GECO®

SERVICE & OPERATING INSTRUCTIONS
FOR AUTONOMOUS CONTROL UNIT

GH19SA

TO CONTROL SYSTEMS
WITH SOLAR COLLECTORS

version 01a

Please read these instructions very carefully before connecting and starting any of our equipment. If in doubt, please contact our company between 8:00 a.m. - 4:00 p.m.

Note!!! The last updating of the manual is marked at the bottom of each of the following pages. Please always use the latest version of the manual which you may obtain free of charge by mail upon request.

CONTENTS

1. Controller Description Summary

The GH19SA Controller is designed to control the solar collector water heating systems. The Controller consists of two modules: room panel with LCD graphic display and keys and external devices control module. The modules are connected by means of a multicore cable in RS 485 communication standard. This allows to install the control module near the water tank and pumps, while the user panel with graphic display can be installed in a convenient place within the house or apartment. The Controller enables automatic control of up to 24 different types of the most common water heating systems incorporating solar collectors. The device is equipped with 5 temperature sensor inputs, and 5 relay and TRIAC outputs. It allows to automatically control even the most complex systems with many pumps and valves.

2. Connections

Mount both parts of the Controller in the chosen places and then connect them with the RS 485 cable. The cable should be terminated at one end with an RJ45 connector – plug this connector into the control module jack marked "LINK". The other end of the cable should have conductors terminated with sleeves used to connect the cable to the terminals available on the back side of the room panel with LCD display. Fix the conductors to the module as shown below in Figure 2.1 (see section 2.1 for description of the connection).

Fig. 2.1. View of the room panel back side where conductors are connected according to the description found in section 2.1.

2.1 Clamping Sleeves on the Other End of the Connector

- Clamp the *brown* conductor in the first sleeve from the left.
- Clamp the *white/brown* conductor in the second sleeve from the left.
- Conductors *white/blue, white/green, white/red*: twist and clamp together in the third sleeve from the left (power – ground).
- Conductors *blue, green, red*: twist and clamp together in the fourth sleeve from the left (power +12V).

NOTE: The above described order of conductor connection should follow the order of the RJ45 connector termination described in section 2.2. Otherwise the connection will be incorrect and may cause damage to the modules.

2.2 Description of Conductor Termination in the RJ45 Connector, Starting From Top (Fig. 2.2)

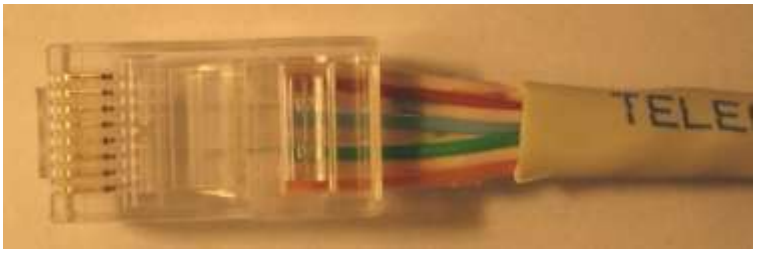


Fig. 2.2. Photo shows termination of the RJ45 connector according to the below description.

- White/brown
- Brown
- White/blue
- Blue
- White/green
- Green
- White/red
- Red

When the modules are connected with the RS 485 cable, you can start connecting the temperature sensors and external devices (pumps and valves). The control module (with TRIACs and relays) is supplied by the 230VAC mains power. Connect the mains power to the relay module using the terminals marked "Un". Connect temperature sensors to the module according to the descriptions provided in tables in section 6. Please note, that the number of sensors depends on the type of the controlled system. Unused sensor inputs can be left without connection. Connect external devices to the O1 – O5 outputs, according to the descriptions of the individual system diagrams that can be found in tables in section 6. Description of input and output parameters are provided in table 2.1:

Input/output	**Description**
Un	Controller power connection: 230VAC
O1	TRIAC input, controlled 0–230V / Current rating: Imax=1A
O2	TRIAC input, controlled 0–230V / Current rating: Imax=1A
O3	Live relay output: 0 / 230V, Current rating: Imax=2A
O4	Live relay output: 0 / 230V. Current rating: Imax=2A
O5	Switchable dry contact relay output, Current rating: Imax=2A
T1, T4	Temperature sensor inputs – platinum sensors PT 1000
T2, T3, T5	Temperature sensor inputs – sensors NTC 10KΩ.

Table 2.1 Description of controller inputs and outputs.

3. Function Keys – Main Screen

3.1 On/Off Function Key - F1

After completing proper connection of the modules with the RS 485 cable, connecting sensors and external devices, you can connect the set to the mains power 230VAC. When the power is on, the room panel turns into one of the two modes: Standby mode or Auto operation mode. The operation mode activated after turning the power on depends on the mode status when the Controller was last time disconnected from power supply. The room panel memorizes the previous operation mode to protect the system in case of an unexpected power down. When the power is restored, and the Controller operated previously in the Auto mode, it will automatically return to that mode of operation. When turned on for the first time, the Controller enters the Standby mode. In the Standby mode, the LCD display shows the name of the Controller, the Geco logo, and the currently installed software version. When turned on in the Auto mode, the display shows diagram of the system with animated devices operating within the system, temperature values measured by sensors, and additional information. Description of the information shown on the display is given in Figure 3.1.

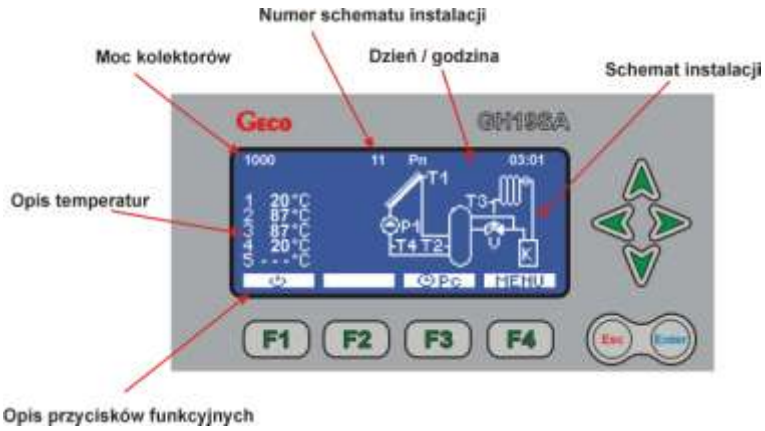


Fig. 3.1. Description of information shown on the display in Auto mode.

To switch to the Auto mode when the Controller is in the Standby mode, or to return to the Standby mode when its in the Auto mode, press the F1 key.

3.2 Heater/Boiler Pump Operating Hours Selector Key - F2 .

To select the heater/boiler pump operating hours option (depending on the system diagram), press the F2 key (when in one of the main screens). The Controller enters the operating hours edition option and displays the image shown in Figure 3.2.

Fig. 3.2. Image shown on the LCD display during operating hours setting for external devices.

The external devices operating hours setting mode allows to set time separately for week days (Monday-Friday) and for Saturday and Sunday. The arrow shown above the scale at the top of the screen indicates the hours range active for edition. To activate or deactivate an external device at specific hour, press the F4 key. If a device is set to operate during the selected hour, it will be indicated on the hour scale with a white field. If you want to turn the device off for the selected hour, use the F4 key to turn off the white field above the hour scale. You can change to the selected hour using the ◄ or ► keys. You can change to the selected day of week using the ▼ or ▲ keys. When you complete setting of operating hours for all days, exit the operating hour selection menu option by pressing the Enter or Esc keys. The changed device operating hours are automatically saved during setting of the individual hours. When the changes are completed, the Controller will automatically switch to the main screen showing the system diagram.

3.3 Circulation Pump Operating Hours Selector Key - F3 .

Setting the operating hours for the circulation pump is performed in the same manner as for the heater/boiler pump. When setting the operating hours, use the same procedure as described in section 3.2 above.

3.4 MENU Key - F4.

You can use the F4 key to enter the Controller MENU system. When navigating through the menu options, you can always return to the main screen by pressing the Esc key. After entering the Controller menu, the LCD display will show the below screen:

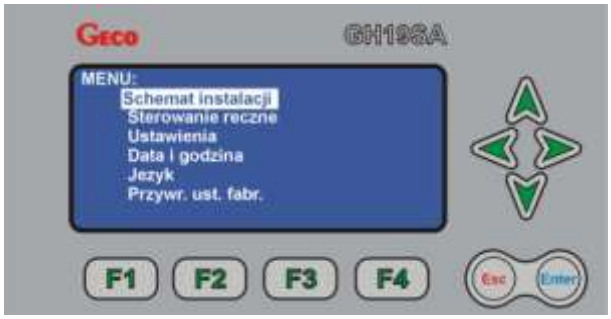


Fig. 3.2. LCD display screen shown after entering the Controller MENU.

Using the ▼ and ▲ keys, you can navigate through the menu by highlighting the selected options. Press the Enter key to activate a selected option.

4. MENU Description

4.1 System Diagram Selection

The Controller allows to control thirteen different configurations of systems with solar collectors. Detailed descriptions of the system diagrams is given in section 5. To select a desired configuration of a system with solar collectors, move to the main menu by pressing the F4 key (when the Controller is in the Auto mode – one of the main screens is displayed). Then, after highlighting the "System Diagram" option using the ▼ or ▲ keys, select the option by pressing the Enter key. After entering the system diagram selection mode, the screen will display a drawing with the system diagram and its number, as shown Figure 4.1.

Fig. 4.1. Image shown in the LCD display during selection of the solar collector system diagram configuration.

Use the ◄ or ► keys to select the system configuration, and confirm by pressing the Enter key. The selected diagram will be stored in the Controller memory and will always be loaded after the Controller is turned on. After pressing the Enter key, the Controller returns to the main menu list. To return to the main screen, press the Esc key. When the system configuration selection option is active, and after viewing all diagrams, if you want the Controller to return to the main screen without saving changes, you can return to the main menu by pressing the Esc key, and then return to the main screen by pressing the Esc key again. During selection of the system diagram the Controller turns all outputs off and suspends automatic control of the external devices. Exiting the system diagram selection option causes the Controller to restore automatic control of all the connected external devices.

4.2 Manual Control

To activate manual control of devices, enter the main menu by pressing the F4 key. Then, after highlighting the "Manual Control" option using the ▼ or ▲ keys, select the option by pressing the Enter key. The LCD display will show the system diagram screen with information on temperatures measured by sensors, and the bottom part of the screen will show letters that correspond to the individual devices visible on the diagram (Fig. 4.2). Device activation will be indicated by flashing of the device icon on the system diagram. When the device is switched off, icon flashing stops.

Fig. 4.2. Display screen shown in the manual control mode.

Depending on the selected system configuration, the Controller can operate from 2 up to 4 external devices. Each device can be separately turned on and off, and its current status is always shown in the system diagram. You can turn the devices on and off by pressing the F1, F2, F3, and F4 keys located below the LCD display. To return to the Auto control mode, press the Esc key twice, and the Controller will return to the main screen.

4.3 Settings

4.3.1 Control Settings

To activate the control settings modification option, enter the main menu by pressing the F4 key. Then, after highlighting the "Settings" option using the ▼ or ▲ keys, select the option by pressing the Enter key. The screen will show the settings selection menu. Using the ▼ or ▲ keys, highlight the "Control Settings" option – after pressing the Enter key the Controller will enter the control settings editing option and display the screen shown below in Fig. 4.3.

Fig. 4.3. Display screen shown in the control settings editing option.
(The setting highlighted for editing on the screen is the ΔT1 setting)

When the Controller is in the control settings editing option, you can modify the setting using the ◄ or ► keys. After modifying the highlighted setting, you can move to editing another setting by pressing the ▼ or ▲ keys. When all the desired modifications of settings are completed, you can return to the menu by pressing the Enter key, and the changes will be saved in memory. If you want to discard all modifications to the settings (changes will not be saved in memory), use the Esc key to return to the menu. During edition of the settings the Controller turns all the external devices off and suspends automatic control of outputs until

you exit the "Settings" submenu. After exiting the "Settings" submenu the Controller restores automatic control of the external devices.

4.3.2 Sensor Correction

The GH19SA Controller is equipped with two measurement channels (T1 and T4) allowing to connect a platinum temperature sensor PT 1000. To eliminate measurement errors that may occur when long cables between the sensor and the control module are used, the Controller software allows to correct the temperature measured by the T1 and T4 sensors. To enter the T1 and T4 sensor correction option, enter the MENU by pressing the F4 key. Then, using the ▼ or ▲ keys, highlight the "Settings" option, and enter the settings submenu by pressing the Enter key. In the "Settings" submenu, use the ▼ or ▲ keys to highlight the "Sensor Correction" function, and enter the settings editing option by pressing the Enter key. With the ▼ or ▲ keys, you can highlight the sensor T1 or T4 scaling value to be modified. Use the ◄ or ► keys to modify the highlighted value within the range from -10 °C to +10 °C. Then press the Enter key to return to the control screen and to save the modified scaling values. To exit the sensor correction editing option without saving changes, just press Esc. During the PT 1000 sensor correction the Controller turns off all outputs. After exiting the "Sensor Correction" submenu, the Controller automatically returns to the Auto control mode.

4.3.3 Heating Medium

Description of the setting is given in section 8 "Calculating the Collector Performance".

4.3.4 Flow / Rotameter

Description of the setting is given in section 8 "Calculating the Collector Performance".

4.4 Setting Date and Time

To modify the date and time settings, enter the main menu by pressing the F4 key. Then, after highlighting the "Date and Time" option using the ▼ or ▲ keys, enter the option by pressing the Enter key. The LCD display will show the date and time setting screen, as seen in Figure 4.4 below:

Fig. 4.4. LCD display with date and time setting screen.

Use the ▼ and ▲ keys to highlight the setting to modify.

Use the and keys to modify the highlighted setting. Press to return to the main menu and to save the new date and time setting.

4.5 Language Selection

To change the displayed language enter the main menu by pressing the F4 key. Then, after highlighting the "Language" option using the or keys, enter the option by pressing the key. When in the language selection option, the screen will show a list of available language versions stored in the Controller memory. Use the or keys to select the desired language version, then confirm selection by pressing the key.

. The selected language version will be saved in the memory, and then the Controller returns to the main menu. If the Controller should remain operating using current language, press the to return to the main menu. To return to the main screen while in the main MENU, press the key.

4.6 Restoring the Factory Defaults

The factory defaults restore function uses the pre-programmed standard settings to replace the current control setting. The standard settings are listed in table 4.1. After selecting the factory defaults restore function, the Controller will automatically return to the main screen showing the system diagram and temperature values measured by sensors.

Setting	Value
System diagram	1
Language	Polish
Δ1 [°C]	8
Δ2 [°C]	8
T1max [°C]	65
T2max [°C]	65
P1 adjustment	YES
Cooling	NO
Circulation	INTERMIT.
Freezing point [°C]	0
Flow/rotameter	1.0
T1 Correction [°C]	0
T4 Correction [°C]	0

Table 4.1 List of factory default setting values restored after recalling the factory defaults.

5. Description of External Device Control Algorithms

Control Algorithm for Collector Pump P1 for All Diagrams

The collector pump P1 (output O1) is controlled by means of the collector sensor T1, the sensor installed in the tank T2, and the parameter T1max. When the sum of the temperature T2 and the control delta Δ1 exceeds the temperature T1 value (T2 + Δ1 > T1), or when the temperature T2 exceeds the T1max value (T2 > T1max), the pump P1 will be turned off and will remain off until the sum T2 + Δ1 drops below the T1 value (T2 + Δ1 < T1), and the temperature T2 will be lower than the T1max value (T2 < T1max). To protect the system from oscillating on/off switching of the pump, when the sum T2 + Δ1 is equal to the temperature T1 (T2 + Δ1 = T1), the Controller incorporates a control hysteresis of 3 °C. To protect the system from oscillating on/off switching of the pump output O1, when the temperature measured by the sensor T2 = T1max, additional hysteresis was applied of 2 °C. Description of the collector cooling function and control operation, when this function is active, can be found in item 6, in the "Cooling" parameter description. The T4 sensor (except the diagrams from 9 to 12) is used to calculate collector power and its installation is optional. If the T4 sensor is disconnected, the Controller does not calculate instantaneous power of the collector.

Control Algorithm for Collector Pump P2 for Diagrams 8 and 9

The collector pump P2 (output O2) is controlled by means of the collector sensor T4, the sensor installed in the tank T2, and the parameter T1max. When the sum of the temperature T2 and the control delta Δ1 exceeds the temperature T4 value (T2 + Δ1 > T4), or when the temperature T2 exceeds the T1max value (T2 > T1max), the pump P2 will be turned off and will remain off until the sum T2 + Δ1 drops below the T4 value (T2 + Δ1 < T4), and the temperature T2 will be lower than the T1max value (T2 < T1max). To protect the system from oscillating on/off switching of the pump, when the sum T2 + Δ1 = T4, the Controller incorporates a control hysteresis of 3 °C. To protect the system from oscillating on/off switching of the pump output O1, when the temperature measured by the sensor T2 = T1max, additional hysteresis was applied of 2 °C. The P2 pump speed control is identical to the P1 collector pump and is described in section 5.1.

Control Algorithm for Circulation Pump Pc for Diagrams 1–10 and 12

The circulation pump Pc (output O4) can operate in two modes: intermittent and continuous. In the continuous mode, the pump operates continuously during the time periods set in the "Pc Time Program" menu option which can be entered using the F3 function key. If the circulation pump Pc is set to operate in intermittent mode, it operates during the time periods set in the "Pc Time Program" menu option using the "10 minutes on/10 minutes off" program.

Control Algorithm for Pump P2 for Diagrams 6 and 7

The pump P2 (output O2) is controlled using the sensors T2 and T3, the additional control delta Δ2, and the parameter T2max. When the sum of temperature T3 and the control delta Δ2 is lower than the temperature T2 (T3 + Δ2 < T2), and the temperature T3 < T2max, the output O2 is on and activates the pump P2. When the sum of parameters T3 + Δ2 is higher than the temperature measured by T2 sensor (T3 + Δ2 > T2), or the temperature T3 > T2max, the pump P2 will be switched off. To eliminate oscillating on/off switching of the pump P2, when the sum T3 + Δ2 = T2, a control hysteresis of 3 °C was applied. To protect the system from

oscillating on/off switching of the pump P2 output, when the T3 = T2max, an additional control hysteresis was applied of 2 °C. The pump P2 is automatically turned off when the heater G is on (the boiler pump Pk). This ensures that the heater (boiler) is heating the hot tap water in only one tank, which significantly speeds up warming of the hot tap water.

Control Algorithm for Heater G for Diagrams 2, 6 and 8

The heater G operates only during the time periods saved in the menu option "K/G Time Program" which can be opened by pressing the F2 function key. The heater G (output O3) is controlled by means of the control sensor T3. When the control sensor temperature is lower than the maximum temperature T2max (T3 < T2max), the output O3 is on and activates the heater. When the temperature measured by the sensor T3 rises above the value T2max (T3 > T2max), the output O3 will turn off thus deactivating the heater G. To prevent the output O3 from oscillating on/off switching, when the control sensor temperature equal to T2max (T3 = T2max), a control hysteresis of 5 °C was applied.

Control Algorithm for Boiler Pump Pk for Diagram 4

The pump Pk operates only during the time periods set in the menu option "Pk Time Program" which can be opened by pressing the F2 function key while in the main screen. The pump Pk control is carried out using the sensor T3 and the parameter T2max. When the temperature T3 is lower than the temperature T2max (T3 < T2max), the output O3 is on and activates the Pk pump. When the temperature T3 rises above the value T2max (T3 > T2max), the output O3 turns off and the pump is deactivated. To prevent the output O3 from oscillating on/off switching, when the control sensor temperature T4 is equal to T2max (T4 = T2max), a control hysteresis of 5 °C was applied.

Control Algorithm for Boiler Pump Pk for Diagrams 5, 7, and 9

The boiler pump Pk (output O3) is controlled using the temperature sensors T3 and T5, additional control delta Δ2 and the parameter T2max. When the sum of the temperature T3 and the additional control delta Δ2 is lower than the temperature T5 (T3 + Δ2 < T5), and also the temperature T3 < T2max, the pump Pk is on. When the sum of parameters T3 + Δ2 is higher than the temperature measured by sensor T5 (T3 + Δ2 > T5), or the temperature T3 > T2max, the pump Pk will be switched off. To prevent the system from oscillating on/off switching of the pump Pk, when the sum of the parameters T3 + Δ2 = T5, a control hysteresis of 3 °C was applied. And to prevent the system from oscillating on/off switching of the boiler pump output O3 at T3 = T2max, an additional control hysteresis of 2 °C was applied.

Control Algorithm for Gas Boiler G for Diagram 3

The boiler operates only during the time periods set in the menu option "G Time Program" which can be opened by pressing the F2 function key, when the Controller operates in Auto mode and shows the main screen. The gas boiler G control is carried out using the sensor T3 and the parameter T2max. When the temperature T3 is lower than the temperature T2max (T3 < T2max), the output O5 is on and activates the gas boiler. When the temperature T3 rises above the value T2max (T3 > T2max), the output O5 turns off and the boiler is deactivated. To prevent the output O3 from oscillating on/off switching, when the temperature T3 is equal to T2max (T3 = T2max), a control hysteresis of 5 °C was applied.

Control Algorithm for Three-Way Valve V for Diagrams 10 and 13

If the sum of the temperature measured by the sensor T2 and the main delta Δ1 is lower than the temperature measured by the sensor T1 (T2 + Δ1 < T1) and T2 < T1max, the collector pump P1 is on, and the valve U is directing the flow towards the heater 1. When the condition T2 + Δ1 > T1 is fulfilled or when the temperature T1max is exceeded (T2 > T1max), the collector pump goes off provided there are no conditions for pool water heating (heater 2), or remains on while the valve U is redirecting the flow towards the pool heater (tank 2). To prevent oscillating on/off switching of the collector pump output O1, when T2 + Δ1 = T1, a control hysteresis was applied of 3 °C. To prevent oscillating on/off switching of the output O1, when the temperature measured by the tank sensor T2 = T1max, a control hysteresis was applied of 2 °C.

When the condition T2 + Δ1 > T1 is fulfilled or when T2 > T1max, and when the sum of the temperature T5 and the auxiliary control delta Δ1 is lower than the temperature measured by the collector sensor T1 (T5 + Δ2 < T1), and when the temperature measured by the pool sensor T5 is lower than the temperature T2max (T5 < T2max) setting, the valve U switches over to direct flow towards the pool heat exchanger, so the pool water is heated (tank 2). When the pool water (tank 2) is heated to the temperature that fulfils the condition T5 + Δ2 > T1, or when the temperature T5 exceeds the T2max value, the collector pump turns off. To prevent oscillating on/off switching of the collector pump Controller output, when the conditions T5 + Δ2 < T1 or T5 = T2max are fulfilled, a control hysteresis was applied of 3 °C for the first condition and 2 °C for the second, respectively. During the pool water heating (tank 2), when the conditions T2 + Δ1 < T1 and T2 < T1max are fulfilled, thus making it necessary to warm up water in the tank 1, the Controller switches the valve U over to direct flow towards the tank 1, so water is heated in that tank. The pool pump Pb (output O4) is time-controlled and operated in the time periods indicated in the "Pb Time Program" menu option which can be opened using the F2 function key. The pool pump Pb is also always on, when the pool water is heated.

Control Algorithm for Three-Way Valve V for Diagram 11

The valve V is controlled by means of sensors T2 and T3, and an auxiliary control delta Δ2. When the sum of the sensor temperature T3 and the additional control delta Δ2 is lower than the temperature T2 (T3 + Δ2 < T2), the valve V is switched to direct flow towards the hot tap water collector tank. When the value of the sum is T3 + Δ2 > T2, the valve switches over to direct flow towards the buffer tank K. To prevent oscillating switching of the valve, when the sum is T3 + Δ2 = T2, a control hysteresis was applied of 3 °C.

Control Algorithm for Three-Way Valve V for Diagram 12

The valve V is controlled by means of sensors T2 and T3, and an auxiliary control delta Δ2. When the sum of the sensor temperature T3 and the additional control delta Δ2 is lower than the temperature T2 (T3 + Δ2 < T2), the valve V is switched to direct flow towards the tank 1. When the value of the sum T3 + Δ2 is higher than the temperature T2 (T3 + Δ2 > T2), the valve switches over to direct flow towards the tank 2. To prevent oscillating switching of the valve, when the sum is T3 + Δ2 = T2, a control hysteresis was applied of 3 °C.

6. System Diagrams – Parameter Description, Input/Output Configuration

6.1 Basic Diagram – Collector, Heater, Circulation Pump

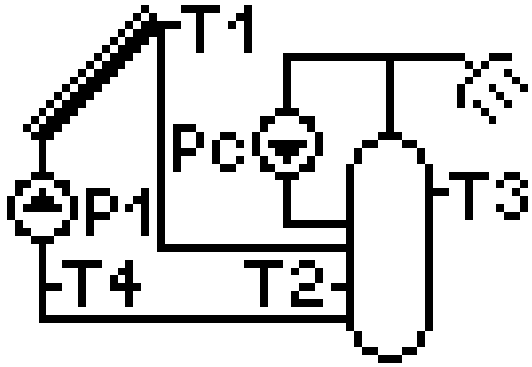


Fig. 6.1. Basic system diagram (collector and heater) with an additional electric heater.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
T1max [°C]	10 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.1 List of parameters for the Figure 6.1 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	---
O3	---
O4	Circulation pump Pc
O5	---
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – (optional)
T4	PT 1000 – sensor used to calculate power (optional)
T5	---

Table 6.2 Description of input/output configuration for Figure 6.1 diagram.

6.2 Basic diagram with additional circulation pump

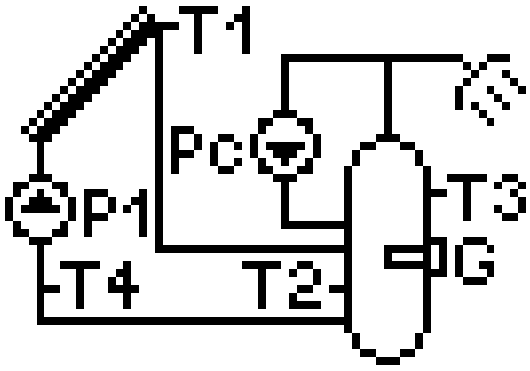


Fig. 6.2. Basic system diagram with heater and additional circulation pump Pc.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.3 List of parameters for the Figure 6.2 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	---
O3	Heater G
O4	Circulation pump Pc
O5	---
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – tank sensor
T4	PT 1000 – sensor used to calculate power (optional)
T5	---

Table 6.4 Description of input/output configuration for Figure 6.2 diagram.

6.3 Basic system diagram with hot tap water heating by boiler function

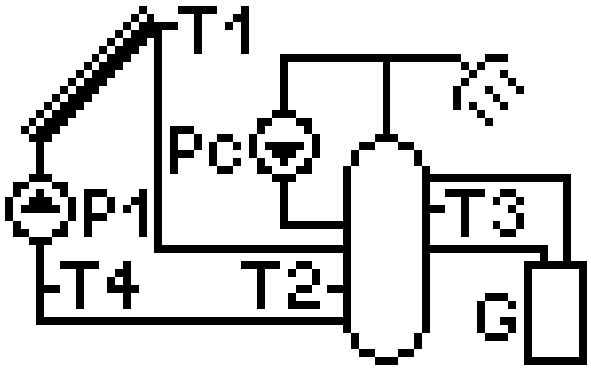


Fig. 6.3. Basic system diagram with hot tap water heating by boiler function.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.5 List of parameters for the Figure 6.3 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	---
O3	---
O4	Circulation pump Pc
O5	Gas stove G
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – tank sensor
T4	PT 1000 – sensor used to calculate power (optional)
T5	---

Table 6.6 Description of input/output configuration for Figure 6.3 diagram.

6.4 Basic system with hot tap water heating by boiler function, and with additional circulation pump

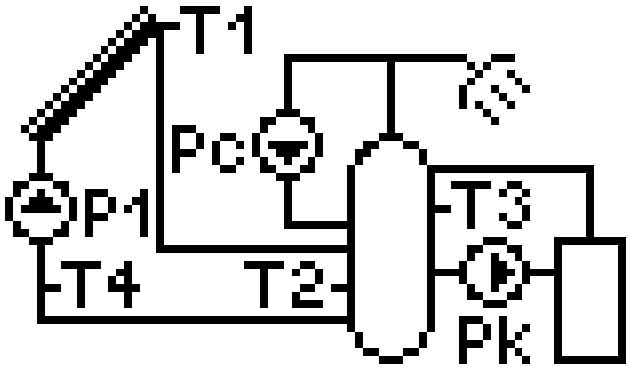


Fig. 6.4. Basic system diagram with hot tap water heating by boiler function, and with additional circulation pump Pc.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.7 List of parameters for the Figure 6.4 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	---
O3	Boiler pomp Pk
O4	Circulation pump Pc
O5	---
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – tank sensor
T4	PT 1000 – sensor used to calculate power (optional)
T5	---

Table 6.8 Description of input/output configuration for Figure 6.4 diagram.

6.5 Basic diagram with additional heater combined with circulation pump and additional heating element

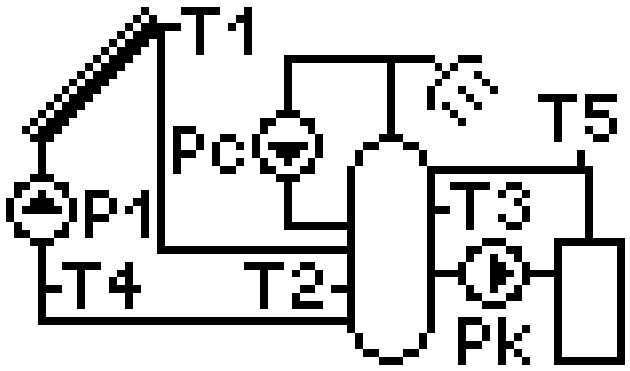


Fig. 6.5. Basic system diagram with additional heater and electric heating element.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
Δ2 [°C]	5 - 15	5
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.9 List of parameters for the Figure 6.5 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	---
O3	Boiler pomp Pk
O4	Circulation pump Pc
O5	---
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – tank sensor
T4	PT 1000 – sensor used to calculate power (optional)
T5	NTC 10KΩ - temperature sensor for outlet water from the boiler

Table 6.10 Description of input/output configuration for Figure 6.5 diagram.

6.6 Basic diagram with additional heater combined with circulation pump, additional heating element, and circulation pump

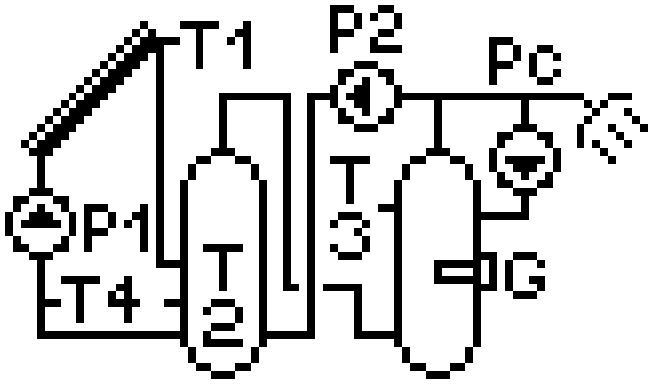


Fig. 6.6. Basic system diagram with additional boiler heater and additional circulation pump.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
Δ2 [°C]	5 - 15	5
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.11 List of parameters for the Figure 6.6 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	Additional pump P2
O3	Heater G
O4	Circulation pump Pc
O5	---
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – tank sensor
T4	PT 1000 – sensor used to calculate power (optional)
T5	---

Table 6.12 Description of input/output configuration for Figure 6.6 diagram.

6.7 Basic diagram with additional heater combined with circulation pump allowing hot tap water heating by boiler

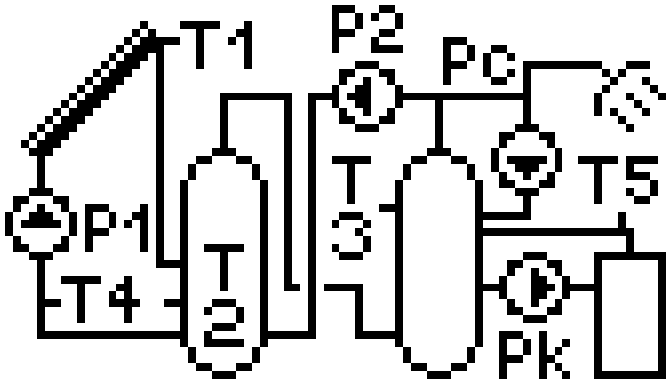


Fig. 6.7. Basic system diagram with additional boiler heater, and boiler pump Pk control.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
Δ2 [°C]	5 - 15	5
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.13 List of parameters for the Figure 6.7 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	Additional pump P2
O3	Boiler pump Pk
O4	Circulation pump Pc
O5	---
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – tank sensor
T4	PT 1000 – sensor used to calculate power (optional)
T5	NTC 10KΩ - temperature sensor for outlet water from the boiler

Table 6.14 Description of input/output configuration for Figure 6.7 diagram.

6.8 Basic diagram with additional heater combined with circulation pump allowing hot tap water heating by boiler, and with additional circulation pump

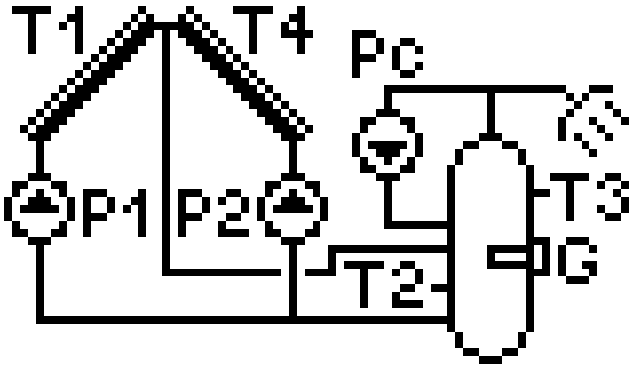


Fig. 6.8. Basic system diagram with additional boiler heater, boiler pump Pk control, and additional circulation pump Pc.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.15 List of parameters for the Figure 6.8 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	Additional pump P2
O3	Heater G
O4	Circulation pump Pc
O5	---
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – tank sensor
T4	PT 1000 – collector sensor
T5	---

Table 6.16 Description of input/output configuration for Figure 6.8 diagram.

6.9 Control system diagram for hot tap water heating by collector battery and additional electric heater

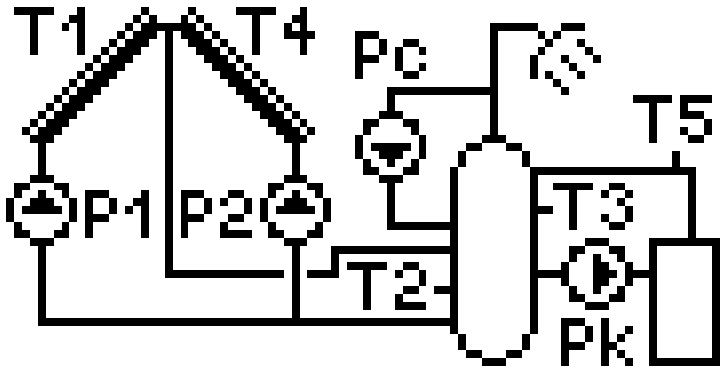


Fig. 6.9. System diagram with solar collector battery connected to a single heater. The additional system is fitted with an electric heater.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
Δ2 [°C]	5 - 15	5
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.17 List of parameters for the Figure 6.9 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	Additional pump P2
O3	Boiler pump Pk
O4	Circulation pump Pc
O5	---
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – tank sensor
T4	PT 1000 – collector sensor
T5	NTC 10KΩ - temperature sensor for outlet water from the boiler

Table 6.18 Description of input/output configuration for Figure 6.9 diagram.

6.10 Control system diagram for hot tap water heating by collector battery, additional electric heater, and additional circulation pump

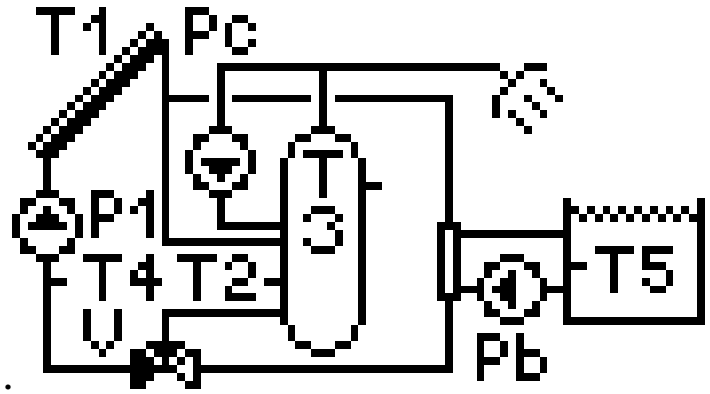


Fig. 6.10. System diagram with solar collector battery connected to a single heater. The additional system is fitted with an electric heater and circulation pump Pc.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
Δ2 [°C]	5 - 15	5
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.19 List of parameters for the Figure 6.10 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	Swimming-pool pump
O3	---
O4	Circulation pump Pc
O5	Three way valve V
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – tank sensor
T4	PT 1000 – sensor used to calculate power (optional)
T5	NTC 10KΩ – swimming-pool sensor

Table 6.20 Description of input/output configuration for Figure 6.10 diagram.

6.11 Control system diagram for hot tap water heating by collector battery supported by boiler

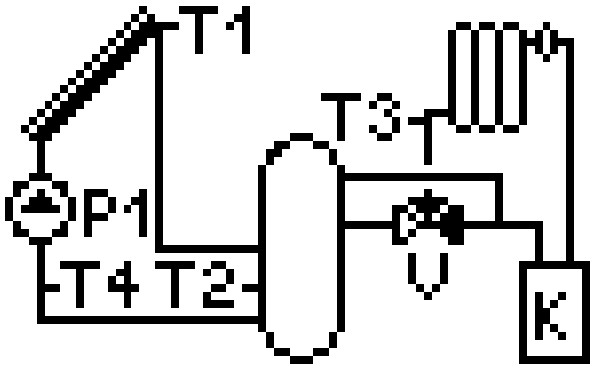


Fig. 6.11. System diagram with solar collector battery connected to a single heater. The system allows additional hot tap water heating by boiler using the boiler pump Pk control.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
Δ2 [°C]	5 - 15	5
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.21 List of parameters for the Figure 6.11 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	---
O3	---
O4	---
O5	Three way valve V
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – return to the boiler sensor
T4	PT 1000 – sensor used to calculate power (optional)
T5	---

Table 6.22 Description of input/output configuration for Figure 6.11 diagram.

6.12 Control system diagram for hot tap water heating by collector battery supported by boiler, and with additional circulation pump

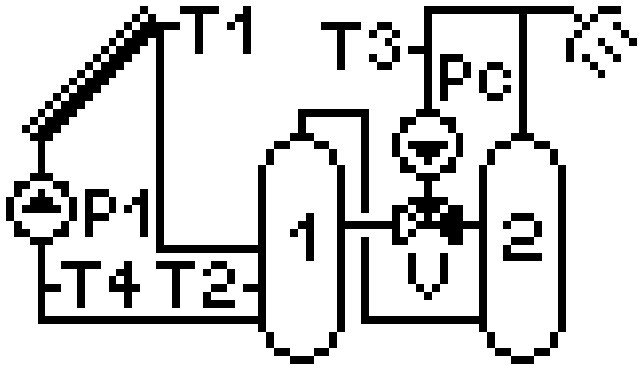


Fig. 6.12. System diagram with solar collector battery connected to a single heater. The system allows additional hot tap water heating by boiler using the boiler pump Pk control. The system also incorporates an additional circulation pump Pc.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
Δ2 [°C]	5 - 15	5
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.23 List of parameters for the Figure 6.12 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	---
O3	---
O4	Circulation pump Pc
O5	Three way valve V
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor
T3	NTC 10KΩ – return from circulation sensor
T4	PT 1000 – sensor used to calculate power (optional)
T5	---

Table 6.24 Description of input/output configuration for Figure 6.12 diagram.

6.13 Basic system diagram with collectors and electric heater providing additional heating for pool water with the solar collectors

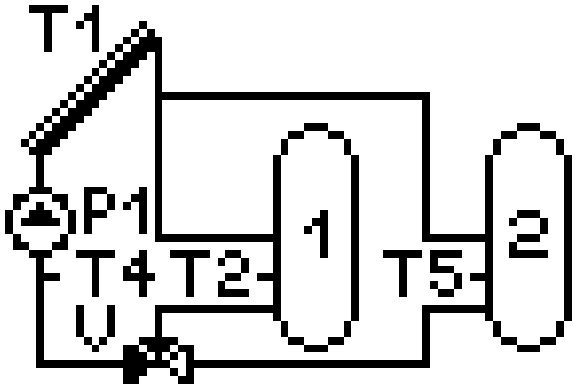


Fig. 6.13. Basic system diagram with collectors allowing additional heating of pool water.

Parameter	Range	Factory settings
Δ1 [°C]	5 - 15	8
T1max [°C]	25 - 85	65
T2max [°C]	25 - 85	65
P1 adjustment	Yes / No	Yes
Cooling	Yes / No	No
Circulation	Intermittent/Continuous	Intermittent

Table 6.25 List of parameters for the Figure 6.13 diagram.

Outputs/Inputs	Connected devices
O1	Collector pump P1
O2	---
O3	---
O4	---
O5	Three way valve V
T1	PT 1000 – collector sensor
T2	NTC 10KΩ – tank sensor nr 1
T3	---
T4	PT 1000 – sensor used to calculate power (optional)
T5	NTC 10KΩ – tank sensor nr 2

Table 6.26 Description of input/output configuration for Figure 6.13 diagram.

7. Description of Control Parameters

Δ1 – the main control delta (**temperature difference**). This parameter specifies condition of the collector pump on/off switching. When the sum of the parameter Δ1 and the tank temperature T2 exceeds the temperature measured by the collector sensor T1, the collector pump turns off. If the sum is lower than the T1 value, the collector pump is on. Additionally, to ensure stable operation of the heating system, a control hysteresis of 3 °C is applied.

Δ2 – the auxiliary control delta (**temperature difference**). This parameter is used to control more complex systems, therefore its description can be found in section 6 only for selected system diagrams with collectors.

T1max – Parameter associated with temperature sensor T2 located inside the tank. This parameter specifies the maximum allowable temperature in the tank measured by the sensor T2 which, when exceeded, causes the collector pump to stop.

T2max – Similar to the above described auxiliary control delta, this parameter is used in more complex system diagrams. For description of its function – see section 5.

P1 Adjustment – Main pump (collector pump) adjustment. If the collector pump adjustment is selected in the Controller settings, the Controller will adjust the collector pump rotation speed. If the collector pump speed adjustment option is set to off, the Controller will only control the pump in the on/off operation mode.

Cooling – Collector cooling option. When the option is set to "Yes", the Controller automatically activates the collector pump to decrease the temperature of water in the tank to below 36 °C. This option is associated with time and operates from 12.00 p.m. (0.00 a.m.) to 6.00 a.m. During the collector cooling, only the collector pump Pk operates. Other devices are inactive: pumps and three-way valves.

Circulation – Circulation pump option. This option refers only to the system diagrams no. 2, 4, 6, 8, 10, 12, and 14. When the parameter is set to "Continuous", the circulation pump will be active in the time periods set in the "Time Program" menu option. If this option is set to "Intermittent", the circulation pump will operate in the time periods set in the "Time Program" menu option, but the operation mode will be in on/off cycles: 10 minutes on / 10 minutes off.

8. Calculation of Collector Instantaneous Power

The Controller has an additional function allowing to calculate the collector instantaneous power. The collector instantaneous power can be calculated in all the system configurations, except the diagrams with two collectors (9, 10, 11, and 12). To allow calculation of the power, the temperature sensor T4 must be installed, and the parameters "Heating Medium" and "Flow/Rotameter" must be properly set in the "Settings" menu.

Heating medium: This parameter specifies the heating medium freezing point, and is related to its specific heat Cw. Knowing the heating medium freezing point, the Controller calculates the specific heat required for power determination. To specify the parameter, please contact the system supplier. To set the parameter, enter the main menu by pressing the F4 key, then using the ▼ or ▲ keys highlight the "Settings" option and press Enter key. In the Settings menu, using the ▼ or ▲ keys, select the "Heating Medium" option,

and press Enter to enter the option. Using the ▶ or ◀ keys, select the appropriate heating medium freezing point, and save the value in the Controller memory by pressing Enter. To exit the option without changing the parameter in the Controller memory, just press the Esc key. To return to the main screen through the main menu, press the Esc twice.

Flow/rotameter: To properly specify the parameter, a rotameter must be mounted in the system. In this option, the output O1 signal provides maximum performance of the collector pump. Set the flow measured by the rotameter in the "Flow/rotameter" menu option, and save it in the Controller memory. To set the parameter, enter the main menu, then highlight the "Control Settings", and select the option using the Enter key. Then, highlight the "Flow/rotameter" option and press the Enter key to activate the option. Further procedure of the "Flow/rotameter" setting is the same as above, in the "Heating medium" option.

If the sensor T4 is not connected or the collector pump is inactive, the power value field in the LCD display will show horizontal dashes. The instantaneous power is calculated and displayed only during operation of the collector pump P1. When the temperature T4 is higher than the temperature T1, when the temperature difference is T1 – T4 > 30 °C, the Controller will show dashes instead of the power value on the LCD screen.

9. Alarms

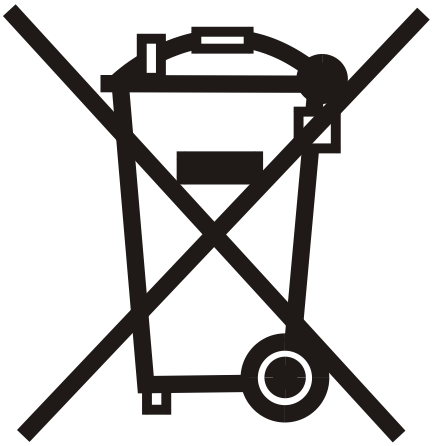
9.1 Incorrect Module Connection Alarm

The GH19SA Controller is a two-module device consisting of a room panel (module with LCD display), and a base module (module with sensor inputs and external device control outputs). The modules are interconnected with a multicore cable that provides communication between the modules. To ensure proper operation of the Controller, the connection between modules must be correct. If the multicore cable is damaged or disconnected from one of the modules, the Controller will switch into the communication alarm status within a few seconds after the failure, displaying "LINK ERROR" message on the LCD screen, and (after several tens of seconds) will deactivate all outputs and stop operation of all the connected external devices. Additionally, the alarm will be indicated by an intermittent audio signal. To repair the module communication error, first disconnect the Controller from the main power 220VAC, then check the multicore cable for damage and ensure proper connection between the modules. After removing the cause of the alarm, the Controller will return to the external devices (pumps and valves) Auto control mode.

9.2 Sensor Connection Alarm

The Controller checks the temperature sensors for proper connection and short-circuits. If a sensor is damaged, cable is broken or the sensor is disconnected, the Controller indicates alarm for that sensor. In the alarm condition all outputs are inactive; additionally, when the Controller displays the main screen, alarm is indicated by audio signal. In the alarm mode, you can browse the menu system, configure settings, and manually control the external devices. The information which sensor is in alarm condition is available in the main screen. The display shows "Er" in place of the sensor temperature. When the Controller indicates sensor alarm, check the system for proper connection and installation of the sensors.

10. Information on Marking and Collection of Electric and Electronic Waste



UWAGA!

Symbol umieszczony na produkcie lub na jego opakowaniu wskazuje na selektywną zbiórkę zużytego sprzętu elektrycznego i elektronicznego. Oznacza to, że produkt ten nie powinien być wyrzucany razem z innymi odpadami domowymi. Właściwe usuwanie starych i zużytych urządzeń elektrycznych i elektronicznych pomoże uniknąć potencjalnie niekorzystnych skutków dla środowiska i zdrowia ludzi.

Obowiązek selektywnego zbierania zużytego sprzętu spoczywa na użytkowniku, który powinien oddać go zbierającemu zużyty sprzęt.

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