PPH MAKOT Małgorzata Pawłowska
ul. Ochota 15F | 32-020 Wieliczka
Dział Techniczny: tel. 602 260 992
email: dt@makot.pl
Dział Handlowy: tel. 537 872 522
email biuro@makot.pl

THERMOREGULATOR SCH-04/1 | SCH-04/2
User manual

1. DESCRIPTION.

The thermo-regulators series SCH-04 are universal controllers designed to control and regulate refrigeration and cooling-heating systems being differently intricate. These regulators are recommended both for simple and for very intricate systems, at the same time they are easy to operate by final users. The casing of these regulators is adapted for mounting onto a rail.

The regulators series SCH-04 have got many utility functions. Some of these functions determine the regulator and refrigeration system operation, whereas other are only the functions of helping or informing nature. In order to ensure versatility of the regulator applications meant for various systems, some of these functions can be either activated or disabled by making appropriate settings, when programming the regulator work.

The regulator has got the operating programm developed by the producer and assigned for its typical utility applications. That programm can be changed or modified optionally at installator's level. The regulator is secured protected by access code against unauthorized interference into its programme by final user.

The particular regulator types series SCH-04 differ from each other within the range of their available functions:

- SCH-04/1 regulator allows to control only one chiller and
- SCH-04/2 regulator enables to control two chillers.

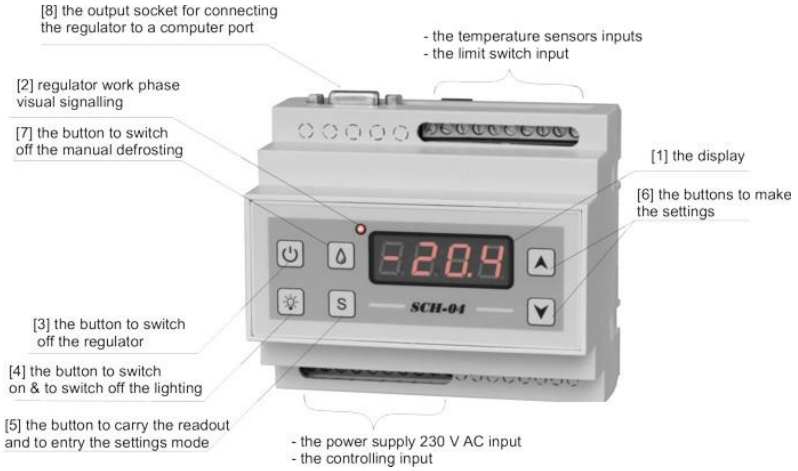
2. TECHNICAL DATA.

regulator's operating mode	cooling OR heating
range of the measurement and control temperature	from -40.0^{O}C to +99.0^{O}C
range of an additional heating unit control temperature	from 0.0^{O}C to +99.0^{O}C
measurement resolution	0.2^{O}C
control resolution	0.2^{O}C
range of temperature for defrosting end	from +1.0^{O}C to +30.0^{O}C
range of temperature for alarm signalling in sensor no. 1	from -40.0^{O}C to +99.0^{O}C

range of temperature for alarm signalling in sensor no. 3	from 0.0^{O}C to +99.0^{O}C
hysteresis range of the refrigeration control	from +1.0^{O}C to +20.0^{O}C
hysteresis range of the additional heating unit control	from +1.0^{O}C to +10.0^{O}C
maximum defrosting duration securing time	from 0 h to 3 h
work time range till the moment of defrosting process	from 1 h to 12 h
number of the measurement sensors	3
length of the measurement sensors	2,5 m (in standard)
load capacity of relay contacts controlling the refrigeration	30A 230V AC +/-10%
load capacity of relay contacts controlling the lighting	10A 230V AC +/-10%
load capacity of relay contacts controlling the fan	10A 230V AC +/-10%
load capacity of relay contacts controlling the heater / defrost solenoid valve	10A 230V AC +/-10%
load capacity of relay contacts controlling heating circuit	10A 230V AC +/-10%
power supply	230V AC +/-10%
environment operation temperature	from +5.0^{O}C to +40.0^{O}C
humidity operation level	from 20% RH to 80% RH
protection class	IP30

3. CONSTRUCTION.

The regulator SCH-04 is placed into a compact casing assigned for mounting onto the rail and containing all the regulator controlling and executive components.



The regulator of the type SCH-04 is equipped with:

- digital temperature display **[1]**, allowing to monitor currently temperature inside the refrigeration device
- visual signalling **[2]**, showing the refrigeration device status
- operation switch **[3]**, enabling to switch off the regulator work at any moment, without switching off the refrigeration system power supply
- lighting on/off switch **[4]**, enabling to switch on and off the refrigeration system's lighting (independently from the regulator work switch status [3])
- multi-function button **[5]**, enabling (among others) to make the readout of the registered temperatures (minimum and maximum values), as well as and to enter the settings
- settings buttons **[6]**
- manual defrosting switch **[7]**, allowing to switch on the defrosting cycle at any moment (independently from the automatic defrosting function).
- output for connecting the regulator to RS 232 computer connector **[8]**.

Regulator control outputs:

- output for controlling the chiller no. 1 or a solenoid valve that pre-turns on the chiller
- output for controlling the chiller no. 2 (**only in SCH-04/2 version**)
- lighting control output
- evaporator fan control output
- condenser fan control output or additional heating element, depending on the temperature on the third sensor
- output for controlling heaters or a solenoid valve during defrost
- outout for triggering defrosting in other connected regulators.

Regulator control inputs:

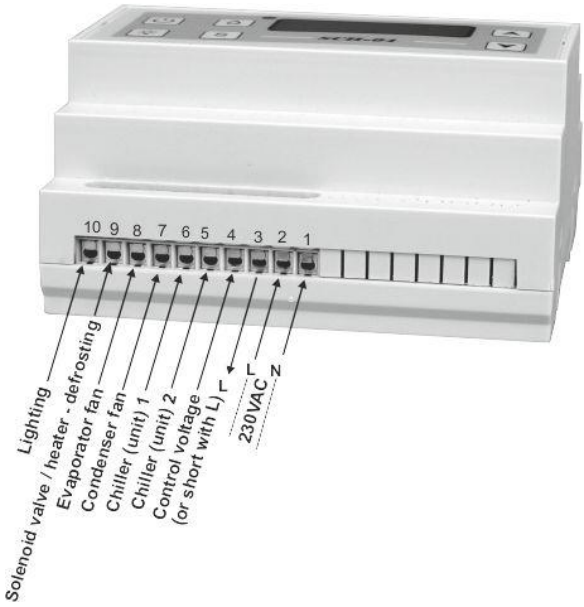
- sensor no. 1 – temperature of the refrigeration chamber, which controls the operation of the chillers
- sensor no. 2 – evaporator temperature, which controls the end of defrosting and possibly the evaporator fan
- sensor no. 3 – which can be set as:
  a. additional defrost sensor or
  b. condenser sensor (condenser fan control)or
  c. sensor controlling a separate heating system
- input for triggering defrosting via the main regulator (with regulators connected to each other),
- input of the limit switch for opening the door or cover.

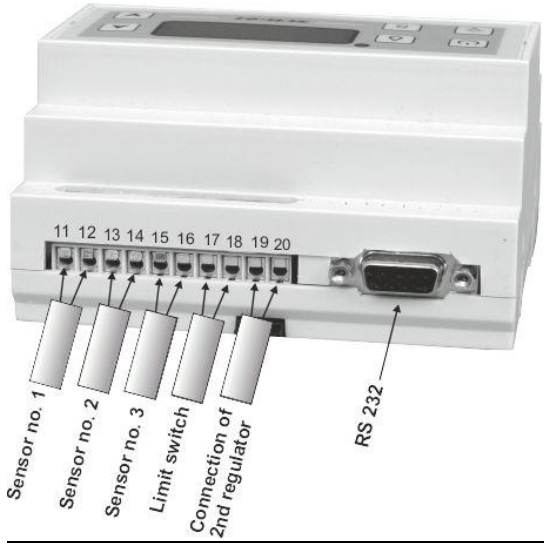
ATTENTION
The controller has a 5 second delay after each switching on, reading, changing settings etc. During this time the buttons and the controller operation are ***inactive****.*

4. SCHEME OF CONNECTION OF THE REGULATOR.

In order to connect the regulator to the refrigeration device, you should carry out the operations as follows:

- attach the regulator,
- place and fix the sensors in the right places,
- connect the regulator.





ATTENTION
Input no. 4 is the input giving the signal, which will be undergoing to switching off through the relays. Any AC or DC voltage from the range of 12V up to 380V may constitute that signal.
In case of using the standard applications, this input is to be connected with a bridge to the output no. 3, giving the AC low-voltage [L] signal of 230V. In such a case the switching over the AC voltage phase of 230 V will be taking place.

5. REGULATOR FUNCTIONS.

5.1. Setting the regulator operation mode – parameter C9.

SCH-04 regulator enables to set up two operation modes: (a) refrigeration mode (**C9=0**) or (b) heating mode (**C9=1**).
The refrigeration mode is the main application. Nevertheless, by setting up heating mode (a reverse relay and hysteresis action takes place) its applying in other fields is enabled. This regulator can be set up such as double heating regulator, having two independent heating circuits, controlled from two temperature sensors.

ATTENTION
In case of setting up the regulator in the heating mode the defrosting and sharp freezing options become ***not active****.*

5.2. Temperature measurement made from three sensors – parameters CP and UC.

The regulator is equipped with three measuring sensors. Temperature measurement is carried out on all sensors simultaneously at intervals of 1 second. The display shows the temperature value from one sensor. The regulator allows to set:

- number of active measuring sensors (**CP** parameter)
- sensor number from which the temperature value will be displayed (**UC** parameter).

At any time, it is also possible to read the temperature on sensors other than the one set in the UC parameter.
When the temperature value is read from a sensor that is not installed, the symbol „**----**" will appear on the display.

ATTENTION
CP parameter (number of measuring sensors) also determines from which measuring sensors t he sensor error will be reported. When the sensor is installed in the controller but it has not been activated in the CP parameter, the regulator will operate normally. However, in the case of failure of such a sensor, the failure will not be signaled and the regulator will switch to emergency operation mode.

5.3. Manual or automatic switching on and off of the refrigeration device – parameter RA.

There are two ways to turn the refrigeration device on and off: (a) if **RA=0**, then switching on/off is done only manually, by using the button, but (b) if **RA=1**, then switching on/off may be done either manually (priority) or automatically, accordingly to the preset times. The regulator is equipped with a real time clock, which allows the execution of this function. The clock has its own battery, so power failures or disconnecting the regulator from the power supply do not affect the operation of the clock.

ATTENTION
*The automatic switch-on and switch-off function is **not active** if at the time when the switching on or off is to take place the regulator is in the settings mode or if the control temperature is being set.*

5.4. Manual or automatic switching on and off of lighting – parameters LU and FL.

The regulator has a function that allows user to set three ways to turn on and off the lighting of a refrigerating device – **parameter LU**. The lighting function is independent of the regulator's operation, which means that even if the regulator is turned off, all lighting operation options (automatic, manual operation and lighting triggering in relation to the limit switch) remain active and are constantly monitored by the regulator. The lighting option is always active, regardless of the failure status of the regulator. The following settings for this function are possible: (a) **LU=0**, enabling to switch the lighting on and off only manually, using the button, (b) **LU=1** allows manual (priority) and automatic switching on and off, according to the real-time clock settings and (c) **LU=2** causes that switching on and off is automatic and carried out by a limit switch; in this mode, the manual button is inactive.
And in the **FL** parameter it is possible to set the reverse operation of the limit switch.

5.5. Controlling one or two chillers (units) – parameters b1, b2 and HI.

The main function of the regulator is to control the chiller (unit), so as to maintain the desired temperature inside the refrigeration device. This function is obtained by comparing the temperature on the control sensor – sensor no. 1 (placed in the refrigeration chamber) with the settings made. Depending on the result of this comparison, the relay(-s) controlling the chiller(-s) are switched on and off. SCH-04/1 regulator allows to control only one chiller (unit), while SCH-04/2 version is equipped with the possibility of controlling two chillers (units) or one chiller and a solenoid valve.
In order to correctly perform this function, user should make the appropriate settings, that is:

- define the range of allowed control temperatures; the regulator enables control in its entire measuring range (i.e. from -40^{O}C to +99^{O}C), however, in order to limit this range for a direct user, the following should be specified:
  a. lower range of control temperature – parameter **b1** and
  b. upper range of control temperature – parameter **b2**,

  which make it impossible to set the control temperature outside this range from the user level

- define the control hysteresis (**HI** parameter); control hysteresis determines the temperature difference between the temperature of switching off the chiller (unit) and switching it on again and the setting in the range from 1^{O}C to 10^{O}C is possible; when selecting the hysteresis value, the permissible frequency of switching on and off of the chiller (unit) should be taken into account
- set the control temperature.

5.6. Time delay for turning on the second chiller (unit) – parameters AP, A1 and A2.

This function is available **only in SCH-04/2** regulator. This version of the regulator is equipped with two chillers control outputs to enable the control of larger refrigeration devices.
In **AP** parameter the setting of the chiller that turns on first is made. The second control output of the chiller repeats the work cycle of the first output. Between the two outputs it is possible to set:

- time delay of switching on the chiller (unit) no. 2 in relation to the first chiller (unit) – parameter **A1**
- time delay of switching off the chiller (unit) no. 2 in relation to the first chiller (unit) - parameter **A2**.

These delays prevent the mains from being overloaded when cooling is turned off.

5.7. Rotation of priority of switching on the chillers (units) – parameter AP.

This function is available **only in SCH-04/2** version of the regulator and secures even wear of the chillers (units) when the control outputs of two units are used with a time delay. If this function has been activated (parameter **AP> 0**), then the switch-on and switch-off sequence is changed after the time set in this parameter.

5.8. Pre-activation of the solenoid valve function – parameters A1, A2 and AP.

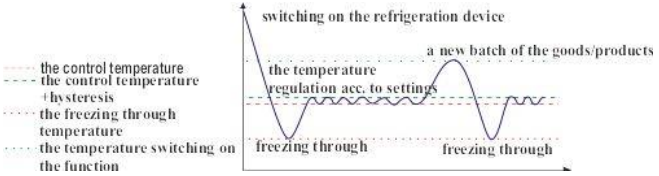
This function is available **only in SCH-04/2**. It requires the use of two chiller control outputs, with only one chiller being used. The solenoid valve should be connected to the output of chiller (unit) no. 1, while the chiller (unit) is connected to the output of chiller (unit) no. 2.
The settings to be made to run this function are:

- parameter **A1** = time of the desired advance of the solenoid valve activation in relation to the chiller (unit) and
- parameter **A2=0** and
- parameter **AP=0**.

5.9. Sharp freezing function – parameters HA, H0 and HF.

The sharp freezing function consists in forcing the chiller(-s)/unit-(s) to operate continuously, until the temperature for deactivating the sharp freezing in the refrigeration chamber is lower than the set control temperature. This is to achieve a low temperature of the goods placed in the refrigeration appliance more quickly. After reaching the preset sharp freezing deactivation temperature, the regulator resumes operation according to the control temperature.

If this function is activated (parameter **HA=1**), it will turn on automatically when the temperature inside the device rises above the sharp freezing activation temperature set by the installer, e.g. due to fresh goods being put into the refrigeration chamber.



Settings made within this function:

- activation of sharp freezing (parameter **HA**: **0** – function inactive, **1** – function active)
- setting the temperature above which the automatic activation of the sharp freezing function takes place (parameter **H0**)
- setting the temperature below which the sharp freezing is deactivated (parameter **HF**)
- deactivation of the maximum operating time of the chiller (unit) – parameter **CC= 0**.

5.10. The function of securing the operation of the chiller(-s) / unit(-s) – parameters CA, CC and CF.

The purpose of this function is to protect the chiller(-s)/unit(-s) against excessive wear, caused by switching it on too often and working for too long. This function allows the following settings:

- minimum operation time of the chiller (unit) – **CA** parameter
- maximum operation time of the chiller (unit) – **CC** parameter
- minimum standstill time of the chiller (unit) – **CF** parameter.

These settings are superior in the process of controlling the chiller (unit), therefore it should be noted that improperly selected parameters will have an impact on the actual temperature fluctuations inside the refrigeration device (the temperature in the refrigeration chamber will differ significantly from the required temperature).

ATTENTION
For the setting of the maximum operation time of the chiller (unit) to make sense, its minimum standstill time must also be set.

ATTENTION
When activating the sharp freezing function, the limitation of the maximum chiller operation time (CC=0) should be disabled.

5.11. Automatic defrosting – parameters 0F, 0E, 0L, CH and CP.

The device enables defrosting in three variants:

- at **0F=0** the defrost function is inactive (disabled)
- at **0F=1** convection defrosting/using heaters takes place
- at **0F=2** hot steam defrosting takes place (reverse circulation).

Completion of the defrosting process is normally supervised by the temperature sensor no. 2. It is also possible to set the temperature sensor no. 3 as an additional defrost sensor (parameter **CH=0**); in this case, the same pre-set temperature must be reached on both sensors. This solution is useful in devices with long evaporators or where difficulties with effective defrosting of the device can be expected.
The end temperature of defrost is set in parameter **0E**.
The regulator also allows the user to set maximum defrosting time, independent of temperature measured by the defrost sensor (parameter **0L**). In addition to its safety nature, this function also allows you to configure the regulator so as to obtain a single sensor regulator with a timed defrosting system.
The selection of the number of active sensors is made in the **CP** parameter.

5.12. Defrosting activation according to time settings – parameters 0U, 0P and 0A.

The regulator allows defrosting to be started cyclically (at specified intervals) or according to the time of the real clock. Defrosting can be started in four different variants:

- at **0U=0** defrosting is only triggered manually (button **[7]**)
- at **0U=1** defrosting is triggered manually and cyclically at intervals defined in parameter **0P**; it is possible to set the cycles in frequency every 0.1 h (=6 minutes)
- at **0U=2** defrosting is triggered manually and automatically according to the start-up times programmed in parameter **0A**:
  -C1 → *hh.mm* → *-C2* → *hh.mm* → *-C3* → *hh.mm* → *-C4* → *hh.mm* → *-C5* → *hh.mm*,
  where the values from *-C1* to *-C5* indicate the time of defrosting according to the real time clock, and *hh.mm* indicate a specific hour and minutes
  not all setpoints (C1-C5) need to be set and there can be a maximum of 5
- at **0U=3**, defrosting is triggered manually and automatically by triggering by another controller connected as the master.

5.13. Function enabling interconnection of regulators – parameter 0U.

The regulator enables the interconnection of any number of regulators in a string. In such a connection, one of the controllers will start defrosting at the same time in all connected regulators, which is especially useful in sequences of refrigeration devices.
In order for this function to be implemented, one of the regulators must be set as the main one and in this regulator, following selection of the method of defrosting is needed: **0U=1** or **0U=2** (*see section 5.12.*). While in other regulators **0U=3** is to be set. Then, after installing the regulators, connect them together.

5.14. Dripping function – parameter LA.

The regulator is equipped with a dripping function that can be turned on after the defrosting phase is completed. Setting the parameter **LA=1** activates this function, while **LA=0** deactivates it.

5.15. Temperature display blocking for defrosting and dripping phases – parameters Pd and P0.

The regulator allows you to lock the temperature display for the duration of the defrosting and dripping phases – parameter **Pd**. If this function is activated (**Pd=1**), the display will show the temperature value that occurred before entering the defrosting mode for the entire duration of defrosting/dripping phase.

This function is complemented by the possibility to set a delay in unlocking the display after the end of defrosting and dripping phases – parameter **P0**.

5.16. Condenser fan control – parameters EL, EF, EH, CP, CH, EF and EH.

The regulator allows you to choose one of five different variants of condenser fan control:

- at **EL=0** the fan operates continuously
- with **EL=1** the fan operation depends on the condenser temperature; in this mode, the condenser fan is turned on if the temperature on the condenser rises above the value programmed in the **EF** parameter
- with **EL=2** the fan operation depends on the operation of the chiller (unit) and the temperature on the condenser; unlike the previous variant, checking the temperature and starting the fan occurs only when the chiller (unit) is running, so the fan is turned on when the temperature measured on the condenser exceeds the set value and the chiller (unit) is running at the same time
- at **EL=3** the fan operates accordingly to the chiller's (unit's) operation
- with **EL=4** the fan operates accordingly to the chiller's (unit's) operation, but during defrosting and dripping, the fan is stopped (regardless of the chiller's/unit's operation); this option is especially useful when a hot steam defrosting is performed.

Settings related to fan operation, depending on the condenser temperature:

- number of measuring sensors: **CP=2** or **CP=3**
- sensor no. 3 function: **CH=1**
- condenser fan switch-on temperature: **EF=temperature value**
- hysteresis for switching off the fan operation: **EH=hysteresis value**; this setting determines at what difference in relation to the switch-on temperature, the fan will switch off, e.g. EF=40 and EH= 5means that the fan will switch on if the temperature on the condenser will rise to 40^{O}C and it will turn off if the temperature drops below 40-5=35^{O}C.

5.17. Evaporator fan control – parameters EU, E0, EC, EP and LP.

The controller allows you to choose one of five different variants of evaporator fan control:

- at **EU=0** the fan operates continuously, bu it is turned off during defrosting and dripping
- at **EU=1** the fan operates continuously
- with **EU=2** continuous fan operation, turned off during dripping phase is on
- at **EU=3** the fan operation depends on the operation of the chiller (unit), but it is turned off during defrosting and dripping
- with **EU=4**, the fan operation depends on the operation of the chiller (unit) during defrosting, but is turned off during dripping.

Additionally, the evaporator fan can be switched off and on via a limit switch (e.g. door limit switch). By default, this function is **inactive** (**LP=0**); to activate it, please set **LP=1**.
Turning on the evaporator fan after the regulator has been switched on or after the defrosting and dripping phase may be delayed for time needed for the evaporator to cool down (**E0** parameter). Possible settings for this function are: (a) **E0=0** for no delay, (b) **E0=1** initiating time delay set in **EC** parameter or (c) **E0=2** initiating temperature delay set in **EP** parameter; the fan will switch on when evaporator temperature reaches the desired value.

ATTENTION
*In order for the temperature delay function (E0=2) to be possible, a setting must be made in the selection of the number of sensors: **CP=1** or **CP=2**. This function cannot be performed with other settings.*

5.18. Controlling of the additional heating system – parameters CP, CH, EF and EH.

The regulator allows to use sensor no. 3 for controlling an additional heating system. In refrigeration applications, such a function may enable the implementation of e.g. control of heaters that heat windows or the use of a regulator to control cooling and heating devices.
When this function is used, the condenser fan control depending on the temperature on the condenser becomes **inactive**.
To activate this function, please make the following settings:

- number of measuring sensors: **CP=2** or **CP=3**
- sensor no. 3 function: **CH=1**
- control temperature: **EF=temperature value**
- control hysteresis: **EH=hysteresis value.**

5.19. Recording and reading of the daily temperature values – parameter EA.

The controller has the function of saving recorded temperature values into the microprocessor's memory. The memory capacity is 24 measurement data saved every 1 hour, always at the even hour (according to the internal RTC clock) from powering-up.
The values shown on the display are saved in the memory. If the display lock is set for defrosting and dripping (parameter **Pd**), the value shown in the display will be stored, **not the actual value**.
If the memory is full, the oldest data are deleted and the youngest are added. In such a cycle, with continuous operation, the temperature data from the last twenty four hours of operation of the cooling device are collected.
The data is available for viewing by the user under the **EA** setting and is arranged by items from *-01-* to *-24-*, where under *-01-* there is always the registered value at the last even hour (latest entry). Readout of the recorded data from the memory takes place using the display and is described in the section on controller operation.
In the event of a power failure, all data will be deleted in the moment when a new sample should be registered (at the even hour).

ATTENTION
In case of sensor failure or when the controller is turned off, values ---- will be saved.

5.20. Recording and reading of the daily minimum and maximum values of the temperature – parameter Ad.

SCH-04 has the function of saving minimum and maximum values of the measuered temperature into the processor memory. As in the case of recording daily values, if the display lock function is activated (parameter **Pd**), the values shown on the display will be saved, not the actual values.
The start of recording of the maximum and minimum temperatures to the processor memory may be delayed in relation to the device being turned on. This delay is set in the **Ad** parameter.
The regulator has its own battery supply system and the maximum and minimum values saved in the memory are not automatically reset in the event of a power failure. These values can only be deleted manually.
Reading and canceling this function is described in the section on operation.

ATTENTION
In the event of a sensor failure, recording of temperature data will be withholded until the failure is fixed.

5.21. Recording of the aggregate operation time of the chiller (unit) – parameter FH.

This function consists in adding up the partial operation times of the chiller (unit). The total operation time of the chiller (unit) can be read by entering the **FH** parameter; it is equals to the displayed value multiplied by 10 hours. The recorded operation time of the chiller (unit) cannot be erased either from the user or installer level.
This function is helpful in assessing the state of wear of the chiller (unit).

5.22. Supervision and signaling of damage to temperature sensors.

During its operation, the controller constantly monitors the state of the sensors; when a sensor failure is detected, an alarm signal appears. This signaling is visual and audible. Alarms are as follows:

- sensor no. 1 failure – optical signaling by displaying the message "ACU1", alternately with the measured temperature value and cyclic acoustic signaling for 5 sec./1 min.
- sensor no. 2 failure – optical signaling by displaying the message "ACU2", alternately with the measured temperature value and cyclic acoustic signaling for 5 sec./1 min.
- sensor no. 3 failure – optical signaling by displaying the message "ACU3", alternately with the measured temperature value and cyclic acoustic signaling for 5 sec./1 min.

In case of failure of the sensor from which the temperature value is displayed, the display will alternately show the alarm message and the symbols "----".

5.23. Emergency operation function – CE parameter.

Depending on the settings made in the **CE** parameter, the controller will react in two ways on detected sensor failure:

- at **CE=0** the regulator switches to emergency mode
- at **CE=1** the regulator suspends the operation for the time of fixing the failure.

The method and implementation of the emergency operation depends on the type of sensor that has failed, as well as on the settings made.

Sensor no. 1 failure.
This sensor is responsible for controlling the chiller (unit). In the event of its failure:

- chiller (unit) control is transferred to the time control system according to the settings made in the **FP** and **F0** parameters
- settings of the minimum and maximum operation times of the chiller and its minimum standstill time are ignored
- other functions of the controller operate normally.

Sensor no. 2 failure.
This sensor is responsible for ending the defrosting process and controlling the temperature delay of the evaporator fan (if this function has been activated). In case of failure of this sensor:

- the regulator will enter the defrosting mode in accordance with the previous settings and the defrosting duration will be determined by the settings made in the **FF** parameter
- evaporator fan temperature delay control will automatically switch to time delay control according to the time set in the **EC** parameter
- other functions of the controller operate normally.

Sensor no. 3 failure.
This sensor can be used in various ways:

- if it is the second defrost sensor, its failure does not affect the operation of the controller, and defrosting is only controlled by sensor 2
- if this sensor has been set as the condenser sensor and controls the condenser fan, then in the event of its failure, the condenser fan will be turned on continuously
- if, on the other hand, sensor no. 3 has been set as a heating circuit sensor, in the event of its failure, this circuit is switched off.

5.24. Audible and optical signaling of alarm status – parameters AA, AL, AH, Ad, A0 and AF.

The regulator has an extensive alarm and warning system for the user of the refrigeration device. By appropriate settings, this system can be narrowed down and also completely turned off. In order for an alarm from a given sensor to be reported, it must be activated in the **CP** parameter.
The controller has the following types of alarms.

- Alarm from sensor no. 1 (control sensor) – this alarm is to warn the user, that the temperature inside the refrigeration device is too high or too low. In case of this alarm, the acoustic signaling is carried out cyclically 5 sec./1 min., as well as "AC1A" message is displayed. Possible settings for this alarm:
  - alarm activation: **AA=2**, **AA=4** or **AA=5**

- setting the temperature below which the alarm is triggered – parameter **AL**
- setting the temperature above which the alarm is triggered – parameter **AH**
- setting the time delay of alarm activation after switching the device on to work – parameter **Ad**
- setting the time delay of alarm activation after defrosting and dripping – parameter **A0**
- setting the time delay of alarm activation after a cause – parameter **AF**.

- Alarm from sensor no. 3 (condenser sensor or additional heating circuit sensor) – this alarm has for the task:
  a. if the sensor is set as a condenser sensor – to warn against an excessive increase in temperature on the condenser, which e.g. may mean excessive contamination of the condenser, failure of the condenser fan or exceeding the allowable ambient temperature
  b. if the sensor is set as an additional heating circuit sensor – to warn against excessive temperature increase.

  In case of this alarm, the acoustic signaling is carried out cyclically 5 sec./1 min., as well as "AC1A" message is displayed. Possible settings for this alarm:
  - alarm activation: **AA=1**, **AA=3** or **AA=5**
  - setting the temperature above which the alarm will be triggered – parameter **A3**.
- Alarm from the limit switch sensor – this alarm is to warn against the door of the refrigeration chamber or cabinet left open. In the event of this alarm, cyclic acoustic signaling 5 sec./1 min., as well as "Ador" message is displayed. Possible settings for this alarm:
  - alarm activation: **AA=3**, **AA=4** or **AA=5**
  - setting the time delay of alarm activation after a cause – parameter **AF**.

table of optical alarm signaling

description of the alarm cause	symbol
failure of sensor no. 1	ACU1
failure of sensor no. 2	ACU2
failure of sensor no. 3	ACU3
alarm from sensor no. 1 (control sensor)	AC1A
alarm from sensor no. 3 (condenser sensor/additional heating circuit sensor)	AC3A
alarm from limit switch	Ador

5.25. Returning to the default settings – parameter PP.

In the event of changing the settings of the regulator so that it starts to malfunction, it is necessary to return to the factory settings. To do this, please enter **PP** parameter and change its value to **1**. The return to default settings will take place only after switching the regulator off and on again.

6. OPERATION OF THE REGULATOR BY THE DIRECT USER.

6.1. Manual switching on and off of the regulator's operation.

switching the regulator on

ATTENTION
The actuator elements (chillers/units, fans, etc.) are turned on with a five-second delay in relation to the moment of pressing the activation button and exiting the setting mode.

switching the regulator off

ATTENTION
1. The switch-off status is signaled by displaying the dot. If the controller supply voltage is turned off, the dot will go out.
2. The controller also enables automatic switching on and off of the controller operation according to the real-time clock.

6.2. Setting the regulator to switch on and off automatically.

The automatic regulator switch-on function is active only when the regulator is set appropriately by the installer and the clock time is correctly set. In order to set the regulator's activation time:

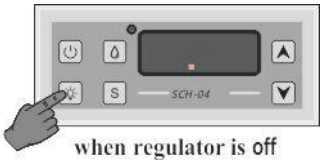
a. press "S" button
b. using the setting buttons ▲ and ▼ [6] set the parameter **r0** and press "S" button
c. using ▲ and ▼ buttons set the time to switch the controller on, and then confirm it with "S" button.

To set the regulator switch-off time:

d. press "S" button
e. using the setting buttons ▲ and ▼ [6] set the parameter **rF** and press "S" button
f. using ▲ and ▼ buttons set the time to switch the controller off, and then confirm it with "S" button.

6.3. Manual switching the lighting on and off.

when regulator is on



when regulator is off

ATTENTION
The controller also allows you to automatically turn the lighting on and off according to the real-time clock.

6.4. Setting the lighting to switch on and off automatically.

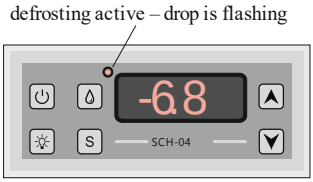
The automatic switching on and of lighting function is active only when appropriate settings are made in the regulator from the installer and the clock time is correctly set. To set the time of switching on the lighting:

a. press "S" button
b. set **0C** parameter according to the procedure described above (*see section 6.2*.)
c. set the time of switching on the lighting with ▲ and ▼ buttons, and then confirm it with "S" button.

To set the time of switching off the lighting:

d. press "S" button
e. set **FC** parameter
f. set the time of switching off the lighting with ▲ and ▼ buttons, and then confirm it with "S" button.

6.5. Manual switching the defrosting on.



ATTENTION
The controller has an automatic defrosting system. Manual defrost is a support function.

6.6. Changing the control temperature value.

Readout of the currently set control temperature

Changes in the value of the set control temperature

pressing again

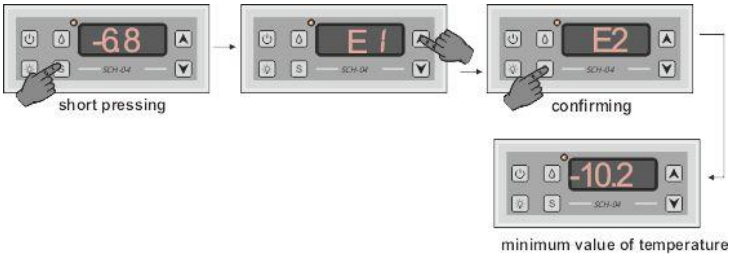
ATTENTION

The change of the set control temperature takes place at the moment of automatic exit from the settings and readout of the control temperature.

When the control temperature is displayed, the regulator switch-off button is inactive.

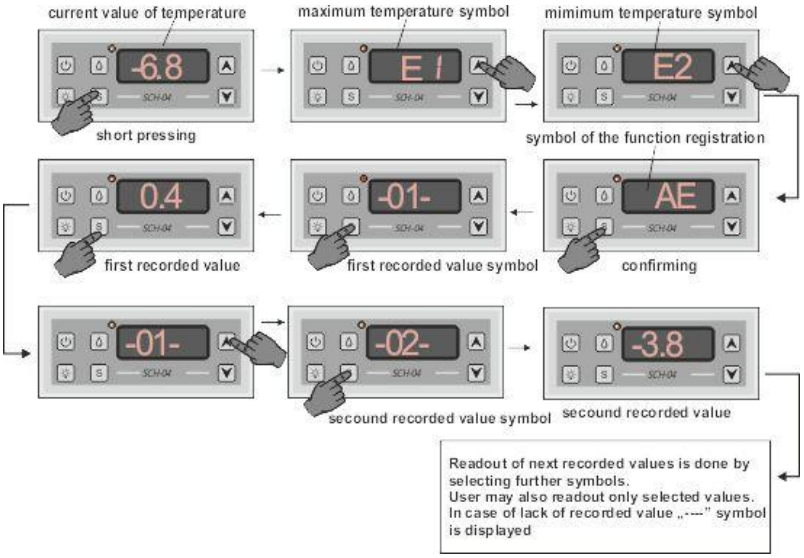
6.7. Readout of minimum, maximum and recorded temperature values.

minimum temperature readout



maximum temperature readout

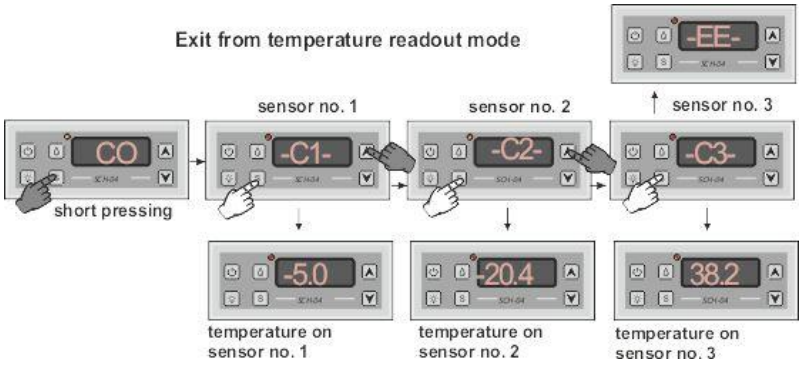
recorded values of temperature readout



6.8. Readout of temperature values on all sensors.

During the regulator operation, the display shows the temperature from the sensor set in the settings by the installer. By default it is control sensor (no. 1). However, you can read the temperature values on the other sensors at any time. In order to do so:

a. press "S" button
b. set the parameter **C0** with ▲ and ▼ buttons and confirm with "S" button
c. then proceed as in the figure below



6.9. Deleting the memory of temperature values.

The values of minimum, maximum and recorded temperatures remain in the regulator's memory even if it is turned off and disconnected from the power supply, because the regulator has an independent battery supply system. To delete the values stored in the memory, perform the following steps.

Deleting the memory of the minimum and maximum value:

a. press "S" button
b. set **EH** parameter with ▲ and ▼ buttons and confirm with "S" button
c. change EH parameter value to **1**, and then confirm it with "S" button.

Erasing the values of recorded temperatures:

a. press "S" button
b. set **LH** parameter with ▲ and ▼ buttons and confirm with "S" button
c. change LH parameter value to **1**, and then confirm it with "S" button.

6.10. Setting the clock time.

In order to set the clock time of the regulator, do as follows:

a. press "S" button
b. set **AC** parameter with ▲ and ▼ buttons and confirm with "S" button
c. set the current time with ▲ and ▼ buttons, and then confirm it with "S" button.

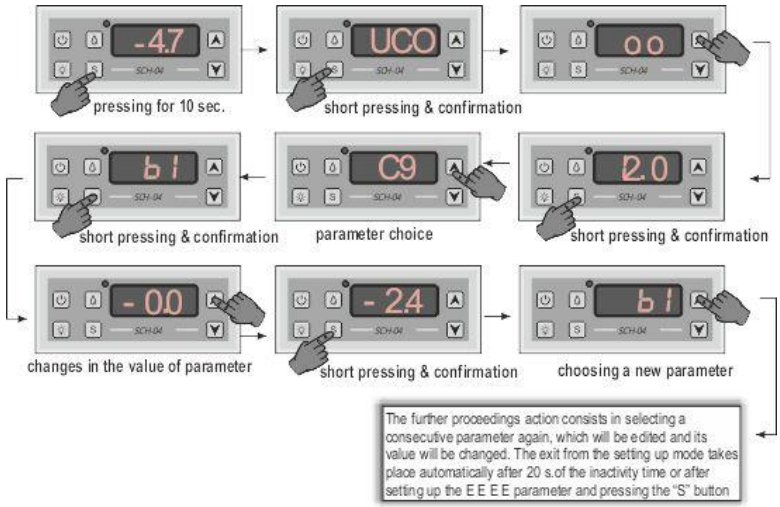
6.11. Table of settings available to the user.

FUNCTION DESCRIPTION	SYMBOL	SETTINGS RANGE	FACTORY SETTING
maximum temperature readout	E1	*n/a*	*n/a*
minimum temperature readout	E2	*n/a*	*n/a*
temperature recording	AE	from -01- to -24- **EE** – exit	*n/a*
deleting the minimum and maximum temperature	EH	**0** – inactive **1** – deleting the recorded values	0
erasing the values of recorded temperatures	LH	**0** – inactive **1** – deleting the recorded values	0
time of turning on the lighting	0C	gg.mm	8.00
time of turning off the lighting	FC	gg.mm	18.00
time of turning on the regulator	r0	gg.mm	6.00
time of turning on the regulator	rF	gg.mm	22.00
readout of the temperature on sensor (no. 1, no. 2, no. 3)	C0	-C1-, -C2-, -C3- **EE** – exit	*n/a*
setting the clock time	AC	gg.mm	*n/a*
exit from settings	EEEE	*n/a*	*n/a*

7. OPERATION OF THE REGULATOR BY THE INSTALLER.

7.1. Programming.

The regulator is factory programmed for standard operation conditions, intended for refrigeration chambers. The factory programming set does not use all the functions and capabilities of the regulator. In order to adjust the regulator to the actual operating conditions and to use the desired functions, it is necessary to analyze the factory settings and make any changes to them. The figure below shows the programming procedure.



In order to enter the settings:

a. hold down "S" button for 10 seconds
b. after **UC0** appears on the display, press "S" button again
c. using ▲ and ▼ buttons, enter the access code, and then confirm with "S" button
d. using ▲ and ▼ buttons select the symbol of the function (parameter) to be edited, and then confirm with "S" button
e. change the desired parameter value with ▲ and ▼ buttons and then confirm with "S" button
f. select a possible next function to be edited
g. after making all the required changes, in order to exit the settings, set the **EEEE** symbol and press the "S" button; the exit is also automatic, if the user is idle for approx. 17 sec.

7.2. Table of settings available to the installer.

FUNCTION DESCRIPTION	SYMBOL	SETTINGS RANGE	FACTORY SETTING
access code	UC0	*n/a*	12.0
regulator operation mode	C9	**0** – refrigeration mode **1** – heating mode	0
lower range of control temperature	b1	setting range from -40.0^{O}C to +99.0^{O}C, every 1.0^{O}C	-20.0 (^{O}C)
upper range of control temperature	b2		10.0 (^{O}C)
control hysteresis	HI	setting range from -1.0^{O}C to +20.0^{O}C, every 0.2^{O}C	2.0 (^{O}C)
minimum operation time of the chiller (unit)	CA	**0** – inactive **>0** – active: possibility to set time in range from 1 min. to 60 min., every 1 min.	0
maximum operation time of the chiller (unit)	CC	**0** – inactive **>0** – active: possibility to set time in range from 1 h to 9 h, every 1 h	0
minimum standstill time of the chiller (unit)	CF	**0** – inactive **>0** – active: possibility to set time in range from 1 min. to 60 min., every 1 min.	0
chiller (unit) operation time in the event of sensor no. 1 failure	FP	setting range from 1 min. to 600 min., every 1 min.	1 (min.)
chiller (unit) standstill time in the event of sensor no. 1 failure	F0		1 (min.)
delay of switching on the chiller (unit) no. 2 [***only in SCH-04/2 regulator***]	A1	**0** – inactive **>0** – active: possibility to set time in range from 1 sec. to 30 sec., every 1 sec.	0
delay of switching off the chiller (unit) no. 2 [***only in SCH-04/2 regulator***]	A2		0
rotation of the order in which the chillers (units) are turned on [***only in SCH-04/2 regulator***]	AP	**0** – inactive **>0** – active: possibility to set time in range from 1 h to 24 h, every 1 h	0
number of measuring sensors	CP	**0** – control sensor (no. 1) **1** – control sensor (no. 1) and second sensor (no. 2) **2** – control sensor (no. 1), second sensor (no. 2) and third sensor (no. 3) **3** – control sensor (no. 1) and third sensor (no. 3)	2
the way the regulator reacts to the failure of sensors	CE	**0** – operation according to preset times **1** – regulator's operation stopped	0
sensor no. 3 function setting	CH	**0** – defrosting sensor **1** – condenser/heating control sensor	1

setting of the sensor from which the temperature is displayed	UC	**1** – sensor no. 1 **2** – sensor no. 2 **3** – sensor no. 3	1
type of defrosting	0F	**0** – no defrosting **1** – convection/by heaters defrosting **2** – hot steam defrosting	1
defrosting end temperature	0E	possibility to set the temperature in range from 1.0^{O}C to 30.0^{O}C, every 0.2^{O}C	14,0 (^{O}C)
defrosting options	0U	**0** – defrosting triggered only by button **1** – defrosting at intervals **2** – defrosting at the preset time **3** – defrosting triggered by the second regulator	1
time between each defrosting phase	0P	possibility to set the time in range from 1 h to 12 h, every 0.1 h (=6 min.)	5 (h)
setting the defrosting at a given time	0A	-C1- → *hh.mm*; -C2- → *hh.mm*; -C3- → *hh.mm*; -C4- → *hh.mm*; -C5- → *hh.mm*	
maximum defrosting time	0L	**0** – inactive **>0** – active; possibility to set the time in range from 0.1 h (=6 min.) to 3.0 h, every 0.1 h (=6 min.)	0,7 (h)
defrosting time in case of sensor no. 2 failure	FF	possibility to set the time in range from 1 min. to 180 min., every 1 min.	1 (min.)
dripping time	LA	**0** – inactive **>0** – active: possibility to set the time in range from 1 min. to 60 min., every 1 min.	1 (min.)
display lock during defrosting and dripping	Pd	**0** – lock off **1** – lock on	1
display lock off delay	P0	**0** – inactive **>0** – active: possibility to set the time in range from 1 min. to 30 min., every 1 min.	20 (min.)
evaporator fan output control, depending on the limit switch	LP	**0** – limit switch **active** **1** – limit switch inactive	1
evaporator fan output control	EU	**0** – continuous operation, but the fan is turned off during defrost and dripping phases **1** – continuous operation **2** – continuous operation, but the fan is turned off during dripping phase **3** – the fan operation depends on the operation of the chiller (unit), but it is turned off during defrosting and dripping **4** – the fan operation depends on the operation of the chiller (unit) during defrosting, but it is turned off during dripping	3

type of delay for turning on the evaporator fan	E0	**0** – no delay **1** – time delay settable in **EC** parameter **2** – temperature delay settable in **EP** parameter	2
evaporator fan switch-on time delay	EC	possibility to set the time in range from 1 min. to 30 min., every 1 min.	1 (min.)
evaporator fan switch-on temperature delay	EP	possibility to set the temperature in range from -20.0^{O}C to +20.0^{O}C, every 0.2^{O}C	2,0 (^{O}C)
condenser fan and heater output control	EL	**0** – continuous fan operation **1** – fan operation dependent on condenser temperature **2** – fan operation dependent on the chiller (unit) operation and temperature **3** – fan operation dependent on the chiller (unit) operation **4** – fan operation dependent on the chiller (unit) operation, but standstill during defrosting and dripping phases **5** – heater operation	3
temperature of condenser fan turning off and turning on the heating	EF	possibility to set the temperature in range from 0.0^{O}C to 99.0^{O}C, every 0.2^{O}C	20,0 (^{O}C)
hysteresis for condenser fan turning on and turning off the heating	EH	possibility to set the temperature in range from 1.0^{O}C to 10.0^{O}C, every 0.2 ^{O}C	2,0 (^{O}C)
lighting options	LU	**0** – lighting switched on only manually **1** – lighting switched on manually and automatically **2** – lighting switched on by a limit switch	0
switching the regulator on/off at a given time	rA	**0** – inactive **1** – active	0
alarm	AA	**0** – inactive; alar is off **1** – active; alarm from sensor no. 3 **2** – active; alarm from sensor no. 1 **3** – active; alarm from sensor no. 3 and a limit switch **4** – active; alarm from sensor no. 1 and a limit switch **5** – active; all alarms are on	5
alarm temperature on sensor no. 3 (condenser)	A3	possibility to set the temperature in range from 0.0^{O}C to 99.0^{O}C, every 0.2^{O}C	50,0 (^{O}C)
lower alarm temperature on sensor no. 1	AL	possibility to set the temperature in range from -40.0^{O}C to +99.0^{O}C, every 0,2 ^{O}C	-20,0 (^{O}C)
upper alarm temperature on sensor no. 1	AH		10,0 (^{O}C)
alarm from sensor no. 1 activation delay, after switching on the device	Ad		18 (min.)

and maximum and minimum temperature measurement delay		possibility to set the time delay in range from 1 min. to 99 min., every 1 min.	
alarm from sensor no. 1 activation delay after the defrosting	A0		10 (min.)
alarm from sensor no. 1 activation delay after a cause	AF		2 (min.)
alarm from a limit switch activation delay	AU		5 (min.)
type of limit switch	FL	**0** – normally closed **1** – normally open	1
sharp freezing activation	HA	**0** – inactive **1** – active	0
sharp freezing activation temperature	H0	possibility to set the temperature in range from -40.0^{O}C to +99.0^{O}C, every 0.2^{O}C	-2,0 (^{O}C)
sharp freezing deactivation temperature	HF		-20,0 (^{O}C)
chiller (unit) aggregate operation time	FH	value displayed multiplied by 10 h = chiller aggregate operation time	0
return to factory settings ***(only occurs after the power is turned on again)***	PP	**0** – inactive **1** – active; regulator returns to factory settings	0
sensor no. 1 scaling	C1	+/- 20^{O}, every 0.2^{O} from the value displayed by the sensor	0
sensor no. 2 scaling	C2		0
sensor no. 3 scaling	C3		0
wyjście z ustawień	EEEE	*n/a*	*n/a*