

G422-P01



Controller for a solar collector system

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1. Description of the controller

G422-P01 Controller is a device designed and produced to be used with solar collector installations. This product has been created on the basis of a faultless modern microchip technology. The controller has a modern look and is very easy to use, thanks to its user panel which features a simple keyboard and an LCD screen.

A powerful feature of the controller is its extended packet of basic options, which significantly increases its functionality. These include:

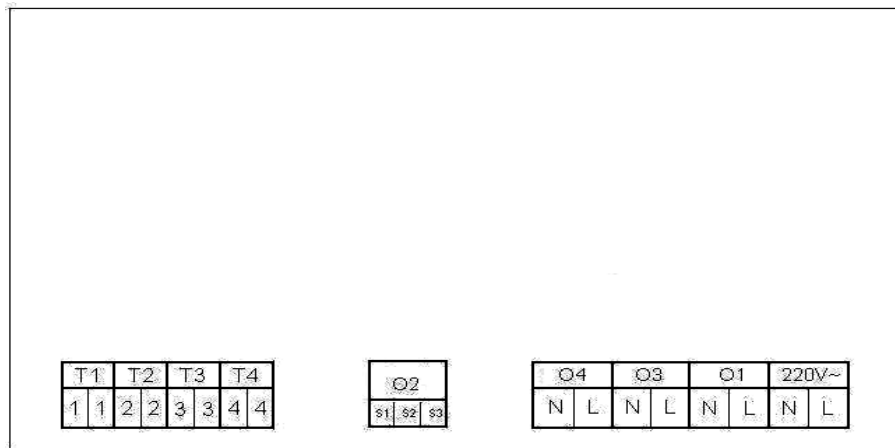
- A selection of 9 different installation configurations,
- Installation diagrams displayed on the screen,
- Animation of operating devices in the installation diagram,
- Regulation of the collector pump speed,
- Possibility of manual control of external devices,
- Calculating momentary collector power,
- Built-in real-time clock.
- Storage of controller settings while disconnected from power

Additionally, a number of functions improving the use of the controller have been introduced:

- Simple menu
- Graphic representation of time periods
- Multiple language versions
- Easy and fast configuration of control parameters

2. Connecting external devices

G44-P01 controller features four inputs allowing for the connection of NTC10k type temperature sensors, and three outputs allowing for the connection of external devices, pumps or three way valves, depending on the selected installation type. Graphic representation of input and output labelling is shown in picture 1. The description of the controller's inputs and outputs is presented in chart 1.



Pic. 1. Controller input and output labelling.

Input/Output	Description
220V~	Connection to a 220V~/50Hz power line
O1	Main pump output Maximum current capacity: 3,15A or 700W
O2	Relay output – potential free output, switch relay Maximum current capacity: 8A - Relay off – S1-S2 contacts closed - Relay on – S2-S3 contacts closed
O3	Relay - current output 220V~ Maximum current capacity: 8A
O4	220V~network power outlet, bridged inside the controller. This output can be bridged externally with the switch relay input, achieving this way a switchable power supply for controlling, for example, a three way valve.
T1, T2, T3, T4	NTC10k temperature sensor inputs

Chart 1. Controller input and output description

When connecting devices to the controller's outputs, it is important to remember that outputs marked O1 and O3 are voltage outputs which can be connected directly with an external device. O2 output has a potency-free character and should be connected in series between the power source and the external device.

ATTENTION!!! Descriptions of connecting devices to the controller in particular installation types is presented in paragraph 6 (Controller systems).

3. Using the controller

3.1 Switching the controller on

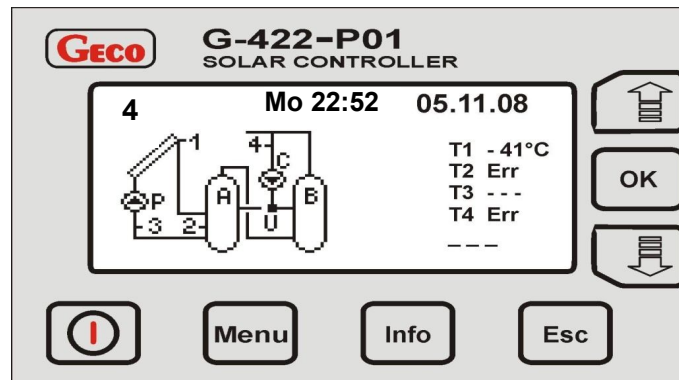
After connecting the controller to a power source, the controller will switch on in a standby mode. LCD display will become half lit, and the screen will show



the current time. When the controller is in a standby mode, it can be switched on with this button . During the controller's regular mode of



operation, it can be put into standby at any time by pressing this button . In standby, all outputs and the alarm sound signal are switched off. When the controller is switched on, the screen displays an image as presented in picture 2.



Pic. 2. An example of the image appearing on the LCD screen after switching the controller on - main screen.

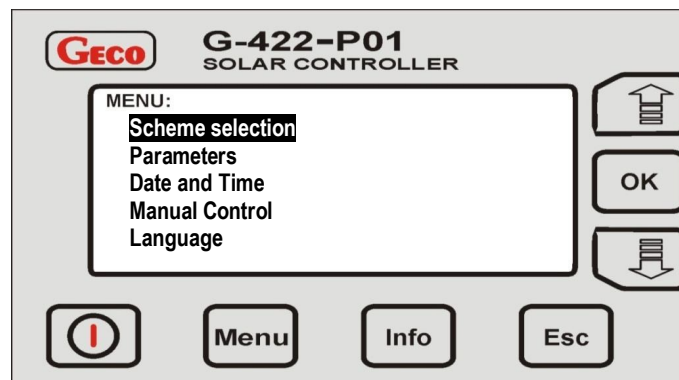
The number of currently chosen installation type is displayed on the left side, in the top row of the LCD screen. Date and time are displayed on the right side. Below the date and time row, the installation diagram will be displayed on the left side. Numbers marked in the diagram represent the numbering of temperature sensors. It is important to remember to install the sensors correctly, in accordance with the description in the diagram. Swapping sensors can cause an improper functioning of the control system. To the right from the installation diagram, temperatures measured by the sensors are displayed. T1 corresponds to the temperature measured by sensor no.1, T2 to the temperature measured by sensor no.2, etc. The controller has been designed in such a way that all four temperature sensors needn't be installed. Only those sensors should be installed which are necessary for controlling the system. When a sensor necessary for controlling the system is not installed, or becomes damaged, message reading "Err" will appear on the screen next to the sensor's symbol (as shown in the example in picture 2 for sensors T2 and T4), indicating a lack or damage of the sensor. In such a case, all external devices will be switched off and the controller will sound a discontinuous alarm sound. When a non-required sensor is not connected to the controller, the controller will not sound an alarm, and the screen will display horizontal lines where normally temperature is displayed (as shown in picture 2 for the temperature sensor T3). Below the displayed temperatures, in the right bottom corner of the screen, the momentary collector power, calculated by the controller, is displayed. When the collector pump is switched off or the return sensor is switched off (usually it is sensor T3), horizontal lines are displayed in place where the power value is usually displayed. For installation types number 8 and 9, the momentary power calculation option is unavailable.

3.2 Selecting installation type




The controller allows for twelve different solar collector installation configurations. A detailed description of these installation systems is presented in paragraph 6. A short description of all installation systems is presented in chart 2:

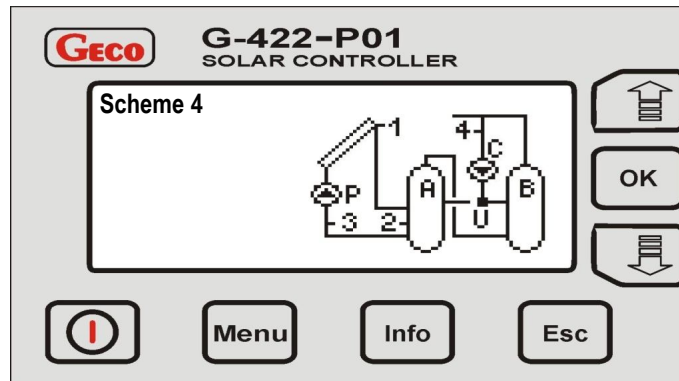


In order to select the desired collector installation configuration, select the main menu by pressing . The LCD screen will display the main menu list, as shown below in picture 3:









Pic. 3. Screen display of the main menu.

Next, using the buttons  or , select the option „Installation type selection”, confirm the selection by pressing . After entering the mode of selecting the installation type, the screen will display an installation type diagram, along with its number, as shown in picture 4.










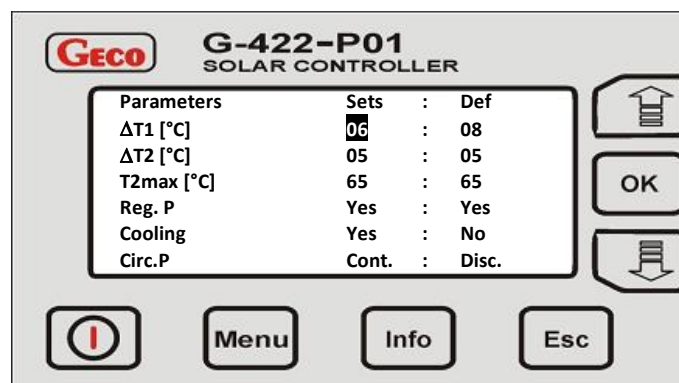
Pic. 4. Display on the LCD screen when selecting a collector installation configuration type.

Using buttons  and  select the desired configuration of the heating system and confirm your selection by pressing . The selected installation type will be stored in the controller's memory and will be always loaded after switching the controller on. After pressing , the controller will switch to the mode of editing parameters. If parameters are to be changed, follow the instructions from paragraph 3.5. In order to exit the mode of editing parameters, press .





The controller will switch to the submenu "Parameters". In order to return to the main screen, press  twice, returning to the main screen through the main menu.

3.3 Editing parameters





In order to select the option of changing the controller's parameters, go to the main menu by pressing . Next, using buttons  or , select the option „Parameters”, confirm the selection by pressing . Using buttons  and , select the "Controller parameters" option. By pressing  the controller will enter the option of editing controller parameters, as shown in picture 5.



Pic. 5. Screen display when editing the controller's parameters. (The parameter selected to be edited in this picture is parameter ΔT1)

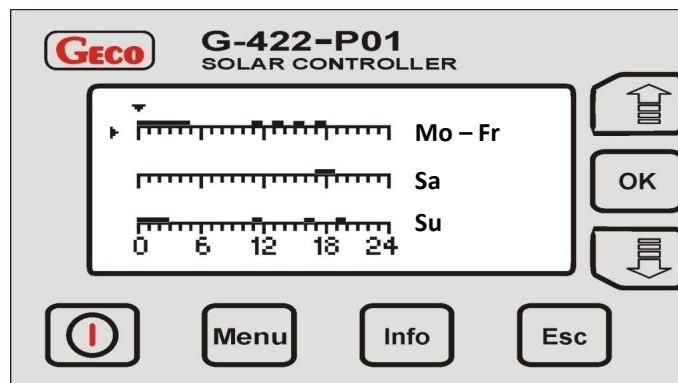
When the controller is in the mode of editing control parameters, change the selected parameter using buttons  and . When the selected parameter is changed, you can move on to edit the next parameter by pressing . When all desired parameters are changed, by pressing  twice, the controller will return to the main screen, through the main menu.

3.4 Setting hours of operation for external devices





In order to select the option of changing the controller's parameters, go to the main menu by pressing **Menu**. Next, using buttons  or , select the option „Parameters“, confirm the selection by pressing **OK**. The screen will display the menu of editing various parameters. Using buttons  and , select the "Time programme C" option. By pressing **OK** the controller will enter the option of editing hours of operation, as shown in picture 6.

The mode of setting hours of operation of external devices let's you set the time for weekdays (Monday to Friday), and separately for Saturday and for Sunday. A horizontal arrow, located above the scale at the top of the screen, indicates the time period being currently edited. In order to activate or deactivate the operation of an external device for a given hour, press **OK**. If a device is programmed to operate in the given hour, it will be indicated on the time scale with a white space. If a device is not supposed to operate in a given hour, erase the white space on the time scale by pressing



OK.

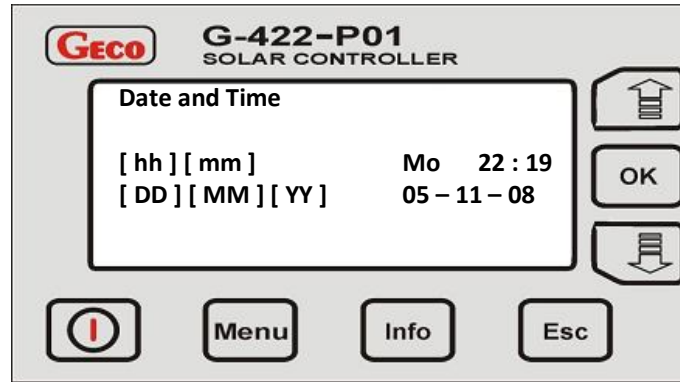


Pic. 6. LCD screen display during while editing hours of operation for external devices.





The selected hour can be changed using buttons  and . Pressing and holding the arrow buttons will move the arrow further without the need to keep continuously pressing the button. In order to select the hours of operation for Saturday or Sunday, keep pressing  or , until the horizontal arrow on the left side of the screen moves to the lines indicating those days. After setting the hours of operation for all required days, changes need to be stored in the controller's memory, do so by pressing **Esc**. After storing the changes, the controller will automatically switch to the „Parameters“ menu. In order to return to the main screen through the main menu, press **Esc** twice.

3.5 Setting the current date and time





In order to select the desired collector installation configuration, select the main menu by pressing **Menu**. Next, using the buttons  or , to select the option „Date and time“, confirm the selection by pressing **OK**. The screen will display the option of editing date and time, as shown in picture 7:

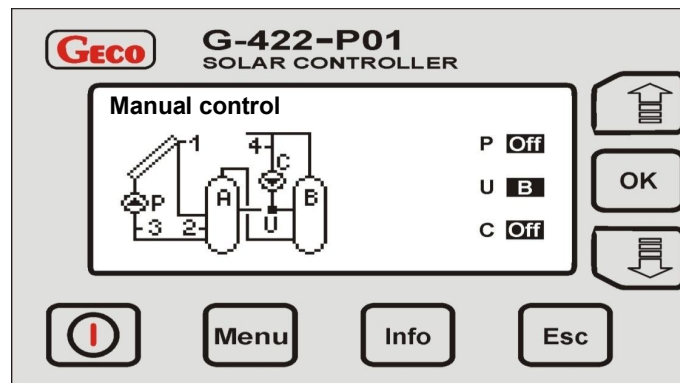


Pic. 7. LCD display showing the date and time change screen

Use buttons  and  to select parameters. Changing the selected parameter is possible by pressing . In order to return to the main menu and store the set date, press .







3.6 Manual control of external devices

In order to select the desired collector installation configuration, select the main menu by pressing . Next, using the buttons  or  to select the „Manual Control” option, confirm the selection by pressing . The LCD screen will display an installation diagram, and (on the right side) letters representing devices in the diagram will appear, along with the state of the external device, as shown in picture 8:










Pic. 8. LCD screen display in the manual control option.

Depending on the selected installation configuration, the controller controls one to three external devices. Each device can be switched on and off individually, and its actual state is always visible on the installation diagram, and on the right side on the screen, next to the letters representing the devices.

Switching devices on or off is done using buttons ,  and , located on the right side of the controller.. Descriptions of the devices and their state displayed on the screen are linked with the mentioned buttons. In the example screen display from picture X, controlling pump P is done using  button, changing on the direction of valve U is done using , and controlling pump C is done using  button.

In order to return to automatic control, press  twice, returning to the main screen.

3.7 Language selection

In order to select the desired collector installation configuration, select the main menu by pressing . Next, using the buttons  or  to select the „Language” option, confirm your selection by pressing . After entering the language selection option, the screen will display the available language versions stored in the controller. Using the button  or , select the desired language, and confirm your selection by pressing . The selected language will be stored in the controller's memory, and the controller will switch to the main menu list.

Esc

If you don't want to change the current language version, return to the main menu by pressing

Esc

4. Description of control parameters

$\Delta T1$ – Basic control coefficient. This parameter determines the condition for switching the collector pump on and off. If the sum of parameter $\Delta T1$ and the temperature in tank T2 exceeds the value of temperature in the tank located on T1 collector, the collector pump will switch off. When this sum is lower from the value of T1, collector pump will switch on. Additionally, in order to guarantee a stable work of the heating system, hysteresis control has been implemented, with a value of 2°C.

$\Delta T2$ – Auxiliary control coefficient. This parameter is used to control more complex systems, therefore its description is given in paragraph 6, only for selected collector installation configurations.

T2max – Parameter linked with sensor T2 located in the tank. Parameter determines the maximum acceptable temperature measured by sensor T2, if exceeded, the collector pump switches off.

T4max - Similarly to the auxiliary control coefficient described above, this parameter is used in more complex installation types. Its description is given in paragraph 6 for selected installation types only.

Reg. P Regulation of the main collector pump. If an option of regulating the collector pump is selected in the parameters, the controller will regulate the collector pump's speed. If the option of regulating the collector pump's speed is switched off, the controller will control the pump on an on/off basis.

Cool. An option allowing for cooling the collectors. When this option is switched on, the controller will automatically switch the collector pump on, in order for the temperature of water in the tank to fall below 35°C. This option is time-related and works between midnight and 6 A.M.

P. circ. Pump circulation option. This option regards installation types no. 2 and 10 only. When the parameter is set to "continuous", the circulation pump will be switched on during hours set in the "Time programme" menu. If the option is set to "non-continuous", the circulation pump will operate in hours set in the "Time programme" menu, however, it will operate in cycles, switching on and off for 10 minute intervals.

Power Parameter used in installation systems described in paragraph 6.1 The controller calculates the collector power and switched off the boiler or the heater, if the calculated power exceeds the power value set as the controlling parameter. When the collector power is below the set value, the control of the boiler/heater output takes place as described in paragraph 6.1.

5. Calculating momentary collector power

The controller has an additional function of calculating momentary collector power. Collector's momentary power can be calculated for all installation configurations, except systems no. 8 and 9. In order to make calculation of momentary power possible, installation of sensor T3 is necessary, as well as a correct programming of the „Heating medium“ and „Flow / rotameter“ parameters, located in the "Parameters" menu.

Heating medium: This parameter defines the solidification temperature of the heating medium. In order to determine this parameter, contact your

installation provider. In order to set this parameter, enter the main menu by pressing

Menu



, then using button

"Control parameters" option and press

OK



. In the control parameters menu, using the button

medium" and confirm your selection by pressing

OK



. Using button

temperature of the fluid and store this value into the controller's memory by pressing

OK

without making and changes, press

Esc

Esc

. In order to return to the main screen, press

Flow / rotameter: In order to correctly determine this parameter, connect a rotameter into the installation. In this option, the O1 output is switched off so that collector pump works with maximum efficiency. The value for the flow through the rotameter needs to be set in the "Flow / rotameter" option and stored into the controller's memory. The procedure of setting the "Flow / rotameter" parameter is done exactly the same way as with the "Heating medium" parameter described above. In the "Control parameters" menu, select the "Flow / rotameter" option, instead of the "Heating medium" option.

When sensor T3 is not connected, or the collector pump is not working, The LCD screen will display horizontal lines in place where the power value would be displayed. Momentary power is calculated and displayed only when the collector pump is working.

6. Controller's installation systems

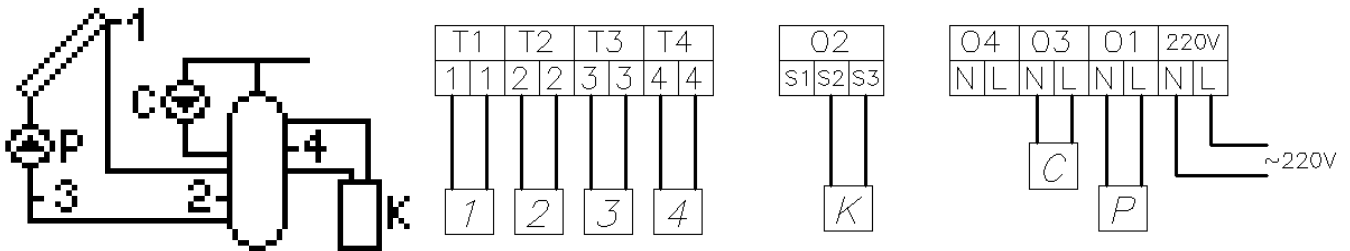
6.1 Basic system of Hot water heating system – controlling the solar collector pump, circulation pump and the boiler

Controlling the collector pump P is done with the use of temperature sensor T1, and sensor T2, placed in the tank. When the sum of temperature T2 and the control coefficient $\Delta T1$ exceeds the value of temperature T1, the pump switches off, and will remain switched off until the sum of $T2 + \Delta T1$ falls below the value of T1. In order to prevent the system from oscillating on and off when the sum $T2 + \Delta T1$ is equal to the temperature T2, hysteresis control has been implemented, with the value of 2°C. When the option of controlling the rotary speed of the collector pump is switched on, the pump is switched to its maximum speed only when the difference between the values of T1 and $T2 + \Delta T1$ exceeds 5°C. When this difference decreases, the pump slows down and reaches its minimum speed when the difference $T1 - (T2 + \Delta T1)$ is equal to 0. A description of the function of cooling the collectors and the work of the controller when this function is active is presented in paragraph 4 in the description of the "Cooling" parameter.

Boiler K operates only during the hours set in the „Time programme K" option, in the „Parameters" menu. The control of boiler K is done with the use of sensor T4. When temperature T4 is lower than temperature T4max, output O2 is switched on, controlling pump K. When temperature T4 falls below the T4max value, output O2 is switched off and the boiler is switched off.

Additionally, controlling collector power calculated by the controller is implemented in this system. When collector power is above the power value set in the control parameters, O2 output is switched off and remains this way until collector power is lower than the value set in the parameters. In order to prevent the O2 output from oscillating on and off when temperature T4 is equal to the T4max value, hysteresis control has been implemented, with the value of 4°C. Sensor T3 is not involved in control and may be disconnected. After disconnecting this sensor, horizontal lines will be displayed in place of the temperature value, and collector power will not be calculated.

Circulation pump C can operate in two modes, continuous and non-continuous. In the continuous mode, the pump operates the whole time it is programmed to operate in the "Time periods" menu, in the control parameters. If the circulation pump C is to operate in the non-continuous mode (10 minute intervals of being switched on and off) during the set hours, mode of operation should be set to non-continuous work in the parameters.



Pic. 9. Schematic and electric diagram of installation no. 1

Parameter	Range	Default settings
$\Delta T1$ [°C]	5 – 15	8
T2max [°C]	10 - 85	65
T4max [°C]	10 - 85	50
Pump regulation	Yes / No	Yes
Cooling	Yes / No	No
Circulation pump	Continuous / Non-continuous	Non-continuous
Power [W]	100 – 3000	1000

List of parameters for diagram no. 1.

6.2 Hot water heating system – controlling the solar collector pump, circulation pump and the heater.

Controlling the collector pump is **analogous** to that in the system no. 1 described in paragraph 6.1. Controlling the circulation pump is **analogous** to that in the system no. 1 described in paragraph 6.1. Controlling the electric heater is **analogous** to that in the system no. 1 described in paragraph 6.1. Fig. 10. Schematic and electric diagram for installation no. 2

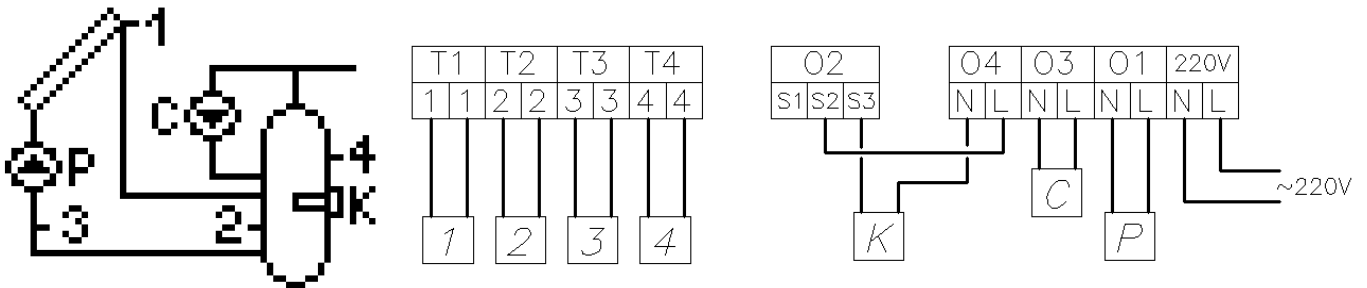


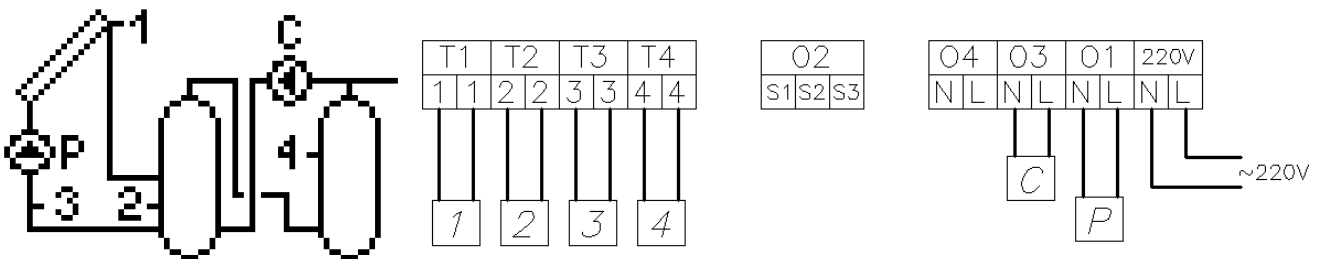
Fig. 10. Schematic and electric diagram for installation no. 2

Parameter	Range	Default settings
$\Delta T1$ [°C]	5 – 15	8
T2max [°C]	10 - 85	65
T4max [°C]	10 - 85	50
Pump regulation	Yes / No	Yes
Cooling	Yes / No	No
Circulation pump	Continuous / Non-continuous	Non-continuous
Power [W]	100 – 3000	1000

List of parameters for diagram no. 2

6.3 A system of two boilers, allowing for additionally heating the boiler with solar energy

Controlling the collector pump is **analogous** to that in the system no. 1, described in paragraph 6.1. Controlling pump C is done with the use of sensors T2 and T4, and an auxiliary control coefficient $\Delta T2$. When the sum of temperature T4 and the auxiliary control coefficient $\Delta T2$ is below the value of temperature $\Delta T2$, output O3 is switched on, controlling pump C. When the sum of T4 + $\Delta T2$ is above the temperature measured by sensor T2, pump C switches off. In order to prevent the pump C from oscillating on and off when the sum of T4 + $\Delta T2$ parameters is equal to temperature T2, hysteresis control has been implemented, with the value of 2°C. Similarly to the previous systems, sensor T3 is used to calculate collector power and is not necessary. If sensor T3 is disconnected, the controller will not calculate momentary power of the collector.



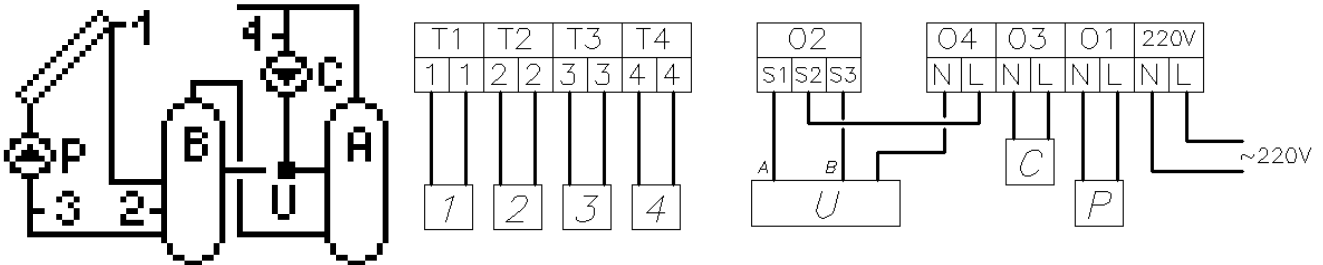
Schematic and electric diagram of installation no. 3

Parameter	Range	Default settings
$\Delta T1$ [°C]	5 - 15	8
$\Delta T2$ [°C]	5 - 15	8
T2max [°C]	10 - 85	70
T4max [°C]	10 - 95	65
Pump regulation	Yes / No	Yes
Cooling	Yes / No	No

List of parameters for diagram no. 3

6.4 A system of two heaters, allowing for additionally heating the return circulation with solar energy

Controlling the collector pump is analogous to that in the system no. 1, described in paragraph 6.1. Controlling valve U is done with the use of sensors T2 and T4, and an auxiliary control coefficient $\Delta T2$. When the sum of temperature from sensor T4 and the auxiliary control coefficient $\Delta T2$ is below the value of temperature T2, valve U is redirected to tank A. When the value of sum $T4 + \Delta T2$ exceeds temperature T2, the valve is redirected to tank B. In order to prevent the valve from oscillating on and off when the sum of $T4 + \Delta T2$ parameters is equal to temperature T2, hysteresis control has been implemented, with the value of 2°C . Sensor T3 is necessary for calculating collector power, but it is not required in order to control the installation. The controller in this case will not display the power on the screen. Controlling the circulation pump is **analogous** to that in the system no. 1 described in paragraph 6.1



Schematic and electric diagram of installation no. 4

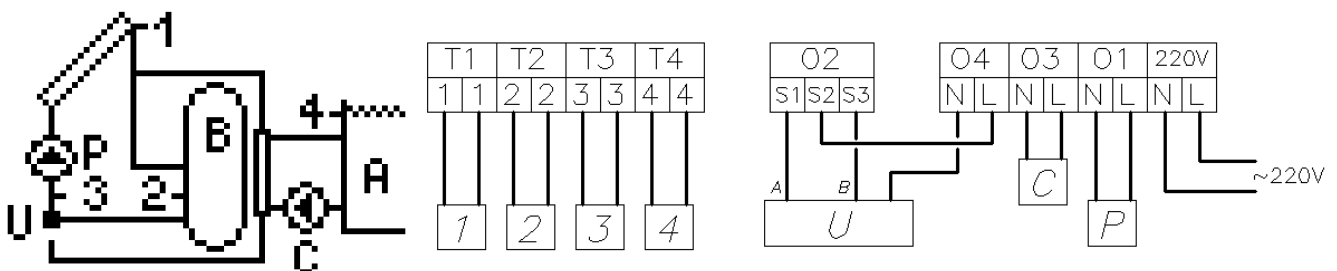
Parameter	Range	Default settings
$\Delta T1$ [$^{\circ}\text{C}$]	5 - 15	8
$\Delta T2$ [$^{\circ}\text{C}$]	5 - 15	5
$T2\text{max}$ [$^{\circ}\text{C}$]	10 - 85	65
Pump regulation	Yes / No	Yes
Cooling	Yes / No	No
Circulation pump	Continuous / Non-continuous	Non-continuous

List of parameters for diagram no. 4

6.5 A system of priority heating of hot water and swimming pool water heating, controlling the work of the swimming pool filtration system's pump

Heating using boiler B collectors takes place analogously to that in system no. 1 described in paragraph 6.1. The second heat receiver is swimming pool A. If the set temperature for boiler B is achieved, or $T2\text{max}$ temperature is exceeded, the controller automatically starts heating water in the swimming pool A, **switching off** the O2 output and redirecting valve U to the swimming pool A. When temperature in swimming pool A is achieved, the controller redirects the valve back in the direction of boiler B and switches off the collector pump. The controller switches the pump off also when temperatures T2 and T4 exceed, respectively, maximum values of $T2\text{max}$ and $T4\text{max}$. The swimming pool pump C is time controlled and operates in hours indicated in the "Time periods C" option, in the "Control parameters" menu. Swimming pool pump C is always switched on when the pool water is being heated. When the controller is heating water in swimming pool A, once every hour, for a duration of 5 minutes, the controller forces a switch-off of the collector pump in order to check the conditions in heater B and switch control back to priority tank B, if it is necessary to heat the water in it.

Similarly to the system described above, sensor T3 is not necessary to control the system, but without it, the controller will not calculate the collector's power. In order to control heating of swimming pool water, auxiliary control coefficient $\Delta T2$ has been introduced. When water in the tank is being heated, controlling takes place with the use of sensors T1 and T2, and control coefficient $\Delta T1$. In case of heating swimming pool water, control takes place with the use of sensors T1 and T4, and the auxiliary coefficient $\Delta T2$.



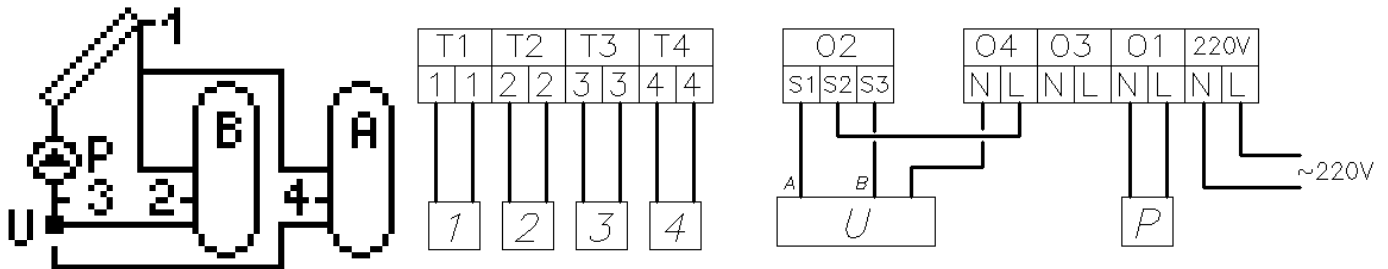
Schematic and electric diagram of installation no. 5

Parameter	Range	Default settings
$\Delta T1$ [$^{\circ}\text{C}$]	5 - 15	8
$\Delta T2$ [$^{\circ}\text{C}$]	5 - 15	5
$T2\text{max}$ [$^{\circ}\text{C}$]	10 - 85	65
$T4\text{max}$ [$^{\circ}\text{C}$]	10 - 50	28
Pump regulation	Yes / No	Yes
Cooling	Yes / No	No

List of parameters for diagram no. 5

6.6 A system of two solar heaters, with heating priority for heater B

Heating using heater B collectors is **analogous** to that in the system no. 1, described in paragraph 6.1. When a given temperature is reached in heater B, or temperature $T2_{max}$ is exceeded, the controller automatically starts heating water in tank A, **switching on** output O2 and redirecting valve U in the direction of heater A. When temperature in tank A is reached or maximum temperature $T4_{max}$ is exceeded, the controller switches the valve back in the direction of tank B and switches off the collector pump. The controller switches the pump off also when temperatures T2 and T4 exceed, respectively, maximum values of $T2_{max}$ and $T4_{max}$. When the controller is heating water in tank A, once every hour, for a duration of 5 minutes, the controller forces a switch-off of the collector pump in order to check the conditions in heater B and switch control back to priority tank B, if it is necessary to heat the water in it. Sensor T3 is used to measure the momentary power of the collector. It is not necessary in the system, but its absence will result in power not being displayed on the screen. Absence of the remaining sensors will cause the alarm to switch on.



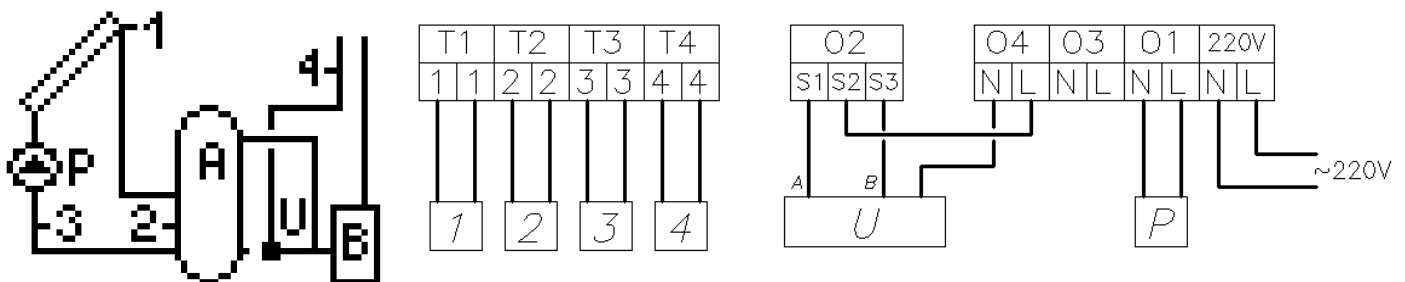
Schematic and electric diagram of installation no. 6

Parameter	Range	Default settings
$\Delta T1$ [°C]	5 - 15	8
$T2_{max}$ [°C]	10 - 85	65
$T4_{max}$ [°C]	10 - 70	65
Pump regulation	Yes / No	Yes
Cooling	Yes / No	No

List of parameters for diagram no. 6

6.7 A system allowing the collectors to cooperate with a buffer accumulator used to cooperate with central heating

Controlling the collector pump is **analogous** to that in the system no. 1, described in paragraph 6.1. Pump K operates with the use of temperature sensors T3 and T4, and an auxiliary control coefficient $\Delta T2$. When the sum of temperature T4 and the auxiliary control coefficient $\Delta T2$ is below the value of temperature T3, pump K is switched on. When the sum of $T4 + \Delta T2$ is above the temperature measured by sensor T3, pump K switches off. In order to prevent the system from an oscillatory on-switching of pump K when the sum of $T4 + \Delta T2$ parameters is equal to temperature T3, hysteresis control has been implemented, with the value of 2°C. In this system, calculating collector power is not possible because sensor T3 measures the temperature of the return from the boiler. Sensor T3 is used to measure the momentary power of the collector. It is not necessary in the system, but its absence will reflect in that power will not be displayed on the screen. Absence of the remaining sensors will cause the alarm to switch on.



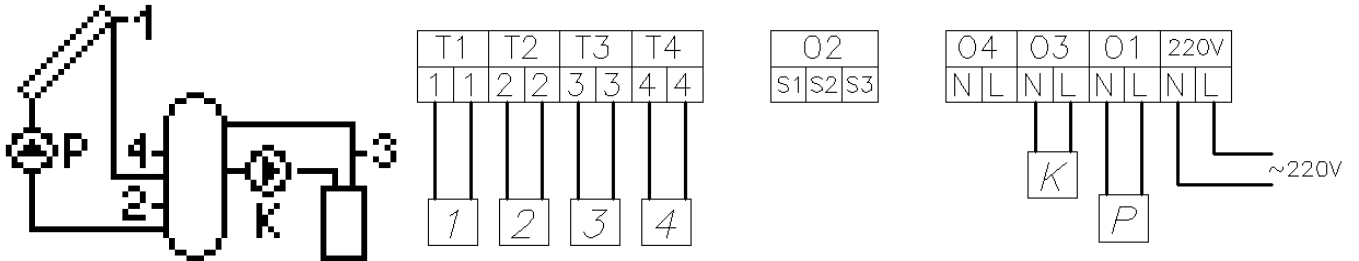
Schematic and electric diagram of installation no. 7

Parameter	Range	Default settings
$\Delta T1$ [°C]	5 - 15	8
$\Delta T2$ [°C]	5 - 15	5
$T2_{max}$ [°C]	10 - 85	65
Pump regulation	Yes / No	Yes
Cooling	Yes / No	No

List of parameters for diagram no. 7

6.8 System of heating hot water with solar collectors. Additionally, a system activating the heating of hot water after the boiler achieves a required temperature

Controlling the collector pump is **analogous** to that in the system no. 1, described in paragraph 6.1. Pump K operates with the use of temperature sensors T3 and T4, and an auxiliary control coefficient $\Delta T2$. When the sum of temperature T4 and the auxiliary control coefficient $\Delta T2$ is below the value of temperature T3, pump K is switched on. When the sum of T4 + $\Delta T2$ is above the temperature measured by sensor T3, pump K switches off. In order to prevent the system from an oscillatory on-switching of pump K when the sum of T4 + $\Delta T2$ parameters is equal to temperature T3, hysteresis control has been implemented, with the value of 2°C. In this system, calculating collector power is not possible because sensor T3 measures the temperature of the return from the boiler.



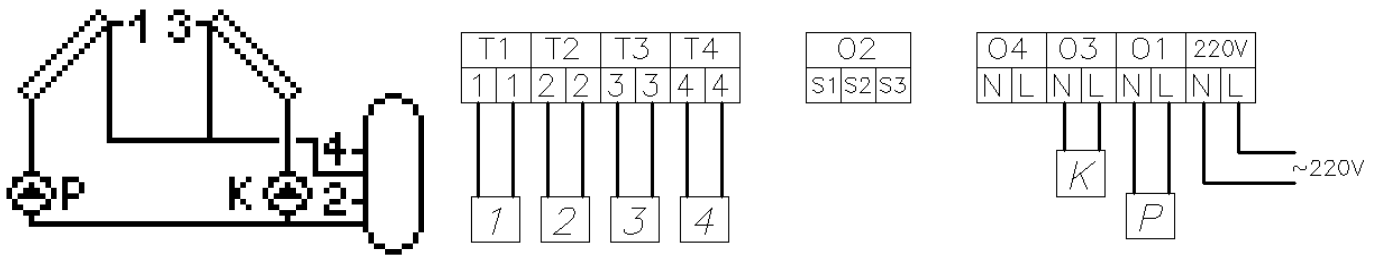
Schematic and electric diagram of installation no. 8

Parameter	Range	Default settings
$\Delta T1$ [°C]	5 - 15	8
$\Delta T2$ [°C]	5 - 15	5
T2max [°C]	10 - 85	65
T4max [°C]	10 - 35	65
Pump regulation	Yes / No	Yes
Cooling	Yes / No	No

List of parameters for diagram no. 8

6.9 A system allowing to control pumps operating with collector batteries situated on various directions

Controlling the collector pump is **analogous** to that in the system no. 1, described in paragraph 6.1. Controlling pump K is done with the use of sensors T2 and T3, and the basic control coefficient $\Delta T1$. When the sum of temperature from sensor T2 and the control coefficient $\Delta T1$ is below the value of temperature T3, output O3 is switched on controlling pump K, which is switched on. When the sum of T2 + $\Delta T1$ exceeds the temperature T3 value, pump K is switched off. In order to prevent the valve from oscillating on and off when the sum of T2 + $\Delta T1$ parameters is equal to temperature T3, hysteresis control has been implemented, with the value of 2°C. In this system, calculating collector power is not possible because sensor T3 measures the temperature of the second collector battery.



Schematic and electric diagram of installation no. 9

Parameter	Range	Default settings
$\Delta T1$ [°C]	5 - 15	8
T2max [°C]	10 - 85	70
Cooling	Yes / No	No

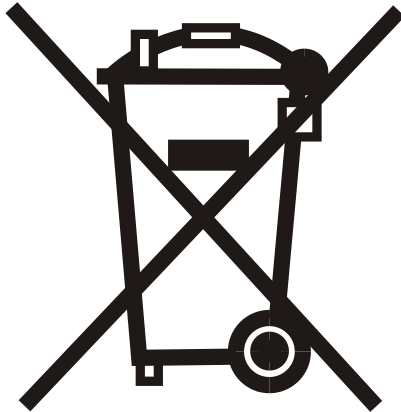
List of parameters for diagram no. 9

7. Sensors' error alarm

The controller features temperature sensors' connection control and short circuit control. If a sensor becomes damaged, a cable is broken or the sensor is disconnected, the controller will alert you about this. During the alarm, all outputs are disconnected, and additionally, when the controller is displaying the main screen, sound alarm signalization is on. In the alarm mode, it is possible to look through the menu, configure parameters, and control external devices manually. Information that a sensor is sending an alarm is displayed on the main screen. Instead of the temperature value, next to the sensor label, the message "Err" is displayed. When the controller reports a sensor alarm, you should inspect the installation in regard to correct assembly and sensor connection.

8. Information regarding labelling and disposal of worn out electric and electronic equipment

ATTENTION!



The symbol found on the product or its packaging indicates selective disposal of worn out electric and electronic equipment. What this means is that this product should not be thrown away with other household waste. Proper disposal of old and worn out electric and electronic equipment will help avoid potentially unfavourable effects on the environment and human health.

The responsibility of selective disposal of worn out equipment lies with the user, who should return it to a proper facility collecting worn out equipment.



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