

FLOWZER VFPP

EN

Controller manual

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BlueBox 
by Swegon

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1 INTRODUCTION

1.1 General

Some information on the use of this manual.

1.1.1 Purpose of the manual

The purpose of this manual is to provide all the necessary information for the installation, programming and use of the controller and relevant software application for the system/plant function indicated on the cover.

This manual is the "SERVICE" version, that is, it is intended only for after-sales service technicians and Factory technicians. Information regarding installation of the units and relevant tests and checks for the first starting is not given in this manual. It is taken for granted that the unit has been installed correctly, the tests and checks prior to start-up have been carried out and that routine maintenance is carried out, according to the information given in the "Installation, operation and maintenance" manual for the units.

We thank in advance all those who will wish to let us know of any errors, omissions, sections requiring further explanation or operations that have not been included.

1.1.2 IPG108D controller functions

The software application for the electronic microprocessor controller of the iPro IPG108D series was designed to manage the flow rate of hydraulic systems for air conditioning.

The system/plant management controller communicates with the refrigerant unit controller to optimize the efficiency of the system.

The user interface of the controller is a graphic LCD display having 8 multifunction buttons.

2 SYSTEM HARDWARE

This chapter describes the basic parts making up the system and any accessories as concerns the operation of this software.

Refer to the wiring diagram of the unit for the various connections.

2.2 IPG108D board

The IP108D controller is the main component of the system/plant and manages the system through its inputs and outputs. A picture of the driver, the layout of the inputs and outputs and relevant description are shown below.



Fig. 1 IPG108D

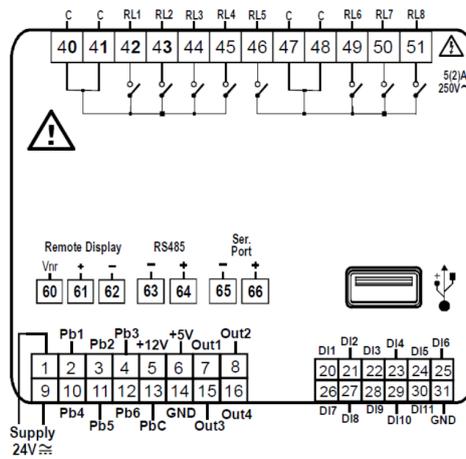


Fig. 2 IPG108D inputs and outputs

PIN	DESCRIPTION
1,9	("GND" 24Vac or "-"24Vdc) Controller power supply
2,3,4	Configurable analogue inputs NTC/PTC/PTC/0-20mA/4-20mA/0-10V/0-1V/0-5V/DI
5	(+12V) Power supply to analogue inputs
6	(+5V) Power supply to analogue inputs
7,8	Analogue outputs 0-10V/4-20mA/DO
10,11,12	Configurable analogue inputs NTC/PTC/PTC/0-20mA/4-20mA/0-10V/0-1V/0-5V/DI
13	Common for analogue inputs NTC/PTC/DI
14	(GND-) reference to 5Vdc/12Vdc power supply, analogue inputs 0-20mA/4-20mA/0-10V/0-1V/0-5V and analogue outputs
15,16	Analogue outputs 0-10V/4-20mA/DO
20 - 30	Digital inputs 24Vac/dc
31	GND(-) digital inputs
40,41	Common for digital outputs
42,43,44,45,46	Digital outputs
47,48	Common for digital outputs
49,50,51	Digital outputs
60 ,61,62	(Vnr),(+),(-) Connection for VISOGRAPH remote terminal
63,64	(+),(-), Slave RS485 serial
65,66	(+),(-) LAN

2.3 Visograph Display

The Visograph display (graphic LCD "240*96 px" having 8 multifunction buttons) is the interface through which the controller is managed.

2 displays can be connected to the same controller. In this case, it is necessary to set a different serial address for each connected display.

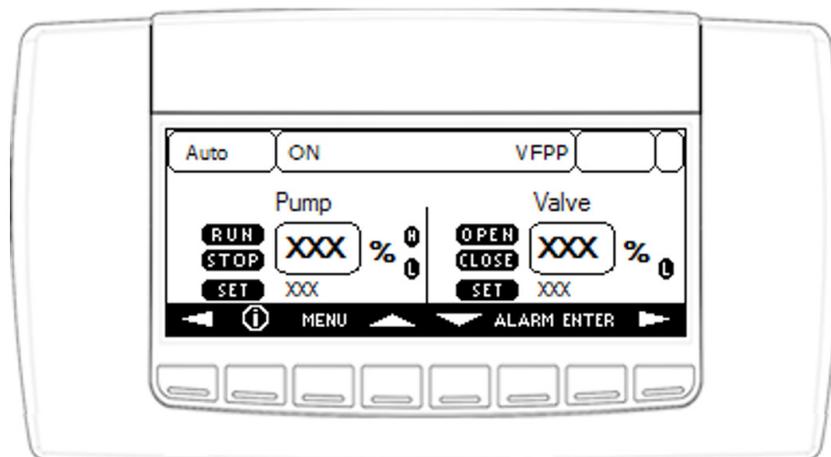


Fig. 3 Visograph Display

The connection between the display and the controller must be made with AWG20 and BELDEN 8772 type cable. The maximum distance between the controller and the display that is furthest away is 120 metres.



Observe the polarity of the power supply in order to prevent irreparable damage to the controller and the display.

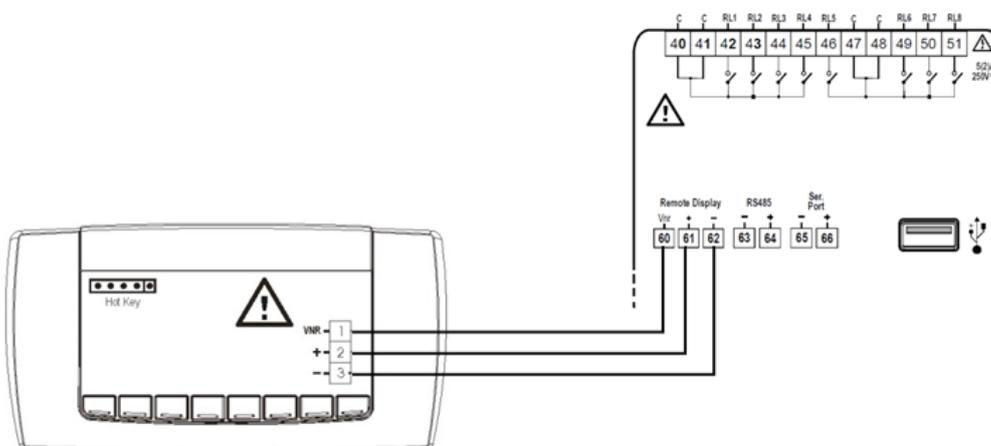


Fig. 4 Connection to terminal

PIN	DESCRIPTION
1	"Vnr"
2	"+"
3	"-"

3 ADDRESSING OF COMPONENTS

The components making up the system that controls the units are networked together. Each component must have a different address in a network.

3.1 Software addressing

Software addressing regards the VISOGRAPH graphic display that is connected to the controller via a serial line.

The local network consisting of controller IPG108D and its display for system/plant function management is different from the one consisting of controller IPG315D and relevant display that manages the unit.

The displays installed in the units and supplied from the factory have the address set to "1".

For the Flowzer function, there is only one display with address "1", and therefore no addressing is required even in the event of replacement.

3.2 IP addressing

The web server integrated in the controller is accessed through the Ethernet port.

To access the controller in this way, it is necessary to know its IP address.

Even for programming with USB pen drive, it is necessary to know the IP address of the controller.

The factory-set IP address is 10.2.3.20

3.2.1 Changing the IP address

To connect the unit to a network, its IP address must be changed.

To do this, you must connect point-to-point with a computer.

The procedure to follow is:

- change the IP address of your computer to address 10.2.3.19
- make sure the network screen is 255.255.255.0
- open a web browser of your PC (FireFox, IE, etc.)
- in the address bar, type 10.2.3.20/panel
- login
- enter Username = service
- enter Password = servicebb
- press the "Configure" button.

Now you can access the screen to give the controller a new IP address and the network characteristics.

TCP/IP	
IP address:	<input type="text" value="10.2.3.20"/>
Netmask:	<input type="text" value="255.255.255.0"/>
Network:	<input type="text" value="10.2.3.1"/>
Gateway	<input type="text" value="10.2.3.1"/>
DNS	<input type="text" value="10.0.0.50"/>
Secondary DNS	<input type="text" value="10.0.0.51"/>

Fig. 5 Screen for changing the IP address

3.2.2 Search for the IP address

If you do not know the IP address of the controller, you can access the configuration screen to force a default address.

With no power to the controller, insert a jumper in the terminals marked with "JMP1" as shown in the figure.

After inserting the jumper, power up the controller (wait about 90 seconds for it to start) and proceed as follows:

- change the IP address of your computer to address 192.168.0.249
- make sure the network screen is 255.255.255.0
- open a web browser of your PC (FireFox, IE, etc.)
- in the address bar, type 192.168.0.250/panel
- login
- enter Username = service
- enter Password = servicebb
- press the "Configure" button.

Now you can correctly read the IP address of the controller and give it a new address if you need to.

TCP/IP	
IP address:	<input type="text" value="10.2.3.20"/>
Netmask:	<input type="text" value="255.255.255.0"/>
Network:	<input type="text" value="10.2.3.1"/>
Gateway	<input type="text" value="10.2.3.1"/>
DNS	<input type="text" value="10.0.0.50"/>
Secondary DNS	<input type="text" value="10.0.0.51"/>

Fig. 6 Screen for changing the IP address

Now logout, switch off the controller and remove the jumper.

4 SOFTWARE MANAGEMENT

It is essential for those who service units provided with this controller to be able to program it or correctly update its software. These operations can make the system unserviceable if they are not carried out correctly.

All useful information for proceeding correctly is given in the next chapters.

4.1 Installing the software

iPRO is a programmable controller and therefore needs some files in order to operate.

The files are inserted through the USB port present on the controller by means of a USB pen drive.



If a controller already installed on the machine has to be programmed, disconnect the 230 V auxiliary circuit. Close the 230 V auxiliary circuit again only after complete programming of the controller and the display.



When the controller is powered up, if a display that has not yet been programmed is connected, the following message appears:

"Please push the button here below to import the application from the iPRO or download the application from the Visoprog".

Do not press any button until the controller programming procedure has finished.

4.1.1 iPRO programming

Programming of the controller is carried out easily and securely using a USB pen drive.



Use a USB pen drive that has a LED. This will enable you to follow the progress of the controller programming and be certain that it has finished when the LED remains on and steady.

Prepare the USB pen drive as follows:

- Create the "ipro" folder in root;
- create the "10.2.3.19" folder in the "ipro" folder;
- The compressed file "www.zip" must be inserted in the "10.2.3.19" folder;
- then, create the 3 folders called "app", "bin" and "conf", in the "10.2.3.19" folder;
- the "isadix" file must be inserted in the "app" folder;
- files with extension ".bin" must be inserted in the "bin" folder for management of the display. The relevant file must be inserted for each language managed by the display.
- the "actual.conf" and "default.conf" files must be inserted in the "conf" folder.
- if the controller is to manage particular functionalities, the manufacturer can supply other files, in addition to the above-mentioned ones, to be inserted in the "conf" folder.



The "www.zip" file inserted in the "10.2.3.19" folder must not be unzipped.

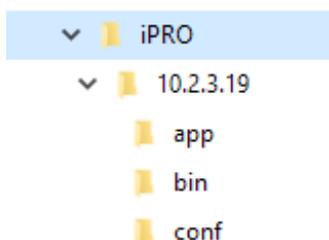


Fig. 7 Folder structure of the USB pen drive



The USB pen drive can be plugged into and unplugged from the controller without turning off the power.

Once the USB pen drive has been prepared as described above, programming will start automatically when it is plugged into the controller.

The LED on the USB pen drive will flash during transfer of the data.

The entire operation takes a few minutes.



Do not remove the USB pen drive from the controller until the programming has been completed. Confirmation of completion of programming is given when the LED of the USB pen drive remains on and steady.



From when programming of the control begins, wait at least 5 minutes before performing any other operation to be certain that the operation has been completed correctly.



Update the display only after the "screensaver" screen has appeared on it.

4.1.2 Programming the display

The files necessary for programming the display must be present in the memory of the controller.



Therefore, programming of the controller must have been completed before programming the display.

If the display has never been programmed before, the flashing "UPD" button can be pressed only after complete programming of the controller.

When the "UPD" button is pressed, the controller downloads the files necessary for operation into the memory of the display.

During programming of the display, a screen appears containing a progress bar that indicates its progress.

After the programming is finished, the display restarts automatically.

By default, programming of the display takes place with loading of the English language.



If you want to change the language, see "Updating the display" in the "Updating the software" chapter.

4.2 Updating the software

Conditions may occur that require updating of the software of the controller, the display or both.

Updating of the software is carried out easily and securely using a USB pen drive.

Updating of the software is divided into two operations:

- insertion of new files in the controller;
- updating of the parameters.

Updating of the software is divided into two operations:

- insertion of new files in the controller;
- updating of the parameters.

4.2.1 Updating the iPRO

As for programming, to update the iPRO controller, the folder structure, as shown in the image, must be created in a USB pen drive.

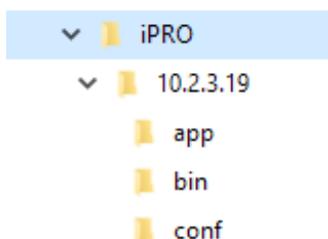


Fig. 8 Folder structure of the USB pen drive



Use a USB pen drive that has a LED. This will enable you to follow the progress of the controller programming and be certain that it has finished when the LED remains on and steady.

Not all the files mentioned in the controller programming chapter are necessary for updating. To simplify the operation, the manufacturer provides only the necessary files and therefore some folders may remain empty.

Prepare the USB pen drive as follows:

- Create the "ipro" folder in root;
- create the folder with the IP address of the controller in the "ipro" folder. If it has not been changed, this is "10.2.3.19" by default;
- create the 3 folders called "app", "bin" and "conf", in the folder with the IP address of the controller;
- the "isadix" file, if present, must be inserted in the "app" folder;
- any files with extension ".bin" must be inserted in the "bin" folder;
- files with extension ".conf" must be inserted in the "conf" folder;
- the www.zip file containing the web pages is located in folder 10.2.3.19.



The USB pen drive can be plugged into and unplugged from the controller without turning off the power.

Once the USB pen drive has been prepared as described above, updating of the controller will start automatically when it is plugged in.

The LED on the USB pen drive will flash during transfer of the data.

The entire operation takes a few minutes.



Do not remove the USB pen drive from the controller until the update has been completed.
Confirmation of completion is given when the LED of the USB pen drive remains on and steady.



From when programming of the control begins, wait at least 5 minutes before performing any other operation to be certain that the operation has been completed correctly.



Update the display only after the "screensaver" screen has appeared on it.

4.2.2 Updating the display

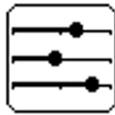
The files necessary for updating the display must be present in the memory of the controller.



Any updating of the controller must have been completed before updating the display.

To update the display, proceed as follows:

- from the main screen, press button **MENU** ;



- in the screen, the selection is on icon ;
- confirm with button **ENTER** ;
- press the button twice  ;
- In the "Update Visograph/Language" screen, with button  select the language you want to set on the display;
- On confirming with button **ENTER** updating of the display language starts.

Updating of the display language takes a few minutes.

During updating of the display, a screen appears containing a progress bar that shows its progress.

After the updating is finished, the display restarts automatically.

4.3 Management of parameter files

Conditions may occur that require updating of the software of the controller or of just the display. Updating of the software is carried out easily and securely using a USB pen drive.



As for programming, disconnect the 230 V auxiliary circuit when updating the controller. Close the 230 V auxiliary circuit again only after complete programming of the controller and the display.

4.3.1 Updating the iPRO

As for programming, to update the iPRO controller, the folder structure, as shown in the image, must be created in a USB pen drive.

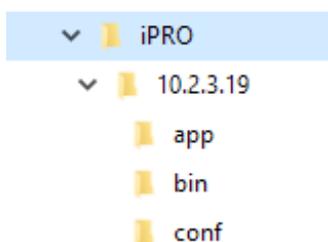


Fig. 9 Folder structure in the USB pen drive



Use a USB pen drive that has a LED. This will enable you to follow the progress of the controller programming and be certain that it has finished when the LED remains on and steady.

Not all the files mentioned in the controller programming chapter are necessary for updating. To simplify the operation, the manufacturer provides only the necessary files and therefore some folders may remain empty.

Prepare the USB pen drive as follows:

- Create the "ipro" folder in root;
- create the folder with the IP address of the controller in the "ipro" folder. If it has not been changed, this is "10.2.3.19" by default;
- create the 3 folders called "app", "bin" and "conf", in the folder with the IP address of the controller;
- the "isadix" file, if present, must be inserted in the "app" folder;
- any files with extension ".bin" must be inserted in the "bin" folder;
- files with extension ".conf" must be inserted in the "conf" folder.



The USB pen drive can be connected to and disconnected from the controller without turning off the power.

Once the USB pen drive has been prepared as described above, updating of the controller will start automatically when it is plugged in.

The LED on the USB pen drive will flash during transfer of the data.

The entire operation takes a few minutes.



Do not remove the USB pen drive from the controller until the update has been completed. Confirmation of completion is given when the LED of the USB pen drive remains on and steady.



From when programming of the control begins, wait at least 5 minutes before performing any other operation to be certain that the operation has been completed correctly.



Update the display only after the “screensaver” screen has appeared on it.

When the update is finished, turn the power to the controller off and then on again.

5 THE SCREENS

5.1 Main Screens

The Visograph display is the interface between the unit and the user.

Interaction with the unit and access to the parameters take place through the Visograph display.

Information regarding installation of the units and relevant tests and checks for the first starting is not given in this manual.

Navigate through the various menus to access the screens where you can carry out the necessary operations for operation of the unit, edit the operating parameters and download the records.

For the next descriptions of the manual, there are reference screens for access to the various functions.



The images and values shown in the screens are for illustrative purposes only.

They can vary according to the configurations and functions present in the controller.

5.1.1 Screensaver page

When a few tens of seconds have passed after powering up the controller or after 120 seconds of inactivity of the keypad, the screen shown below appears on the display.



Fig. 10 Screensaver page

Press any button to access the main screen.

5.1.2 Main mask

The main screen is accessed directly when any button is pressed while the screensaver screen is present on the display. You will return to the main screen, from whichever other screen you are in, by pressing once or twice on **EXIT** . The main screen is the starting point for navigating through the various branches of the application.

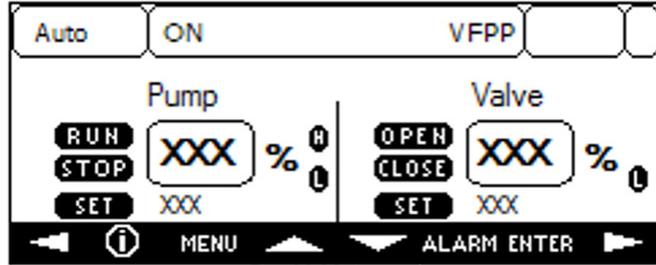


Fig. 11 Main mask

This screen shows the main operating parameters of the system/plant.

From the "Main" screen, when you press button **MENU** you will access the screens where general information on the controller is shown.

5.1.3 "Menu" screen

The branch of screens, where the user can edit the values and the functions present in the controller, can be accessed from the "Menu" screen.

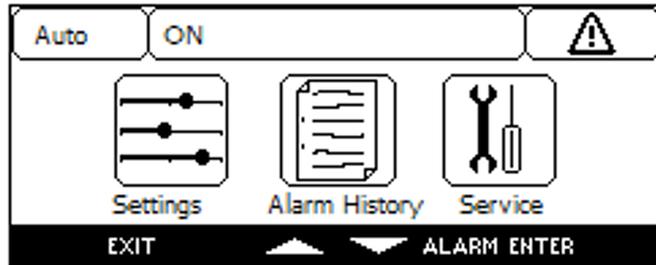
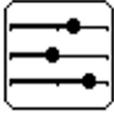
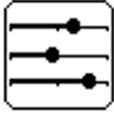


Fig. 12 "Menu" screen

Using buttons **◀** **▶** you can select an icon in the menu screen, and on confirming with button **ENTER** you will access the relevant branch of parameters.

5.1.4 "Settings" screen



After selecting icon  and on confirming with button **ENTER** you will access the "Settings" branch where the main operating parameters can be edited.

5.1.5 "Alarm Log" screen



After selecting icon  and on confirming with button **ENTER** you will access the "Alarm Log" branch where the alarms recorded over time can be seen.

5.1.6 "Service" screen



After selecting icon  and on confirming with button **ENTER** you will access the "Service" branch.

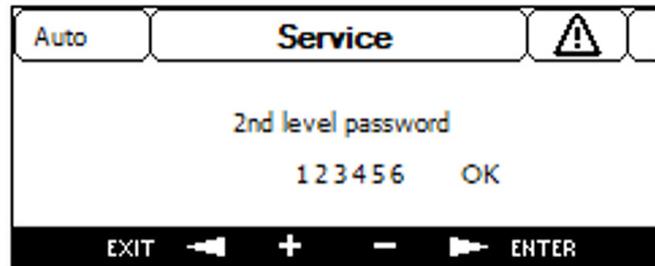


Fig. 13 Screen for entering the "Service" password

To enter the "Service" branch, the password must be entered.

After entering the correct password, the first screen of the "Service" branch is accessed.

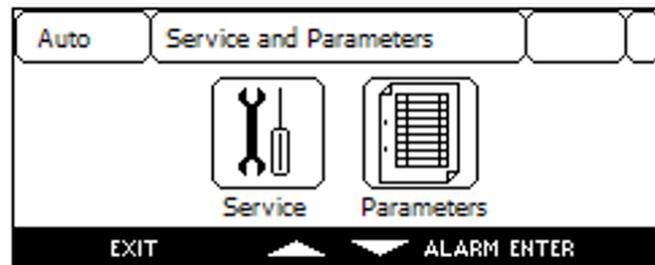


Fig. 14 First screen of the "Service" branch



On selecting and confirming with button **ENTER** icon  you will access the set of screens that, in order, allow you to set the IP address, the serial address and the communication speed, to upload the "default" parameters and to delete the alarm log.



On selecting and confirming with button **ENTER** icon  you will access the screen showing the groups of parameters for management of the following functions:

- IO - Input/Output Parameters
- PA - Pump Parameters
- PAL - Alarm Parameters
- PLANT - System/Plant Parameters
- SCAMB - Heat Exchanger Parameters
- VALVE - Valve Parameters

6 GRAPHICS ON THE DISPLAY

During development of the application, particular attention was given to intuitive use of the user interface. That is why large use has been made of symbols and icons.

6.1 Graphic conventions

Thanks to the characteristics of the graphic display, use has been made of the possibility of using symbols and icons for immediate understanding of the functionalities and to make it easy to navigate between the screens of the various menus. All the symbols and icons present in the various screens of the user interface are shown below, divided by homogeneity of function.

6.1.1 Conventions

Again, in order to make it easy to understand and use the user interface, conventions in the use of symbols and icons for displaying information in the screens have been maintained:

 When the icon flashes, there is an active alarm.

 °C When the parameter is on a white background, it means it is not selected.

 °C When the parameter is on a black background, it means it is selected.

 °C When the parameter is flashing "white/black", it means it can be edited.



When the image is on a white background, it means the represented function cannot be selected.



When the image is on a black background, it means the represented function can be selected.

6.1.2 General button symbols

The advantage of the multifunction buttons present on the display is that they can carry out different functions in different screens.

When a button can be used in a screen, the symbol of the relevant function appears on the last line of the display.

The functions of the buttons are:

 **EXIT** Return to the previous menu.

 **ENTER** Activates an editable field.

 Selects the next editable field in a screen or increases the value when an editable field is selected.

 Selects the previous editable field in a screen or decreases the value when an editable field is selected.

 Scrolling in the previous page with the same graphic structure.

 Scrolling in the next page with the same graphic structure.

 Scrolling in the previous page with different graphic structure.

 Scrolling in the next page with different graphic structure.

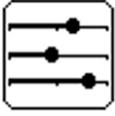
 Increase of an editable value.

 Decrease of an editable value.

 **ALARM** This appears when there is an alarm, and the alarm screen can be accessed by pressing it.

6.1.3 Access to the branches of screens

The general buttons described above are used to navigate through the screens of the display and to edit the parameters. Some screen branches are accessed by selecting an icon.



This allows you to access the screen branch to view the operating status and the serial communication parameters.



This allows you to view the alarm log of the unit.



After pressing button **MENU** this screen allows you to access the screen to set the "Service" branch password. When you are in the "Service" branch, this icon allows you to set the serial communication parameters and the default parameters.



In the "Service" branch, this icon allows you to access the lists where to set the operating parameters.

7 TABLES OF PARAMETERS

The system/plant control parameters are in the "Service" branch. The "Service" branch is password protected. The factory-set parameters are appropriate for correct control for most systems. In particular cases, it may be necessary to make adjustments to improve control.



In the "Service" branch, there are the "Service" menu with icon  and the parameters menu with icon . For access to the menus, see the "Service Screen" section.

7.1 Service Menu

7.1.1 Serial communication parameters

The parameters regard serial communication between the controller of the unit and the system/plant controller.



The values are set at the factory and must not be changed. Setting incorrect values will cause the control to stop.

Parameter	Value	UM	Description
SP1	0	s	Time for checking serial connection
SP2	0	s	Number of readings allowed for serial connection test
SP6	0	-	Enables BMS supervision (not used)
SP12	5	-	BMS serial address
SP14	2	bps	Modbus speed (1 = 9600; 2 = 19200; 3 = 38400)

7.2 Menu of parameters for system/plant control

The parameters regard management of the various system/plant components.



The values of the parameters are representative. In specific cases, different values can be set.

7.2.1 Output/Input parameters

In these screens, the status of the controller outputs and inputs is set.



The status of the outputs and inputs is set in keeping with the envisaged operation.
The change can cause the alarms of the unit to be triggered

7.2.2 Pump parameters

The table shows the parameters that regard pump management.

Parameter	Value	UM	Description
PA1	2	-	Operation of the pumps (1 = Manual, 2 = Automatic)
PA2	75	%	Pump starting speed
PA3	50	%	Minimum pump speed
PA4	100	%	Maximum pump speed
PA5	6	%	Pump speed increase step
PA6	3	%	Pump speed decrease step
PA7	35	s	Delay between two steps
PA8	65	%	Pump speed in manual operating mode
PA10	75	%	Starting pump speed in heat pump mode
PA11	15	s	Delay before activating outputs on starting

7.2.3 Alarm parameters

The table shows the parameters that regard alarm management.

Parameter	Value	UM	Description
PAL1	25	s	Delay before the alarm of transducers BPWO and BPWI
PAL2	35	s	Delay before ending of the alarm of transducers BPWO and BPWI
PAL3	2	-	Maximum number of alarms/hour for transducers BPWO and BPWI
PAL4	25	s	Delay before the alarm of the differential transducer of heat exchanger BP41
PAL5	35	s	Delay before ending of the alarm of the differential transducer of heat exchanger BP41
PAL6	2	-	Maximum number of alarms/hour for differential transducer of heat exchanger BP41
PAL7	5	s	Delay before the inverter offline alarm
PAL8	5	s	Delay before ending of the inverter offline alarm
PAL9	2	-	Maximum number of alarms/hour for inverter offline

7.2.4 System/Plant parameters

The table shows the parameters that regard system/plant control.

Parameter	Value	UM	Description
PLANT1	0	kPa	Minimum full-scale value of system/plant transducers BPWO and BPWI
PLANT2	1000	kPa	Maximum full-scale value of system/plant transducers BPWO and BPWI
PLANT3	100	kPa	Low system/plant pressure difference threshold
PLANT4	140	kPa	High system/plant pressure difference threshold
PLANT5	600	l	Volume of the system/plant in litres
PLANT6	0	kPa	Offset of system/plant transducer BPWO
PLANT7	0	-	Selection of type of system/plant crossing time (0 = automatic, 1 = by parameter)
PLANT8	60	s	System/Plant crossing time in manual mode
PLANT10	0	kPa	Offset of system/plant transducer BPWI

7.2.5 Heat exchanger parameters

The table shows the parameters that regard heat exchanger control.

Parameter	Value	UM	Description
SCAMB1	5.00	°C	Thermal gradient of heat exchanger
SCAMB2	1	-	Type of head loss control (1 = pressurised)
SCAMB4	0	kPa	Initial scale value of heat exchanger transducer
SCAMB5	100	kPa	Full-scale value of heat exchanger transducer
SCAMB7	60	s	Delay before starting the compressors
SCAMB8	70	kW	Capacity of the unit in chiller mode
SCAMB9	70	kW	Capacity of the unit in heat pump mode
SCAMB10	11	kPa	Minimum working value of the exchanger differential transducer

7.2.6 Valve parameters

The table shows the parameters that regard bypass valve control.

Parameter	Value	UM	Description
VALVE1	35	%	Pre-positioning opening percentage on starting
VALVE2	0.0	%	Minimum bypass valve opening in automatic operating mode
VALVE3	100	%	Maximum bypass valve opening in automatic operating mode
VALVE4	0	%	Bypass valve percentage in manual mode
VALVE6	20	s	Time between two valve position increments
VALVE7	5	%	Percentage of the step for valve opening
VALVE8	20	s	Time between two valve position decrements
VALVE9	5	%	Percentage of the step for valve closing
VALVE14	5	s	Delay before reading the differential pressure sensor of heat exchanger BP41 from Off to On

8 SYSTEM MANAGEMENT

Through specially developed logics, the controller manages hydraulic air conditioning systems connected to a refrigerant unit.

The management system aims to increase the efficiency of hydraulic systems by saving energy for water circulation. When these systems are used, water circulation in the system/plant follows the load demand while remaining within design limits without impairing correct operation of the refrigerant unit.

8.1 VFPP system management

The system is based on variable flow rate management on the primary circuit.

The system keeps the water pressure and temperature difference in the system/plant stable as demand changes.

The water flow rate and temperature are independent variables and not directly connected.

The control of the “single pump” of the system/plant provides the necessary flow rate while the cooling capacity control ensures the correct temperature.

Control of water flow rate in the primary circuit always takes place within the set limits for correct operation of the refrigerant unit.

8.1.1 Reference hydraulic diagram

For application of the system, the hydraulic circuit must be made as shown in the diagram below.

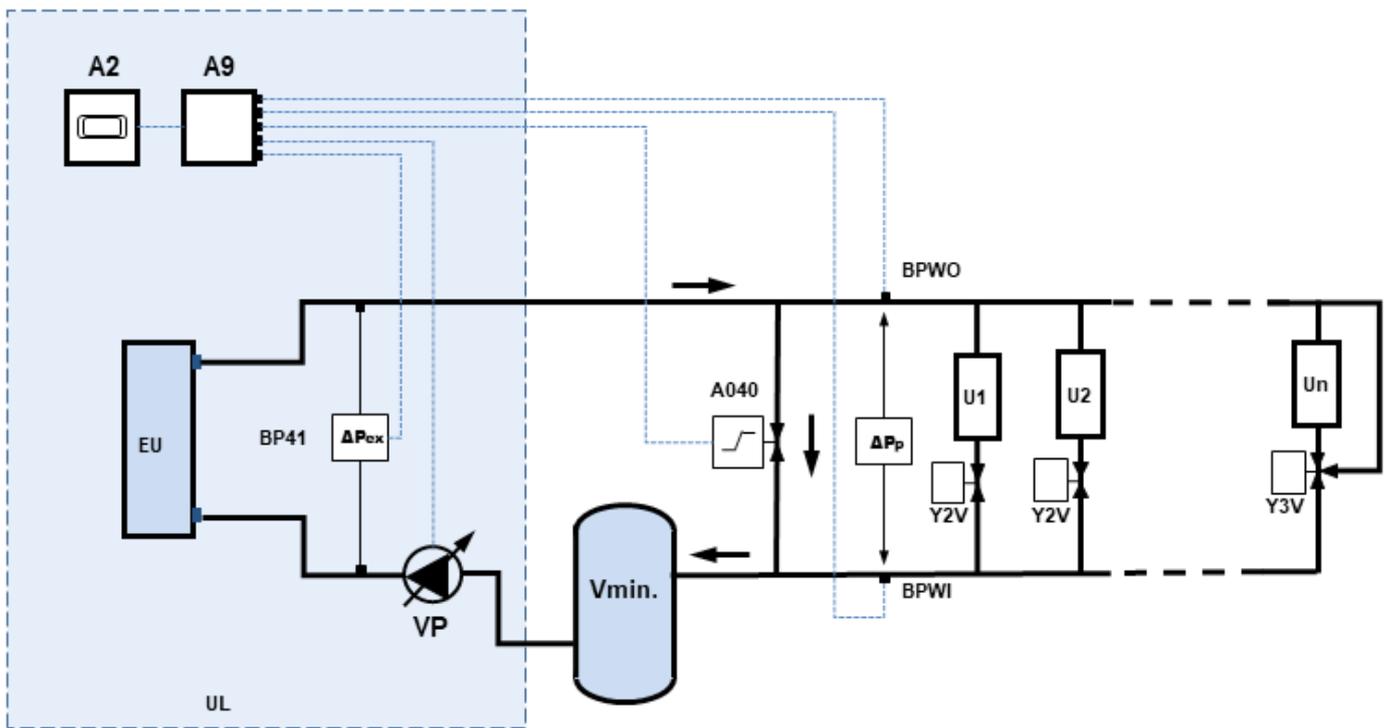


Fig. 15 Reference hydraulic diagram

The abbreviations present in the diagram indicate:

- A2 = refrigerant unit controller
- A9 = VFPP system controller
- EU = refrigerant unit heat exchanger
- BP41= differential pressure sensor
- ΔP_{ex} = pressure difference at the ends of the unit
- VP = variable flow pump
- A040 = 2-way bypass valve servo control

- A040 = 2-way bypass valve servo control
- BPWO = system/plant delivery pressure sensor
- BPWI = system/plant return pressure sensor
- ΔP_p = pressure difference at the ends of the system/plant
- U1, U2 .. Un = points of use present in the system/plant
- Y2V = 2-way valve servo controls
- Y3V = 3-way valve servo controls
- Vmin = minimum water volume in the system/plant
- UL = limit of the supply.

8.1.2 The hydraulic circuit

When making the hydraulic circuit as shown in the diagram, pay attention to the following.

- The two-way bypass valve supplied by the manufacturer must be connected between the delivery line and the return line of the system/plant using pipe of the same diameter as the connections of the unit.
- The servo control of the two-way bypass valve must be connected to the terminal board of the electrical control panel of the unit as shown in the wiring diagram.
- The pressure sensors must be connected as shown in the relevant chapter.
- To give greater reactivity to the system/plant and to reduce the capacity of the tank, the points of use furthest away from the refrigerant unit must be fitted with a three-way instead of a two-way valve.
- The tank must complete the quantity of water to ensure that, with points of use switched off, there is circulation of the minimum volume indicated in the installation manual for the unit.

8.1.3 Installation of pressure sensors

For operation, the system needs to measure the pressure difference on the heat exchanger and on the system/plant in use. Differential sensor BP41 for the pressure difference on the heat exchanger is assembled at the factory whereas sensors BPWO and BPWI must be assembled by the installer.

For this purpose, the Manufacturer supplies a measurement kit.

The kit consists of:

- 2 pressure sensors;
- 2 M-M couplings ($\frac{1}{4}$ SAE - $\frac{1}{4}$ NPT);
- 2 connectors complete with cable.



Fig. 16 Components of the kit



The kit is supplied pre-assembled inside the electrical control panel and electrically connected to the terminal board.

The couplings must be installed in the system/plant as shown in the hydraulic diagram of the unit with welding on of female sleeves ¼ NPT (not supplied).

Install the couplings vertically and in a position where they are not exposed to accidental damage.

Use a suitable sealant to ensure water tightness between couplings and sleeves.

Secure the pressure sensors to the couplings with torque of about 14 Nm (do not use sealant or gaskets).

After completing the thermal insulation of the hydraulic circuit, insert the connectors in the sensors and secure the cables properly.



Fig. 17 Connection of a pressure sensor

It may be necessary to extend the cables.

If the cables are extended, this must be done professionally to ensure a good electrical connection and protection from moisture over time.



After the sensors have been installed, make sure they are protected from accidental damage and that the connection cables are secured properly.

8.2 Instructions for starting the system/plant

In addition to what is specified in the "Commissioning" chapter of the "Manual for installation, use and maintenance" of the unit, in systems with the VFPP system, correct sizing of the pumps must be checked for good control and the increase in efficiency at low loads.

Correct sizing is obtained with checking of pump operation at the rated flow rate of the system/plant and at the minimum flow rate.

For these checks, it is not necessary for there to be a load demand because these are checks of the hydraulic system.



The "SCAMB10" parameter for controlling the head losses of the heat exchanger of the unit is calibrated at the factory and this calibration must not be changed.

An incorrect value of this parameter can neutralize the control of the pump inverter or lead to the risk of tripping the protective devices of the unit.

8.2.1 Checking the rated flow rate

Open all the system/plant user points present and wait for about ten minutes until the system reaches an equilibrium.

The following situations can occur:

1. The ΔP_{sy} value reaches the required set point within the set differential, the ΔP_{ex} value is around the declared rated value ± 10 kPa and the pump works at a percentage higher than 80%, so that the system/plant can be considered sufficiently calibrated at its rated operating point. But, if in this condition, the pump has to work at below 80%, the pump is oversized for the specific system/plant and should therefore be re-selected, otherwise its control margin would be excessively reduced with consequent reduction in efficiency of the variable flow rate system.
2. The ΔP_{sy} value reaches the required set point within the set differential, but ΔP_{ex} is higher than the expected rated value plus 10 kPa (e.g. the expected rated head loss is 40 kPa, but the measured value is 55 kPa). This means the water flow rate elaborated by the system is higher than the required rated flow rate and the ΔP_{sy} set point must therefore be reduced until the ΔP_{ex} parameter falls within the range of the declared rated value ± 10 kPa. In this new condition, the pump must work at a percentage higher than 80%, in which case the check can be considered successfully finished. But, if in this condition, the pump has to work at below 80%, the pump is oversized for the specific system/plant and should therefore be re-selected, otherwise its control margin would be excessively reduced with consequent reduction in efficiency of the variable flow rate system.
3. The ΔP_{sy} value reaches the required set point within the set differential, but ΔP_{ex} is lower than the expected rated value minus 10 kPa (e.g. the expected rated head loss is 40 kPa, but the measured value is 25 kPa). This means the system water flow rate is lower than the required rated flow rate and the ΔP_{sy} set point must therefore be increased until the ΔP_{ex} parameter falls within the range of the declared rated value ± 10 kPa. In this new condition, the pump must work at a percentage higher than 80%, in which case the check can be considered successfully finished. But, if in this condition, the pump has to work at below 80%, the pump is oversized for the specific system/plant and should therefore be re-selected, otherwise its control margin would be excessively reduced with consequent reduction in efficiency of the variable flow rate system.
4. The ΔP_{sy} value does not reach the required set point. The pump will have to work at 100% (the controller increases the pump speed to reach the set ΔP_{sy} set point). In this case, the ΔP_{sy} set point must be reduced to obtain a pump speed higher than 80% and a correct ΔP_{ex} value (declared rated value ± 10 kPa). If possible, you can calibrate/partially close the user points and then repeat the test.
5. The ΔP_{sy} value does not reach the required set point. As in the previous case, the pump will have to work at 100% but ΔP_{ex} is lower than the declared rated value minus 10 kPa (e.g. declared value 40 kPa, but measured value lower than 30 kPa). This means the pump is insufficient to overcome the total head losses of the system, and therefore, if there are no margins for improvement (partially closed valves/gate valves, clogged filters, etc.), the pump must be replaced with one having a higher head.

8.2.2 Checking the minimum flow rate

Progressively close all the user points and check that the pump speed slows progressively.

If the pump speed does not slow down, the reason could be the presence of too many 3-way valves (for example, "Un" user points shown in the reference hydraulic circuit). In this case, you can check with the installer/design engineer whether it is possible to progressively choke the third port of the 3-way valve (bypass port) to obtain a progressive reduction in pump speed and consequent increase in total efficiency of the variable flow rate system.

9 ALARMS

9.1 Introduction

The alarms present and generated by the application have the same characteristic of being able to activate a relay, if suitably configured.

The relay will be switched on if:

- there is an active alarm;
- there is an alarm that has not been reset.

The buzzer will be switched on if:

- at least one alarm is active.

The relay will be switched off if:

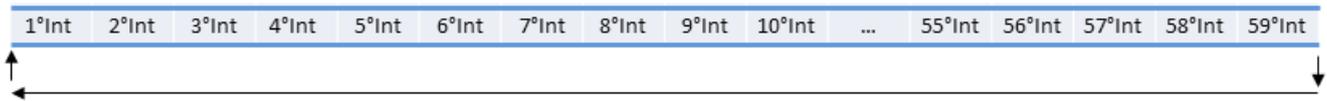
- there are no active alarms.

The buzzer will be switched off if:

- any button is pressed during an active alarm.

9.1.1 Automatic/Manual procedure and alarm reset

The holding of the alarms takes place considering a time window of 1 hour. The hour is divided into 60 intervals of 1 minute each.



The window is sliding as regards the alarm event and always covers the last hour. During the interval of one minute, if an occurrence is detected, this time interval is considered active.

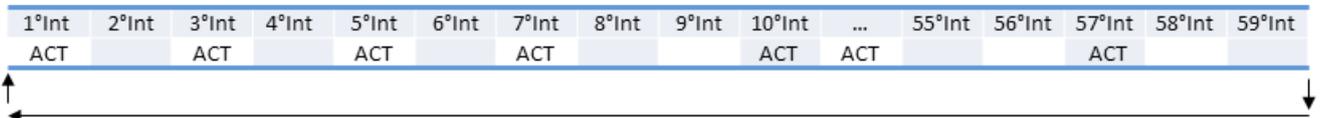
"ACT" is assigned to the active interval to record the event. The sum of the active intervals in the last hour allows the number of events/alarms per hour to be calculated.

If the sum of the active intervals does not exceed the respective threshold value of occurrences/hour, they are deleted.

Two examples are given below with threshold of occurrences/hour = 5



In the first example, since the number of active intervals is 3, which is lower than the threshold of occurrences/hour set to 5, the events are deleted.



In the second example, the number of active intervals is 7, and therefore exceeds the threshold of occurrences/hour set to 5. In this case, the alarm becomes a manual reset alarm and therefore the work of technical personnel will be necessary.

Even if the alarm is no longer active, only a manual reset will cause the deletion of the alarm from the display and from the list of active alarms.

Alarms that merely notify, that is, no output is energized/de-energized are also managed in the application. These are called WARNINGS.

9.2 Alarms

The alarms managed by the controller are essentially linked to the inverter and to the sensors.

In addition to a warning, in the first case, the controller stops operation of the inverter and therefore of the refrigerant unit, and in the second case, it activates manual operation.

The managed alarms are listed below.

9.2.1 Inverter alarm

The parameters involved are shown in the table.



The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL7	5	s	Delay before inverter alarm
PAL8	2	s	Delay before ending of the inverter alarm
PAL9	2	-	Maximum number of automatic resets of the alarm in one hour

Cumulative inverter alarm

Alarm code	AL3
Reason for activation	When the relevant digital input remains open for a time longer than "PAL7"
Reset	After the delay set in parameter "PAL8" when the digital input closes
Reset mode	Automatic for a number of occurrences in one hour equal to the value set in parameter "PAL9"
Alarm icon	Flashing
AlarmLog	Yes
Buzzer	Yes
Alarm relay	Yes
Devices	Behaviour in the event of an alarm
Pump	Switched off
Valve	Closed

9.2.2 Pressure sensor alarm

The parameters involved are shown in the table.



The values of the parameters are representative. In specific cases, different values can be set.

Parameter	Value	UM	Description
PAL1	25	s	Delay before the alarm of transducers BPWO and BPWI
PAL2	35	s	Delay before ending of the alarm of transducers BPWO and BPWI
PAL3	2	-	Maximum number of alarms/hour for transducers BPWO and BPWI
PAL4	25	s	Delay before the alarm of the differential transducer of heat exchanger BP41
PAL5	35	s	Delay before ending of the alarm of the differential transducer of heat exchanger BP41
PAL6	2	-	Maximum number of alarms/hour for differential transducer of heat exchanger BP41
PAL7	5	s	Delay before the inverter offline alarm
PAL8	5	s	Delay before ending of the inverter offline alarm
PAL9	2	-	Maximum number of alarms/hour for inverter offline
PAL13	30	s	Delay before the alarm for reversed connection of sensors BPWO and BPWI
PAL14	10	s	Delay before ending of the alarm for reversed connection of sensors BPWO and BPWI
PAL15	2	-	Maximum number of alarms/hour for reversed connection of sensors BPWO and BPWI

Differential pressure sensor alarm of the heat exchanger of the refrigerant unit "BP41"

Alarm code	AL2
Reason for activation	When the relevant analogue input measures a value outside the operating range for a time longer than parameter "PAL4"
Reset	After the delay set in parameter "PAL5" when the analogue input measures a value within the operating range
Reset mode	Automatic for a number of occurrences in one hour equal to the value set in parameter "PAL6"
Alarm icon	Flashing
AlarmLog	Yes
Buzzer	Yes
Alarm relay	Yes
Devices	Behaviour in the event of an alarm
Pump	Operation at the set speed in manual mode
Valve	Operation at the set opening in manual mode

System/Plant delivery and return pressure sensor alarms

Alarm code	AL1 for pressure sensor "BPWO", AL4 for pressure sensor "BPWI"
Reason for activation	When the relevant analogue input measures a value outside the operating range for a time longer than parameter "PAL1"
Reset	After the delay set in parameter "PAL2" when the analogue input measures a value within the operating range
Reset mode	Automatic for a number of occurrences in one hour equal to the value set in parameter "PAL3"
Alarm icon	Flashing
AlarmLog	Yes
Buzzer	Yes
Alarm relay	Yes
Devices	Behaviour in the event of an alarm
Pump	Operation at the set speed in manual mode
Valve	Operation at the set opening in manual mode

Alarm for reversed connection of delivery and return pressure sensors of the "BPWO" and "BPWI" system/plant

Alarm code	AL5
Reason for activation	When the controller measures a negative value for the difference of the values read after delay "PAL13" when the system/plant is started
Reset	After the delay set in parameter "PAL16" when the difference of the read values is positive
Reset mode	Automatic for a number of occurrences in one hour equal to the value set in parameter "PAL15"
Alarm icon	Flashing
AlarmLog	Yes
Buzzer	Yes
Alarm relay	Yes
Devices	Behaviour in the event of an alarm
Pump	Operation at the set speed in manual mode
Valve	Operation at the set opening in manual mode

10 FAQ

10.1 Frequently Asked Questions

The necessary instructions for working on the controller, with regard to the main managed functions, are given below.

10.1.1 Activate and deactivate control from the keypad

For operation of the control, starting is through the digital input and therefore the OK signal from the keypad must always be enabled.



At the end of programming, the OK signal from the keypad must be enabled.

To change the status of the OK signal from the keypad, starting from the main screen, press button **MENU** then press twice on button **ENTER** and with button  you activate the OK signal; with button  you deactivate it.

Confirm the selection with button **ENTER**.

10.1.2 Activate and deactivate automatic operation

Correct system/plant management is with automatic operation.

There may be particular conditions for which manual operation must be used.

To change the type of operation, starting from the main screen, press button **MENU** press button **ENTER**, with button  and on pressing button **ENTER** you enter the field to be changed.

With button  you activate manual operation; with button  you activate automatic operation.

Confirm the selection with button **ENTER**.



If the controller is re-programmed, at the end, automatic operation must be activated.

10.1.3 Changing the pump speed in manual operating mode

Correct system/plant management is with automatic control of pump speed.

There may be particular conditions for which it is necessary to be able to set a specific speed.

To set the required pump speed, after selecting manual operation, in the main screen, press button  and on confirming with button **ENTER** it is possible, with button  to increase the speed, and with button  to decrease it.

Confirm the selection with button **ENTER**.



If the manual speed value is changed to carry out tests, the factory value must be restored when automatic operation is reactivated.

10.1.4 Changing the bypass valve opening in manual operating mode

Correct system/plant management is with automatic control of bypass valve opening.

There may be particular conditions for which it is necessary to be able to set a specific opening.

To set the required opening of the bypass valve, after selecting manual operation, in the main screen, press twice on button  and on confirming with button **ENTER** it is possible, with button  to increase the opening, and with button  to decrease it.

Confirm the selection with button **ENTER**.



If the manual bypass valve opening is changed to carry out tests, the factory value must be restored when automatic operation is reactivated.

10.1.5 Changing the display language

The software is currently in Italian and English.

If the display language needs to be changed, starting from the main screen, press button **MENU** press button **ENTER** , twice with button  and again press button **ENTER** you enter the field to be changed.

With button  and  the new language is selected and, on confirming with button **ENTER** the update is started.

The update takes a few minutes. When the update is finished, the display goes back to the "screensaver" page.

10.1.6 Accessing the alarm log

Starting from the main screen, press button **MENU** press button  and confirm with button **ENTER** .

In each screen, 2 alarms are recorded.

With buttons  and  the page can be changed.

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