

## *SMT-04 CONTROLLER* **USER MANUAL**

### **Table of contents**

1. Description.	2
2. Technical data.	2
3. Construction.	3
4. Scheme of connection.	4
5. Functions.	4
6. Programming.	6
7. Operation cycle.	7
7.1. Control of the refrigeration unit.	7
7.2. Control of the stirrer's moto reducer.	8
7.2.1. Automatic stirrer operation.	8
7.2.2. Manually triggered stirrer operation.	8
8. Additional functions.	9
8.1. Limit switch of the flap.	9
8.2. Registering the minimum and maximum temperatures.	9
8.3. The function of alarm signalling the exceeding of the correct temperature range.	10
8.4. Temperature sensor damage indication.	11
9. Table of settings.	11

## 1. DESCRIPTION.

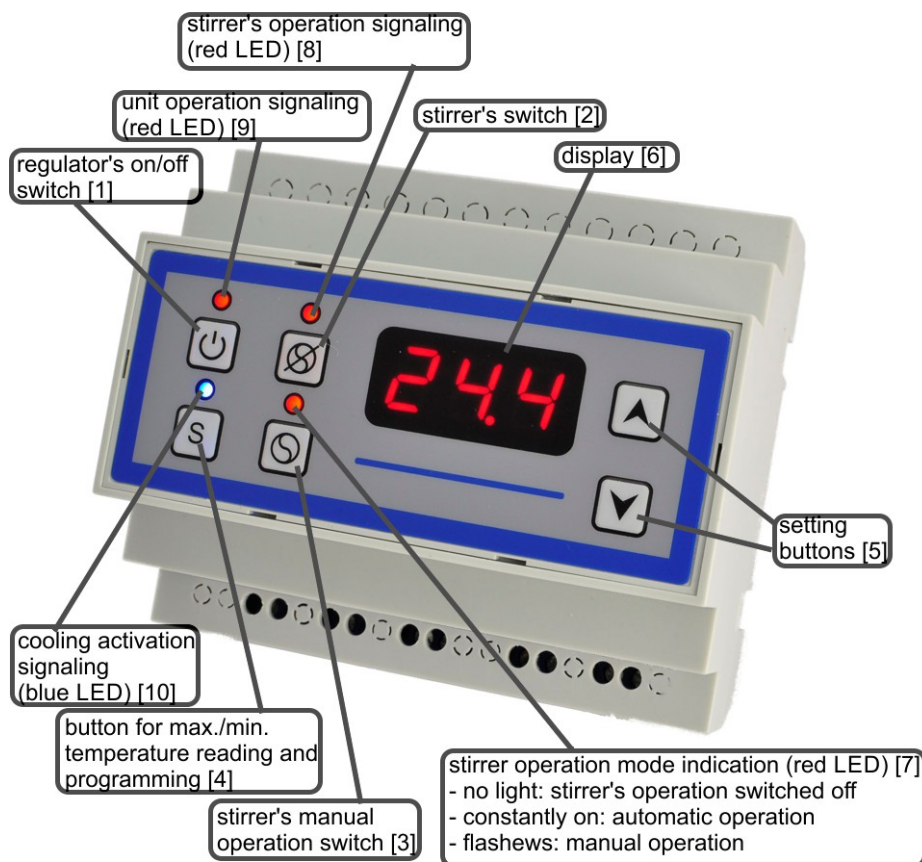
The SMT-04 controller is a microprocessor-based, programmable temperature regulator, intended for use in e.g. in milk coolers and all kinds of dryers. The casing of the regulator enables its installation on a DIN rail.

## 2. TECHNICAL DATA.

temperature measuring range	from -40°C to +120°C
control temperature range	from -40°C to +120°C (decreased by a set hysteresis)
measuring resolution of the temperature measurer (resolution of control temperature settings)	under -9,9°C → 1°C from -10°C to +100°C → 0,2°C over +100°C → 1°C
control hysteresis [programmable parameter]	under -10°C → from 1°C to 10°C from -10°C to +100°C → from 0,2°C to 10°C over +100°C → from 1°C to 10°C
operation time of the stirrer / ventilator [programmable parameter]	from 1 min. to 60 min.
standstill time of the stirrer / ventilator [programmable parameter]	from 1 min. to 60 min.
temporary operation time of the stirrer / ventilator [programmable parameter]	from 1 min. to 60 min.
time delay for switching the chiller (unit) / stirrer on after the regulator is turned on or the power supply decay occurs	from 1 s. to 999 s.
length of control sensor	4/5 m
type of temperature sensor	thermistor NTC 10 kΩ +/- 1%
type of temperature measurer	digital LED
load capacity of relay contacts controlling the chiller (unit) / heating system	30A 250 VAC
load capacity of relay contacts controlling the stirrer / ventilator	10A 250 VAC
power supply	230 VAC 50 Hz
protection class	IP 20
safety class	CE

### 3. CONSTRUCTION.

SMT-04 is placed in a compact casing, containing all control and executive elements.

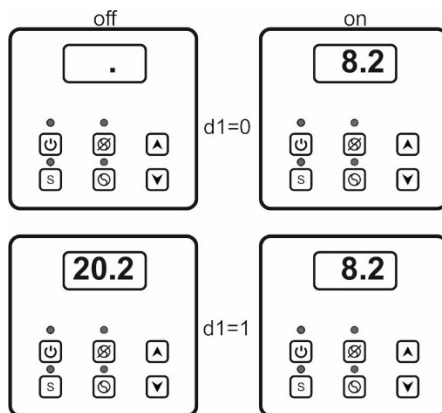


The device is equipped with:

- ✓ button for switching the regulator's operation on and off [1]
- ✓ button for turning off the automatic operation of the stirrer (ventilator) [2]
- ✓ button for switching on the manual operation of the stirrer (ventilator) [3]
- ✓ digital temperature meter, allowing for ongoing temperature control, regardless of switching the regulator on or off [6]
- ✓ light signalling showing the current operating status of the cooling (heating) device and the stirrer (ventilator) [7] [8] [9]
- ✓ input for connecting a limit switch
- ✓ control outputs, that is:

- unit (heating system) control output
- stirrer (ventilator) control output.

A dot is displayed on the controller display when the control work is **off** (factory setting). By changing the parameter **d1** from the value 0 to the value **1** (see section 6), during the switched off control operation of the regulator, the display will show the current measured temperature.



#### 4. SCHEME OF CONNECTION.

To connect the controller to the device it is to control, perform the following actions:

- place the controller on the DIN rail
- place the temperature sensor inside the cooling chamber, in the most convenient place for temperature measurement but at the same time protected against accidental damage,
- connect the controller to the outputs, according to the following diagram:



#### 5. FUNCTIONS.

The controller is equipped with several functions that, together with the possibility of creating your own program, enable adjusting its operation to the individual needs of the user. Some of the functions listed below are activated after the appropriate programming of the controller (see section 6 and section 9).

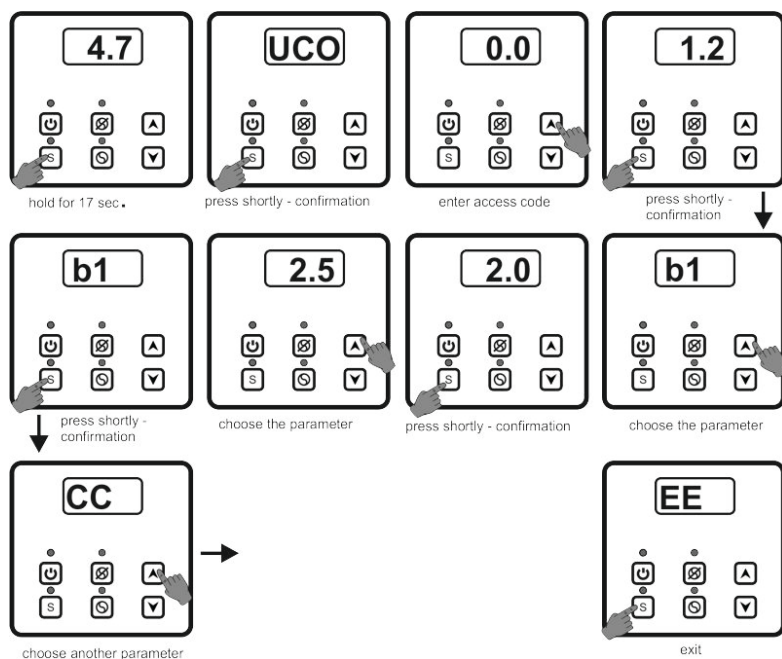
1. **Continuous temperature measurement**, regardless of whether the regulator is on (although it must be connected to the power supply) – parameter **d1** is set to 1.
2. **Controlling the refrigeration system (chiller)**, depending on the measured temperature – parameter **C9** is set to the value 0.
3. **Control function of the heating system**, depending on the measured temperature – parameter **C9** is set to 1.
4. **Light signalling function for switching on the cooling/heating operation** – blue LED diode is on.
5. **The stirrer or ventilator control**, enabling the implementation of the following variants of this control – depending on the **F0** parameter settings:
  - a. automatic operation:
    - cyclic operation of the stirrer/ventilator, independent of the operating condition of the chiller (unit)/heating system,
    - stirrer operates continuously during the operation of the chiller (unit), when the chiller is switched off, the stirrer goes into cyclic operation,
    - stirrer/ventilator operates only when the chiller/heating system is switched on,
    - continuous stirrer/ventilator operation while the regulator's operation is on (main application in dryers),
    - switched off stirrer/ventilator operation,
  - b. operation triggered manually:
    - switching on continuous stirrer/ventilator operation, regardless of whether the control operation of the regulator is switched on; in order to end the stirrer operation, press the button **[3]**,
    - switching on the stirrer/ventilator operation for a strictly defined time, regardless of whether the control work of the regulator is switched on.
6. **Blocking of the stirrer and the chiller (unit) when the flap of the milk cooler tank opens** (actuation of the limit switch) – parameter **AF**. In dryers it can be used to turn off the ventilator, e.g. when the door is opened.
7. **Defining the operation of the limit switch as negative or positive** – parameter **UU**.
8. **The chiller (unit) operation supervision**, consisting in the possibility of setting the maximum and minimum operation time of the chiller (unit), as well as its minimum standstill time – parameters **E1** and **E2**.
9. **Registering the maximum and minimum temperature values throughout the operation cycle**. This function relates to the possibility of temporally delaying the recording of temperature data to the device memory since its activation – parameter **AA**.
10. **Alarm signalling (visual and audible) of exceeding the set temperature range** – parameters **HA** and **HE**. This function relates to the possibility of delaying the time of switching on the alarm system of the regulator from the moment of its activation.
11. **Monitoring and signalling function of the damage to the temperature sensor** – in such case the letters **“ACU”** appear on the display.

12. **Adjustable delay time for switching on the chiller (unit) and stirrer** after decay and re-switching on the voltage – parameter **dE**.

## 6. PROGRAMMING.

To ensure the correct operation cycle of the controller, it is necessary to program its operating parameters accordingly. By default, the controller is programmed for standard operating conditions for the purpose of controlling the milk cooler.

The following figure illustrates the programming procedure:



To change the factory setting, enter the setting mode. This is done by holding the button marked with the letter **S** for approx. 17 seconds. After entering the setting mode “**UCO**” appears on the display. The next pressing of the **S** button confirms the willingness to make changes. Then press the **▲** key to enter the access code and confirm with the **S** button. After correct entry into the setting mode, the **▲** and **▼** buttons are used to select the desired parameter. The entry to the parameter settings is made by pressing the **S** button. The change of the parameter value is made using the **▲** and **▼** buttons; for the change to be saved, confirm with the button **S**. The exit from the setting mode is made by setting the **EE** parameter and confirmation with the **S** button or automatically after 17 seconds of inactivity.

## 7. OPERATION CYCLE.

When the device is connected to the mains and its operation is switched on with the button **[1]**, the controller goes – after the delay set in parameter **dE** – to the control phase.

The controller controls two control circuits:

- a) control circuit for the refrigeration / heating unit;
- b) control circuit for the stirrer's moto reducer.

Operation for the control settings of the refrigeration system will be discussed below.

### ATTENTION

Parameter **dE** is the delay of switching on the chiller (unit) and the stirrer after switching on the regulator's work or after the supply voltage decay – default value is set to **5 sec**.

### 7.1. Control of the refrigeration unit.

The temperature control value (within the range specified in parameters **b1** and **b2**) is set by pressing the buttons marked with the symbols **▲** and **▼**, while short pressing any of these buttons displays the currently set value, while only the next pressing causes the change of this value. Transition from reading the measured temperature to the reading of the set control temperature is signalled by the digits/numbers flashing.

The chiller (unit) control in the cooling phase takes place depending on the temperature present in the refrigeration chamber. The controller can control the cooling temperature in the range of -40°C up to +120°C. To limit the scope of the control so as to prevent the user of the cooling device from setting the temperature outside this range, set the proper parameters: **b1** (limitation of the lower control temperature range) and **b2** (limitation of the upper control temperature range).

### ATTENTION

*Temperatures specified in parameters **b1** and **b2** do not indicate control points for switching off and switching on the operation of the unit.*

*Setting **b1=b2** blocks the possibility of changing the programmed temperature by means of the **▲** and **▼** buttons. It is not allowed to set **b1 > b2**.*

*The change in the value of **b1** or **b2** can be blocked by the currently set control temperature. In the event of such a situation, change the control temperature settings and then change parameters **b1** and / or **b2**.*

It is also important to set the control hysteresis correctly – parameter **HI**. The control hysteresis is a parameter that determines the temperature difference at which the switching off occurs and then the unit is switched on. For example, if the control temperature is set to +4°C and hysteresis to 2°C, then the unit will be switched off after reaching 4°C, while its re-activation will occur after the temperature has risen to 4+2 = 6°C.

The regulator allows to set the hysteresis of the control in the range of 0.2°C to 10°C, every 0.2°C.

### **ATTENTION**

*If the controller is set in heating mode, the hysteresis operation has the opposite character, i.e. the heating system is switched off after the temperature has dropped below the set value, taking into account the value of the programmed hysteresis.*

## **7.2. Control of the stirrer's moto reducer.**

The status of the stirrer is signalled by two red LED (see section 3):

- signalling of switching on the stirrer's moto reducer [8],
- indication of the stirrer operation mode [7].

The controller has two modes of stirrer operation, i.e. automatic or manual, which are described in detail below.

### **7.2.1. Automatic stirrer operation.**

In this mode, depending on the settings of parameters **F0**, **E1** and **E2**, the stirrer may be connected to the operation of the unit or completely independent of the operation of the chiller (unit) (see section 9).

The stirrer operation setting in the automatic mode is signalled by the continuous lighting of the red LED diode [7].

The stirrer's operation can be switched off at any time by means of the [2] button (see section 3), except when the **F0** parameter is set to 2 or 3.

Switching off the regulator by pressing the [1] button also turns off the stirrer operation.

### **7.2.2. Manually triggered stirrer operation.**

The manual stirrer operation can be initiated by pressing the button marked by symbol ☉ [3] (see section 3); at this point, the automatic operation of the stirrer stops, and the manual operation starts. Manual operation of the stirrer is also possible when the regulator is switched off (button [1]) or stirrer operation switched off (button [2]). The setting of the stirrer operation in manual mode is signalled by a flashing red LED diode [7].

The manual operation of the stirrer is not interrupted when the regulator is switched off manually by pressing the [1] button.

The stirrer operation in this mode can be interrupted at any time by pressing the button ☉ again.

The manual stirrer operation can take place in two variants, depending on the **CP** parameter settings:

- setting the value 0 means continuous stirrer operation,
- setting the value >0 means that the stirrer operates for the set number of minutes; after the time set elapses, the manual operation of the stirrer is switched off.

### **ATTENTION**

*No light signalling of the stirrer operation [7] [8] when the regulator is switched off means that the automatic stirrer operation has been switched off, at the same time the manual operation has not been switched on.*



## 8. ADDITIONAL FUNCTIONS.

Below, some specific functions of the controller will be described, enabling the regulator to be used for various applications.

### 8.1. Limit switch of the flap.

The controller is equipped with the possibility of connecting the external limit switch of the tank flap. The principle of operation of this input consists in immediately switching off the stirrer's operation when shorting or opening of this input (depending on the **UU** parameter setting), made by the connected limit switch of the flap. The return of the stirrer operation (after being interrupted by the limit switch) begins after the disappearance of the flap opening signal with a delay of 5 seconds.

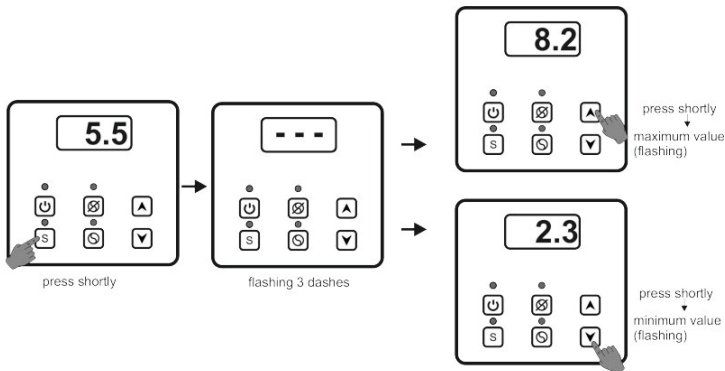
At the same time, depending on the **AF** parameter settings made, it is possible to disable the chiller (unit) operation. The chiller operation is switched off with a set delay in relation to the opening signal of the flap, so that the momentary opening does not immediately stop the operation of the chiller. The chiller restarts operation after the flap opening signal disappears, considering the programmed minimum standstill time of the chiller.

### 8.2. Registering the minimum and maximum temperatures.

The controller has the function of recording in its internal memory the values of maximum and minimum temperatures that occur throughout operating cycle. This function makes it possible to check whether the milk is stored under the correct temperature conditions.

When the device is switched on, after the end of the programmed delay (parameter **AA** – see section 9), the temperature values are recorded to the internal memory. The programmable delay time of enabling this function allows pre-cooling of the milk after the start of cooling and thus not considering the maximum temperature when the device is started. This time should be selected by the user for the type of tank and the actual operating conditions of the device.

At any time, the user can read the maximum and minimum temperature values presently available. The following figure illustrates reading.

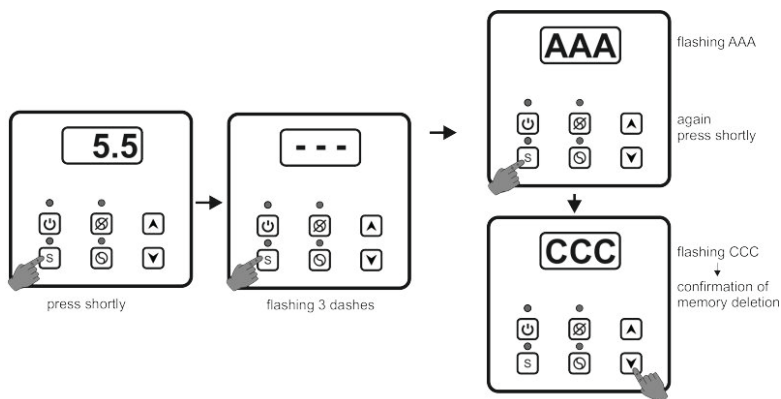


### ATTENTION

*In the absence of entries of maximum and minimum temperatures in the regulator's memory, the symbol --- is displayed.*

*Power supply loss causes the regulator's memory to be cleared.*

At any time, you can manually delete the current maximum and minimum values. The following figure illustrates manual memory erasing:

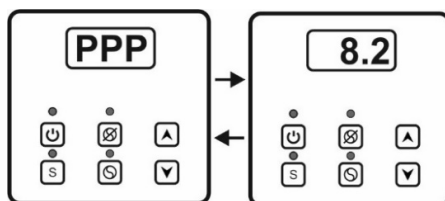


### 8.3. The function of alarm signalling the exceeding of the correct temperature range.

The device has the function of signalling the exceeding of the set temperature range. For the function to work properly, the appropriate temperature range must first be programmed, this is: parameter **A1** – temperature below which the alarm will be activated and parameter **A2** – temperature above which the alarm will be triggered (see section 9).

The third parameter to be defined is the time delay of switching on the alarm function from the moment the device's operation is switched on – parameter **AA**. This delay eliminates triggering of an alarm in the initial cooling phase.

Exceeding the set temperature range is signalled visually and sound. In the event of activation of the alarm, the buzzer is triggered cyclically every 1 minute for 5 seconds, and at the same time letters "PPP" and the temperature value are displayed alternately.



### ATTENTION

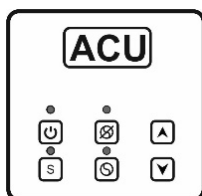
The parameter **AA** is identical to the delay specified in the maximum and minimum temperature recording function.

In other words, the delay value set in the parameter **AA** will be the same for recording maximum and minimum temperature and for parameters **A1** and **A2**.

The audible alarm can be turned off by setting the **HE** parameter to 1 (see section 9). In this case, exceeding the set temperature range is signalled only visually, as shown in the figure above. The alarm system (audible and visual) can also be turned off completely by changing the **HA** parameter to 1 (see section 9).

## 8.4. Temperature sensor damage indication.

If the regulator detects damage to the temperature sensor, the letters “**ACU**” appears on the display, and at the same time the audible alarm signal is activated. The operation of the chiller (unit) and the stirrer is interrupted until the failure is removed.



### ATTENTION

Sensor damage indication also occurs if the range of temperatures measured by the regulator is exceeded.

## 9. TABLE OF SETTINGS.

<i>parameter description</i>	<i>symbol</i>	<i>setting range</i>	<i>default setting</i>
entry in setting mode	UC0	access code	1.2
operation mode	C9	<b>0</b> – cooling <b>1</b> – heating	0
limitation of the lower value for the control temperature range	b1	setting the temperature from -40°C to +120°C, every 1.0°C	2 (°C)
limitation of the upper value for the control temperature range	b2	setting the temperature from -40°C to +120°C, every 1.0°C	10 (°C)

control hysteresis	HI	setting the temperature: <ul style="list-style-type: none"> <li>under <math>-10^{\circ}\text{C} \rightarrow</math> from <math>1.0^{\circ}\text{C}</math> to <math>10^{\circ}\text{C}</math>, every <math>1^{\circ}\text{C}</math></li> <li>from <math>-10^{\circ}\text{C}</math> to <math>+100^{\circ}\text{C} \rightarrow</math> from <math>0.2^{\circ}\text{C}</math> to <math>10^{\circ}\text{C}</math>, every <math>0.2^{\circ}\text{C}</math></li> <li>over <math>+100^{\circ}\text{C} \rightarrow</math> from <math>1.0^{\circ}\text{C}</math> to <math>10^{\circ}\text{C}</math>, every <math>1^{\circ}\text{C}</math></li> </ul>	2 ( $^{\circ}\text{C}$ )
minimum operation time of the chiller (unit)	CA	<b>0.00</b> – inactive <b>&gt;0.00</b> – active: setting the time from 1 min. to 60 min., every 1 min.	0
maximum operation time of the chiller (unit)	CC	<b>0.00</b> – inactive <b>&gt;0.00</b> – active: setting the time from 0,5 h to 9,5 h, every 0,5 h	0
minimum standstill time of the chiller (unit)	CF	<b>0.00</b> – inactive <b>&gt;0.00</b> – active: setting the time from 1 min. to 60 min., every 1 min.	0
time after which the chiller (unit) is turned off after the flap of the milk tank is opened	AF	<b>0.00</b> – inactive <b>&gt;0.00</b> – active: setting the time from 0,1 min. (6 sec.) to 15 min., every 0,1 min. (6 sec.)	0.1 (min.) [= 6 sec.]
stirrer operation mode	F0	<b>0</b> – operation according to the times set in <b>E1</b> and <b>E2</b> , regardless of the operation of the chiller (unit) <b>1</b> – continuous operation while the chiller (unit) is running; when the chiller is on standby, the stirrer operates according to the times set in <b>E1</b> and <b>E2</b> <b>2</b> – as in setting 1, but disabling with the stirrer's operation button causes its operation only during the operation of the chiller <b>3</b> – as in setting 1, but the button that disables the stirrer operation is inactive <b>4</b> – continuous operation, regardless of the operation of the chiller (unit) and times set in <b>E1</b> and <b>E2</b>	1
standstill time of the stirrer	E1	setting the time from 1 min. to 60 min., every 1 min.	15 (min.)
operation time of the stirrer	E2	setting the time from 1 min. to 60 min., every 1 min.	2 (min.)
manual stirrer operation mode	CP	<b>0.0</b> – continuous work <b>&gt;0.0</b> – stirrer operation for a specified time in the range of from 1 min. to 60 min., every 1 min.	5 (min.)
delay of registering of the max./min. values of temperature and delay	AA	setting the time from 0 h to 4 h, every 0,1 h	2 (h)

of activation of the temperature alarm			
lower temperature of the alarm	A1	setting the temperature from -40°C to +120°C, every 1.0°C	2 (°C)
upper temperature of the alarm	A2	setting the temperature from -40°C to +120°C, every 1.0°C	12 (°C)
sound of the alarm	HE	<b>0 – active</b> <b>1 – inactive</b>	0
visual and sound alarm of exceeding the set temperature range (parameters <b>A1</b> and <b>A2</b> )	HA	<b>0 – active</b> <b>1 – inactive</b>	0
scaling the control sensor**	CU	every 0,2°C	scalable value
setting the operation of the limit switch of opening the tank's flap	UU	<b>0 – closing the limit switch: raising the flap</b> <b>1 – opening the limit switch: raising the flap</b>	0
delay of starting the chiller (unit) and the stirrer after pressing on/off button or when power supply decay occurs	dE	setting the time from 1 sec. to 999 sec., every 1 sec.	5 (sec.)
display status when the control is switched off	d1	<b>0 – the dot is displayed</b> <b>1 – the currently measured temperature is displayed</b>	0
return to factory settings	FA	<b>0 – no return to the factory settings</b> <b>1 – after setting parameter to 1 and turning off the regulator from the power supply, switching it on again restores the factory settings and the parameter value automatically goes back to 0</b>	0
exit from setting mode	EE		

**\*\* set at the manufacturing stage (do not change without obvious need)**