ **For information on the technical specifications of *PCI2150*, see the instruction sheet.**

PCI2150

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*. It is also important to avoid electroshocks, especially on the open metal surfaces of each unit. It is therefore necessary to adopt special measures to convey electrostatic currents to the ground.

18.5 Sonde

A

D

B

C

A: Humidity probe EWHS280: *dimensions* 103x25 mm.
B: Humidity probe EWHS300: *dimensions* 80x80x52 mm.
C: Pressure probe EWPA007
D: Temperature probe NTC

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