

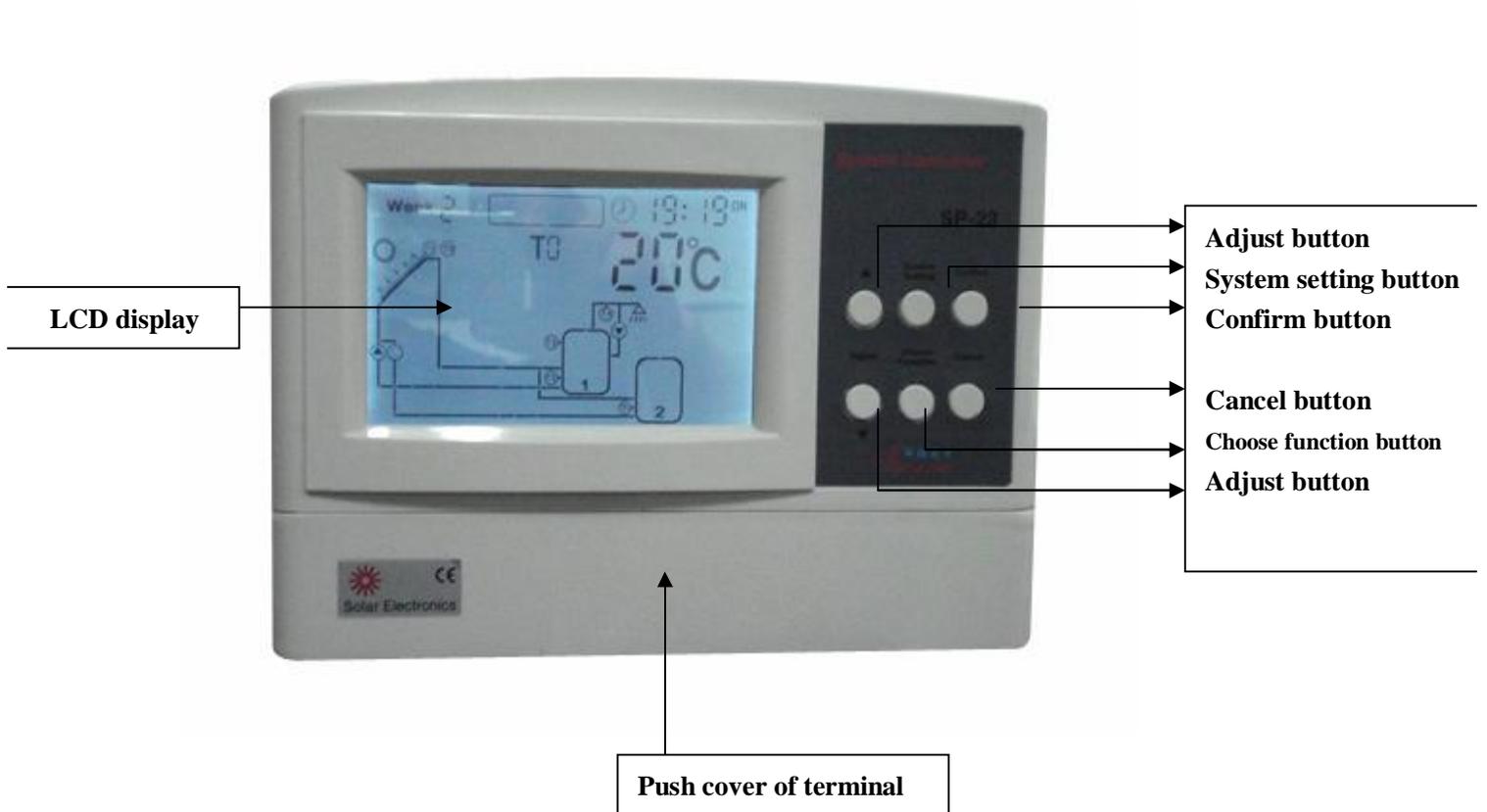


SP23 Manual

OPERATION INSTRUCTION

Solar controller for split water heater: SP23

Display illustration



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Technical data

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Note: Dear customers: The operation instruction maybe are not completely conformable with the purchased controller since improving and systematization of products from time to time. We are apologized for it and hope you understand.

1. Safety information

1.1 Installation and commissioning

- When laying cables, please ensure that no damage occurs to any of the constructional fire safety measures presented in the building.
- The controller must not be installed in rooms where easily inflammable gas mixtures are present or may occur.
- The permissible environmental conditions must not be exceeded at the site of installation.
- Before connecting the device, make sure that the energy supply matches the specifications of controller on the type plate.
- All devices connected to the controller must conform to the technical specifications of the controller.
- All operations on an open regulator are only to be conducted cleared from the power supply. All safety regulations for working on the power supply are valid. Connecting and /or all operations that require opening the regulator (e.g. changing the fuse) are only to be conducted by specialists.

1.2 About this manual

This manual describes the installation, function and operation of a solar thermal controller.

When installing the remaining components e.g. the solar collectors, pump assemblies and the storage unit, be sure to observe the appropriate installation instructions provided by each manufacturer.

Installation, electrical connection, commissioning and maintenance of the device may only be performed by trained professional personnel. The professional personnel must be familiar with this manual and follow the instructions contained herein.

1.3 Liability waiver

The manufacturer cannot monitor the compliance with these instructions or the circumstances and methods used for installation, operation, utilization and maintenance of this controller. Improper installation can cause damages to material and persons. This is the reason why we do not take over responsibility and liability for losses, damages or cost that might arise due to improper installation, operation or wrong utilization and maintenance or that occur in some connection with the aforementioned. Moreover we do not take over liability for patent infringements or infringements – occurring in connection with the use of this controller- on third parties rights. The manufacturer preserves the right to put changes to product, technical date or installation and operation instructions without prior notice. As soon as it becomes evident that safe operation is no longer

Possible (e.g visible damage). Please immediate take the device out of operation. Note: ensure that the device cannot be accidentally placed into operation.

1.4 Description of symbols

Safety instruction:

Safety instructions in the text are marked with a warning triangle. They indicate measures can lead to injury of persons or safety risks.

Operation steps: small triangle “▶” is used to indicate operation step.



Notes: Contains important information on operation or function, is written in red color.

2. Installation

2.1 Opening/closing the case of controller

 Danger of electrocution! Before opening the case please ensure power is switched off.

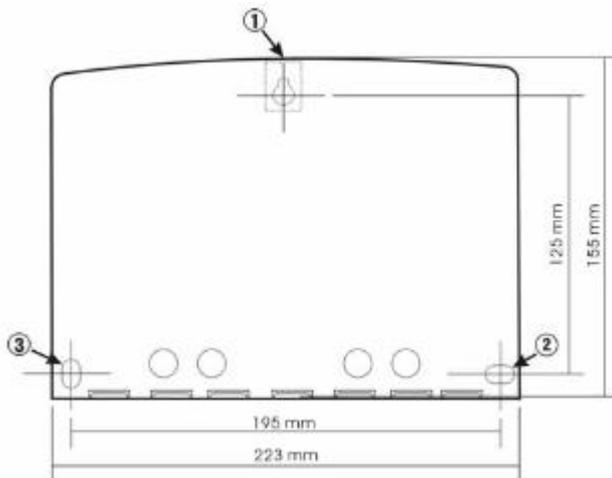
- ▶ Loosen the screw ① and remove the upper case ② in an upwards direction.



- ▶ Close the case: insert the hinge grooves of upper case into the retaining pegs of the lower case.
- ▶ Pivot the upper case down.
- ▶ Fasten the case tightly with the screw.

2.2 Installing the controller

Attention: the controller must only be installed in an area having an adequate level of protection.



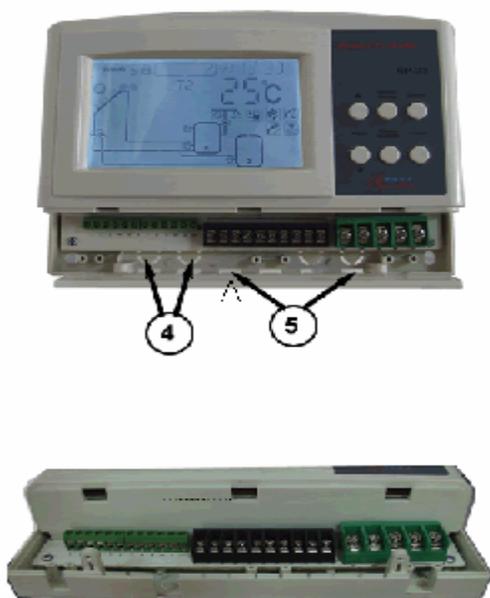
- ▶ Choose a suitable location
- ▶ Drill the upper fastening hole
- ▶ Screw in the screw
- ▶ Remove the upper case
- ▶ Hang the bottom case in the recess ① in picture
- ▶ Mark the position of the lower fastening holes ② and ③
- ▶ Remove the bottom case again
- ▶ Drill the lower fastening holes
- ▶ Re-hang the case in the recess ①
- ▶ Screw the case firmly using the lower fastening holes ② and ③
- ▶ Mount the upper case.

2.3 Power connection

 Remove the device from the main supply before opening the case! All guidelines and regulations of the local electricity supplier must be observed!

2.3.1 Preparation before connection

Power can only be switched on when the housing of controller is closed, an installer must make sure that the IP protection class of the controller is not damaged during installation.



Depending on the type of installation, the cables may enter the device through the rear of the case ④ or the lower side of the case ⑤.

Cable come from the rear ④: remove the plastic flaps from the rear side of the case using an appropriate tool.

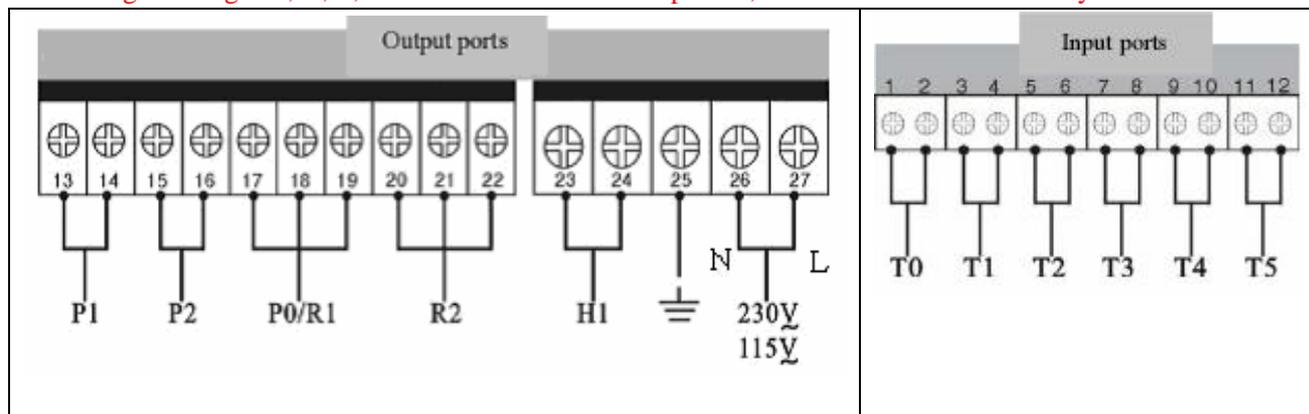
Cable come from the below ⑤: cut the left and right plastic flaps using an appropriate tool (e.g. knife) and break them out of the case.

Notes: the flexible cabling must be fastened to the case using the strain-relief clamps provided

2.3.2 Terminal connection

※ If the circuit diagram not confirm with operation instruction, please as the operation instruction connect wire.

※ The grounding line, N, L, as the terminal connection picture, the text don't indicate one by one.



| | | |
|---|--|---|
| <p>Power</p> <p>1.Please note the type of power supply required from the type plate on the case of the device</p> <p>2.The protective conductor must be also be connected</p> <p>3.Cables type of H05W-...(NYM...) can be used</p> | <p>Connection</p> <p>1.Outputs P1&P2: electromagnetic relays max/ switching current: 3A</p> <p>2.Outputs P0&R1, R2: electromagnetic relays, maximal switching current: 5A</p> <p>3.When using P0 circulation pump, connection ports are 17 and 18; When using R1 3-way electromagnetic valve, connection ports 17,18 & 19; When power is switched on, port17&18 is shut off; port 17&19 is turned on.</p> <p>4.When using R2 controls circulation pump, connection ports are 20 and 21; When using R2 controls 3-way electromagnetic valve, connection ports 20, 21&22. When power is switched on. Port 20&21 is shut off; port 20&22 is turned on.</p> <p>5.Output H1: electromagnetic relay, max switching current 16A.</p> | <p>Outputs</p> <p>1.Inputs T0 and T1: for PT1000 temperature sensors.</p> <p>2.Inputs T2-T5: for NTC10k sensors.</p> |
|---|--|---|

Advice regarding the installation of temperature sensors:

Only original factory equipped Pt1000 temperature sensors are approved for use the collector, it is equipped with 1.5meter silicon cable and suitable for all weather conditions, the temperature sensor and cable are temperature resistant up to 280°C, not necessary to distinguish the positive and negative polarity of the sensor connection.

Only original factory equipped NTC10K, B=3950 temperature sensors are approved for use with tank and pipe, it is equipped with 1.5meter PVC cable, and they are temperature resistant up to 105°C, not necessary to distinguish the positive and negative polarity of the sensor connection.

All sensor cables carry low voltage, and to avoid inductive effects, must not be laid close to 230 volt or 400 volt cables (minimum separation of 100mm)

If external inductive effects are existed, e.g. from heavy current cables, overhead train cables, transformer substations, radio and television devices, amateur radio stations, microwave devices etc, then the cables to the sensors must be adequately shielded.

Sensor cables may be extended to a maximum length of 100 meter, when cable length is up to 50m, and then 0.75m² cable should be used. When cable length is up to 100m, and then 1.5m² cable should be used.

Note: the connection of the pump and sensors depends on the chosen solar system, every port can only connect one cable, fine core cables should use wire end sleeves.

3. Commissioning



Connect the sensors, pumps or electromagnetic valves to the controller before you connect the power supply!

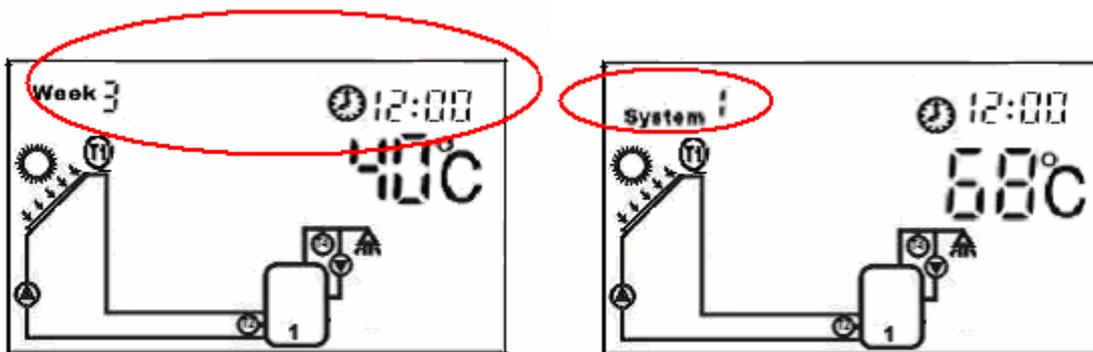
After switching on power to the controller, firstly it will ask for the “time” to be set and the correct “solar system” to be chosen.

Factory setting: In order of safety, electric heating is shut off. This single “” display on the screen. If you want to use auxiliary heating, please see operation: “4.21 Permit / prohibit auxiliary heating”.

3.1 Setting the Clock/ Week

When power is switched on,

- ▶ Press “system setting” button, clock selection area “” display on the screen.
- ▶ Press “▲” button to adjust hour of clock, press “▼” button to adjust minute of clock..
- ▶ Press “confirm” button, confirm the setting. Press “cancel” button, cancel the setting.
- ▶ Press “system setting” button , week selection area “▶” display on the screen.
- ▶ Press “▲” “▼” button to adjust week , “Week_ _” display on the screen.
- ▶ Press “confirm” button to confirm the setting, press “cancel” button to cancel the setting.



3.2 Choosing the solar system

- ▶ Press “system setting” button, until “**System**” display on the screen.
- ▶ Press “▲” “▼” button select system. (System 1-8 available to be chosen).
- ▶ Press “confirm” button to confirm the setting, press “cancel” button to cancel the setting.

3.3 Operation switch

When there is no function in the display screen,

- ▶ Press “confirm” button to switch on/off solar circuit pump manually.
- ▶ Press “cancel” button to switch on/off hot water circulation pump manually.

3.4 Temperature query function

When you want to query the temperature sensor at any time

- ▶ Press “▲” “▼” button to choose the temperature value of T0-T5 one by one.

4. Device setup

Note : When only one insert for temperature sensor on tank, and you would like to use auxiliary heating, you must use T3 instead of T2 to insert, Now T3 show the bottom temperature of the tank, and this temperature value is much lower than the actual value of the top. To ensure the security when using auxiliary heating, it is strongly recommended that using the tank which has two inserts for temperature sensor.

4.1 Setting the Clock/Week

- ▶ Press “system setting” button, clock selection area “🕒” display on the screen.
- ▶ Press “▲” button to adjust hour of clock, press “▼” button to adjust minute of clock.
- ▶ Press “confirm” button, confirm the setting. Press “cancel” button, cancel the setting.
- ▶ Press “system setting” button, week selection area “▼” display on the screen.
- ▶ Press “▲” “▼” button to adjust week, “Week_” display on the screen.
- ▶ Press “confirm” button to confirm the setting, press “cancel” button to cancel the setting.

4.2 Systems selection

- ▶ Press “system setting” button, until “System” display on the screen.
- ▶ Press “▲” “▼” button select system. (System 1-8 available to be chosen).
- ▶ Press “confirm” button to confirm the setting, press “cancel” button to cancel the setting.

4.3 System 1

1 collector array – 1 storage tank – 1 pump

Description:

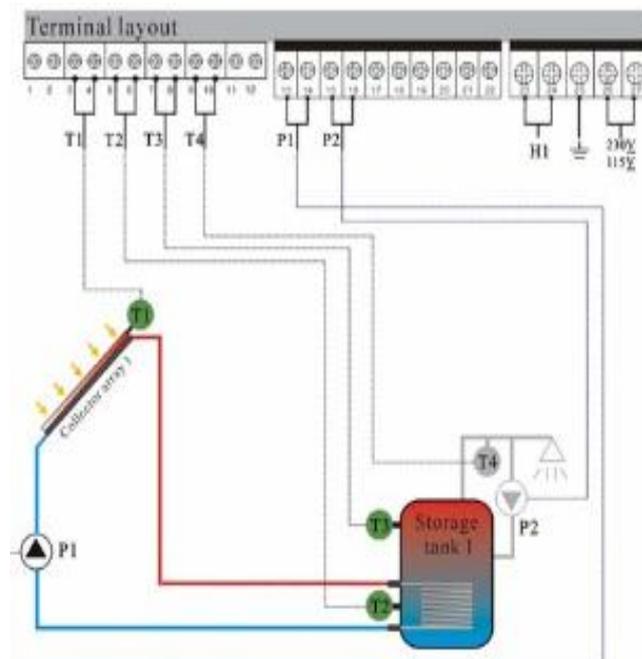
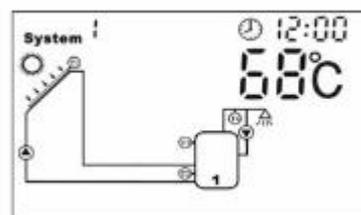
The solar circuit pump (P1) is switched on as soon as the switch-on temperature difference between the collector array (T1) and the storage tank (T2) is reached. If the temperature difference between the collector array (T1) and storage tank (T2) drops below the switch-off temperature difference, or the storage tank (T2) reaches the maximum storage temperature, then the solar circuit pump is switched off.

- T1: Temperature sensor for collector 1.
- T2: Temperature sensor in the bottom part of tank 1.
- T3: Temperature sensor on the top part of the tank (for control auxiliary heating).
- T4: Temperature sensor in hot water pipe.
- P1: Solar circuit pump 1.
- P2: Hot water circuit pump.

Note:

1. H1 is connected with auxiliary heating, suitable for system 1-8.
2. T3, T4, P2 are suitable for system 1-8.
3. T3 is alternative, when no sensor (T3) is installed on the top part of tank, controller

System 1 display



will use the signal of sensor T2 automatically to control the auxiliary heating.

4.4 System 2

1 collector array – 2 storage tanks – 2 pumps

Description:

If the switch – on temperature difference between the collector array (T1) and one of the two storage tanks (T2 or T5) is reached, then the appropriate solar circuit pump (P1) or (P0) is switched on. According to the priority switching, both storage tanks (T2, T5) are loaded one after by one. until either of the relevant switch-off temperature difference between the collector array (T1) and storage tank (T2, T5) falls below the threshold, or the maximum storage temperature is reached.

T1: Temperature sensor for collector 1.

T2: Temperature sensor in the bottom part of tank. 1

T3: Temperature sensor on the top part of tank 1.

T5: Temperature sensor in the tank 2.

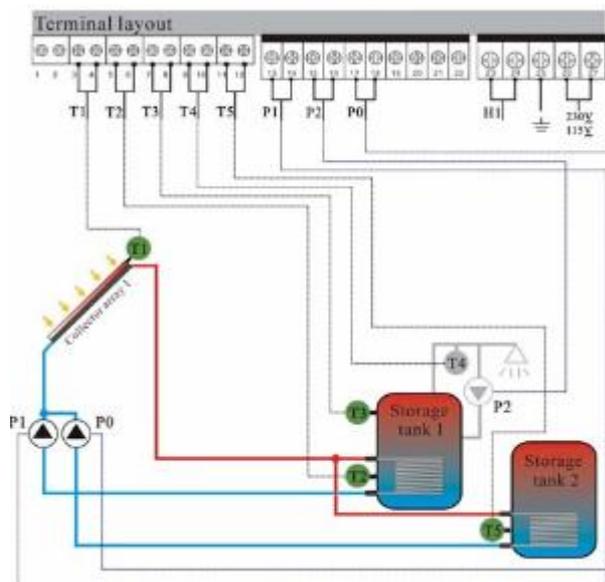
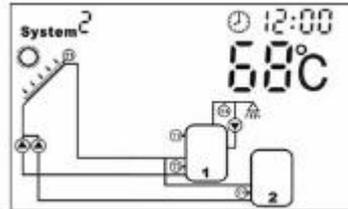
T4: Temperature sensor on hot water pipe.

P1: Solar circuit pump 1.

P0: Solar circuit pump 2.

Note: the default priority tank is tank 1.

System 2 display



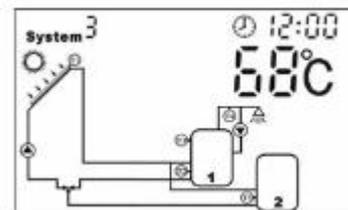
4.5 System 3

1 collector array – 2 storage tanks – 1 pump- 1 valve

Description:

If the switch – on temperature difference between the collector array (T1) and one of the two storage tanks (T2, T5) is reached, then the solar circuit pump (P1) is switched on and the switching valve (R1) is set to the correct position depending on the storage tank to be loaded. According to the priority switching, both storage tanks (T2, T5) are loaded one after the other, until either the relevant switch-off temperature difference between the collector array (T1)

System 3 display



and two storage tanks (T2, T5) falls below the threshold, or the maximum storage temperature of T2 or T5 is reached.

T1: Temperature sensor for collector 1.

T2: Temperature sensor in the bottom part of tank 1.

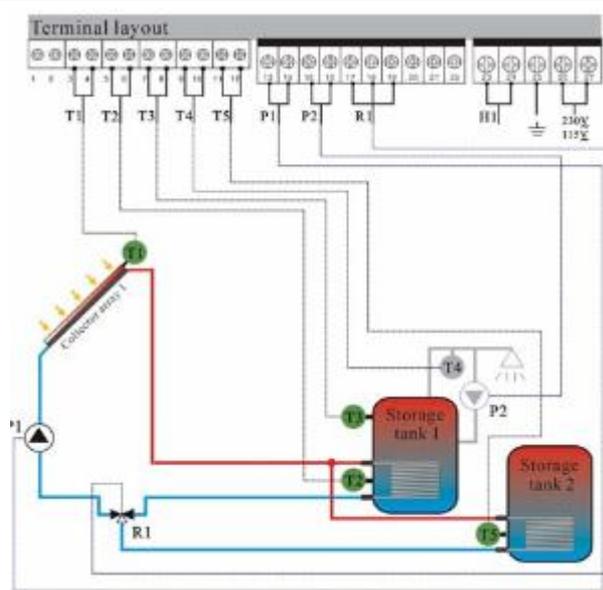
T5: Temperature sensor in the tank 2.

P1: Solar circuit pump 1.

R1: 3-way electromagnetic valve (Ports 17,18 are disconnect, Ports 17,19 are connect).

Note: When no power is in the system, the electromagnetic valve (R1) must be set to storage tank 1 (T2)

*** The default priority tank is tank 1.**



4.6 System 4

2 collector arrays (east/west roof) – 1 storage tank – 2 pumps

Description:

If the switch – on temperature difference between the storage tank (T2) and one or the other of the collector array (T1, T0) is reached, then the solar circuit pump (P1) for collector array 1 (T1) or solar circuit pump (P0) for collector array 2 (T0) is switched on, depending on where the temperature difference occurs. If the switch-on temperature difference is reached for both collector arrays (T1, T0), then both pumps (P1, P0) are switched on. The pumps switch off independently of each other. When either of the relevant switch off temperature difference between one or both of collector arrays (T1, T0) and the storage tank (T2) falls below the threshold, or the maximum storage temperature is reached, and then the corresponding circuit pump is switched off.

T1: Temperature sensor for collector 1.

T0: Temperature sensor for collector 2.

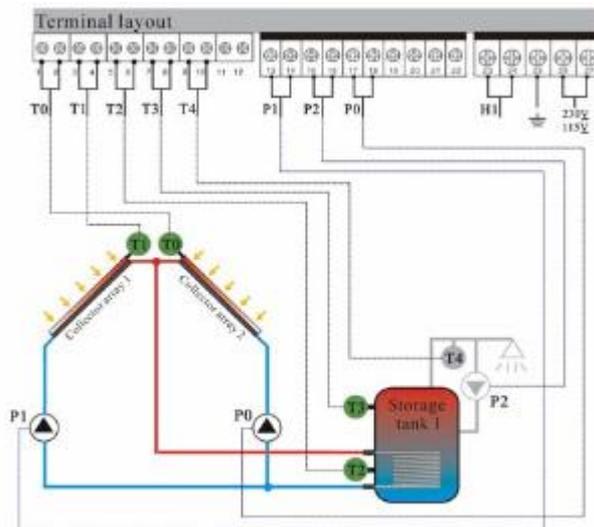
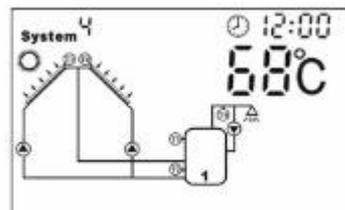
T2: Temperature sensor in the bottom part of tank 1.

P1: Solar circuit pump 1.

P0: Solar circuit pump 2.

Note: when no power is in the system,

System 4 display



electronic valve2 (R2) must turn to water tank1 (T1)
 * The default priority tank is tank 1.

4.7 System 5
 2 collector arrays (east/west roof) – 1 storage tank – 1 pump – 1 valve

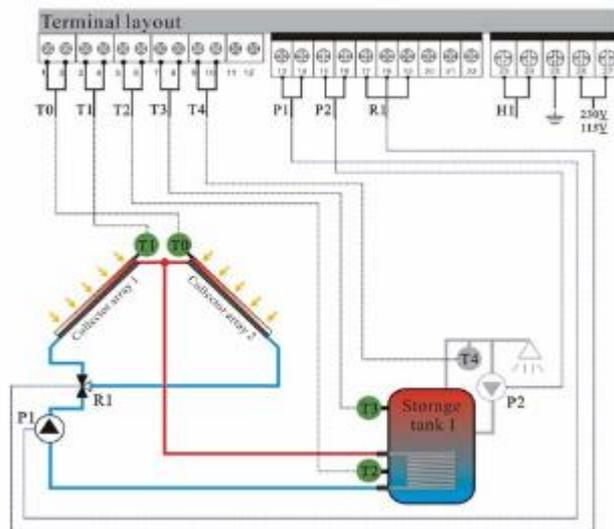
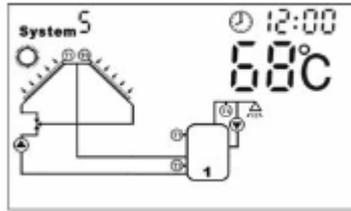
Description:

The solar circuit pump (P1) is switched on as soon as the switch – on temperature difference between one of the two collector arrays (T1, T0) and storage tank 1 (T2) is reached, the switch valve R1 is always set so that flow occurs through the warmer of the two collector arrays (T1, T2). The pump P1 switches off as soon as the switch-off temperature difference between the two collector arrays (T1, T0) and the storage tank (T2) falls below the threshold or the maximum storage temperature is reached.

- T1: Temperature sensor for collector 1
- T0: Temperature sensor for collector 2
- T2: Temperature sensor in the bottom part of tank 1
- P1: Solar circuit pump 1
- R1: 3-way electromagnetic valve (Ports 17,18 are disconnect, Ports 17,19 are connect).

Note:
 * When no power is in the system, the electromagnetic valve (R1) must be set to collector array 1 (T1).

System 5 display

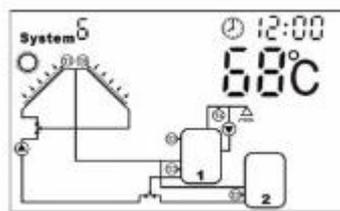


4.8 System 6
 Valve-controlled 2 collector arrays (east/west roof) – 2 storage tanks – 1 pump – 2 valves

Description:

If the switch-on temperature difference between one of the two tanks (T2, T5) and collector array1 (T1) or collector array 2 (T0) is exceeded, then the solar circuit pump (P1) is switched on, switching valve (R1) switches the relevant tank into the solar circuit, and switching valve (R2) switches the effected collector array (T1 or

System 6 display



T2) into the solar circuit also. Switching valve 1 (R1) is always set so that flow occurs through the warmer of the two collector arrays (T1, T0). Switching valve 2 (R2) controls the loading of the storage tanks (T2, T5) according to the priority switching. Pump (P1) switches off when the switch-off temperature difference between either or both collector arrays and its corresponding storage tank1 (T2) and storage tank2 (T5) falls below the threshold or the maximum storage temperature (T2 or T5) is reached.

T1: Temperature sensor for collector 1.

T0: Temperature sensor for collector 2.

T2: Temperature sensor in the bottom part of tank 1.

T5: Temperature sensor in the bottom part of tank 2.

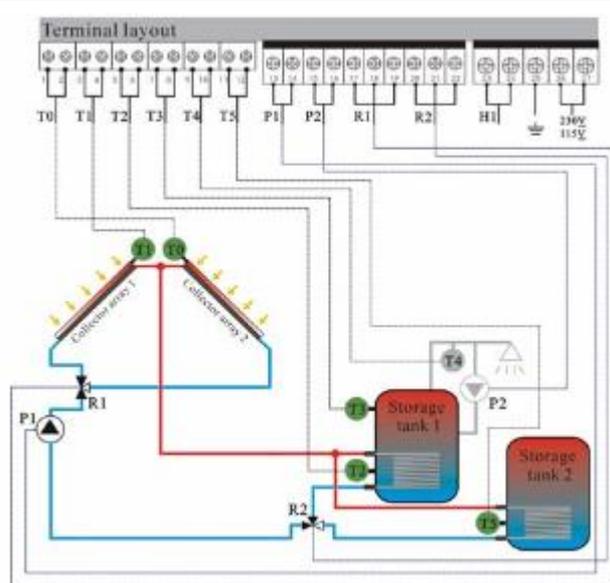
P1: Solar circuit pump 1.

R1: 3-way electromagnetic valve 1 (Ports 17,18 are disconnect, Ports 17,19 are connect).

R2: 3-way electromagnetic valve 2 (Ports 20,21 are disconnect, Ports 20,22 are connect).

Note:

- * When no power is in the system, the electromagnetic valve 2 (R2) must be set to tank 1 (T2), the electromagnetic valve 1 (R1) must be set to collector array 1(T1).
- * Default priority tank is tank 1(T1).



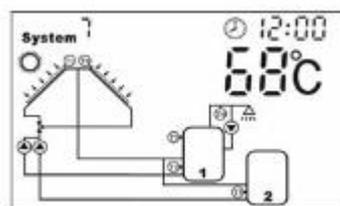
4.9 System 7

Valve-controlled 2 collector arrays (east/west roof) – 2 storage tanks – 2 pumps – 1 valve

Description:

If the switch-on temperature difference between one of the two tanks (T2, T5) and collector array 1 (T1) or collector array 2 (T0) is exceeded, then the switching valve R2 switched the corresponding collector array (T1 or T0) into the solar circuit. Depending on which storage tank has reached the switch-on temperature, solar

System 7 display



circuit pump (P1) for storage tank 1 (T2) or solar circuit pump (P0) for storage tank 2 (T5) is switched on. The switching valve R2 is always set so that flow occurs through the warmer of the two collector arrays. Both storage tanks (T2, T5) are loaded one after the other, according to the priority switching, until either of the relevant switch-off temperature difference falls below the threshold, or the maximum storage temperature (T2 or T5) is reached.

T1: Temperature sensor for collector 1.

T0: Temperature sensor for collector 2.

T2: Temperature sensor in the bottom part of tank 1.

T5: Temperature sensor in the bottom part of tank 2.

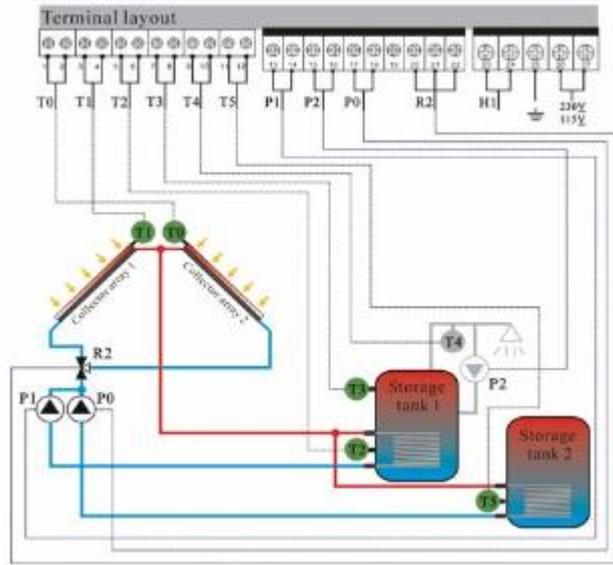
P1: Solar circuit pump 1.

P0: Solar circuit pump 2.

R2: 3-way electromagnetic valve 1 (Ports 20,21 are disconnect, Ports 20,22 are connect).

Note:

- * When no power is in the system, the electromagnetic valve (R2) must be set to collector array 1(T1).
- * Default priority tank is tank 1(T1).



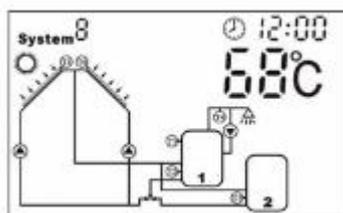
4.10 System 8

Pump controlled 2 collector arrays (east/west roof) – 2 storage tanks – 2 pumps – 1 valve

Description:

If the switch-on temperature difference between one of the two tanks (T2, T5) and collector array1 (T1) and collector array 2 (T0) is exceeded, then the switching valve (R2) switches the relevant storage tank (T2, or T5) into the solar circuit. If the switch-on temperature difference between the storage tanks (T2, T5) and one of the collector arrays (T1, T0) is reached, then either solar circuit pump P1 for collector array1 (T1), or solar circuit pump P0 for collector array 2 (T0) is switched on, depending on where the temperature

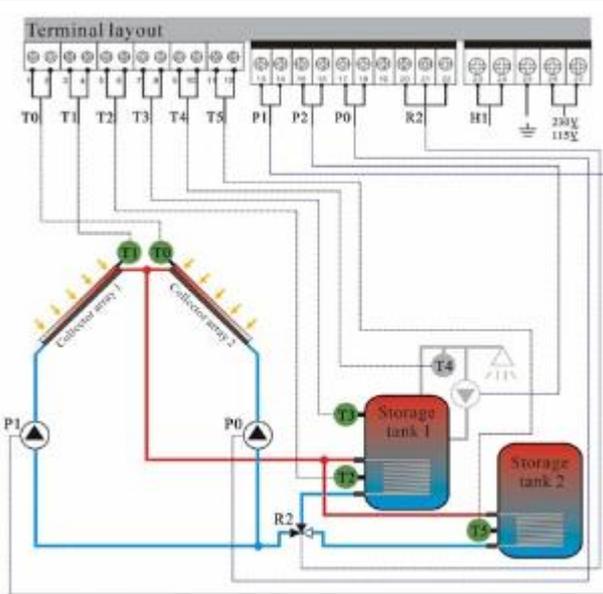
System 8 display



difference occurs. If the switch-on temperature difference is reached for both collector arrays (T1, T0), then both pumps (P1, P0) are switched on. The switching valve (R2) controls the loading of the storage tank (T2, T5) according to the priority switching. The pumps (P1, P0) switch off independently of each other, when either the relevant switch-off temperature for one or both of the collector arrays (T1, T0) with regard to the storage tanks (T2, T5) falls below the threshold, or the maximum storage tank temperature is reached.

- T1: Temperature sensor for collector 1.
- T0: Temperature sensor for collector 2.
- T2: Temperature sensor in the bottom part of tank 1.
- T5: Temperature sensor in the bottom part of tank 2.
- P1: Solar circuit pump 1.
- P0: Solar circuit pump 2.
- R2: 3-way electromagnetic valve 1 (Ports 20,21 are disconnect, Ports 20,22 are connect)

Note:
 * When no power is in the system, the electromagnetic valve (R2) must be set to storage tank 1(T1).
 Default priority tank is tank 1(T1).



4.11 On/Off of temperature difference setting function for temperature difference circulation pump

Functional description:

Solar circuit pump P1 is triggered by temperature difference function, so long as the preset temperature difference between collector and tank is reached, solar pump is switched on.

When there are two tanks or two collector arrays, controller will compare the temperature between one tank and one collector, one extra number indicates the correspondingly tank or collector.

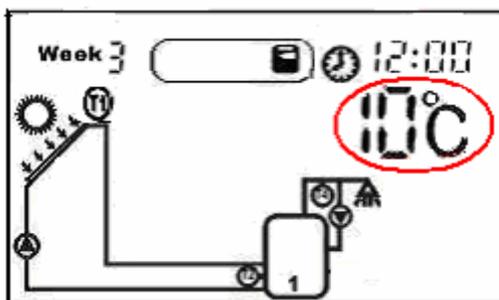
Important information:

The switch-on temperature difference is 10°C and the switch-off temperature difference is 5°C. To avoid mistake the minimum difference between two temperature differences ($\Delta T_{on} - \Delta T_{off}$) is 2°C.

Setup steps:

- ▶ Press “system setting” button, when “☰” display on the screen.
- ▶ Press “▲” “▼” button to adjust storage tank temperature, default value is 60°C. (adjust range: 45~75°C)

- ▶ Press “confirm” button. to confirm the setting. Then enter into switch on temperature difference setting of temperature difference circulation pump.
- ▶ Press “▲” “▼” button to adjust temperature, adjustable range:[(OFF +2°C) ~20°C, default value is 10°C]
- ▶ Press “confirm” button confirm the setting. Then enter into switch off temperature difference setting of temperature difference circulation pump.
- ▶ Press “▲” “▼” button to adjust temperature, adjustable range: [0°C ~ (ON-2°C), default value is 5°C].
- ▶ Press “confirm” button confirm the setting. Press “cancel” button to cancel the function.



Kindly note: During 60°C~70°C it is easy appear boiler scale, we usually set the water tank temperature is 60°C. After 70°C, the boiler scale is not easy appears.

4.12 Protection for water tank at high temperature

Functional description:

To avoid the tank temperature is too high, controller will start its maximum tank temperature protection function. Controller checks the temperature which getting from bottom part of tank and compares it with turning-on and turning-off temperature of this function, when the temperature is higher than the turning-on temperature, solar circuit pump is stopped, when the temperature is lower than tuning-off temperature, solar circuit pump is triggered automatically. When the tank temperature is higher than the maximum tank temperature, even the condition of temperature difference circulation is reached, solar pump is still forbidden to trigger.

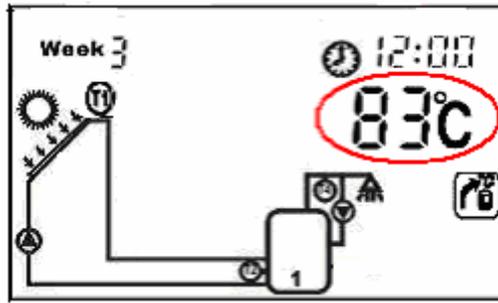
Activate/deactivate this function:



- ▶ Press “choose function” button, when  display on the screen.
- ▶ Press “▲” “▼” button to adjust the maximum tank temperature (adjustable range: 50°C~ 95°C), default value is 80°C.
- ▶ Press “confirm” button to confirm the setting, press “cancel” button to deactivate the function.



When signal of maximum tank temperature is displayed on screen, it indicates this function is activated. When the signal isn't display on screen, it indicated this function is deactivated.



4.13 Protection for collector at high temperature

Functional description:

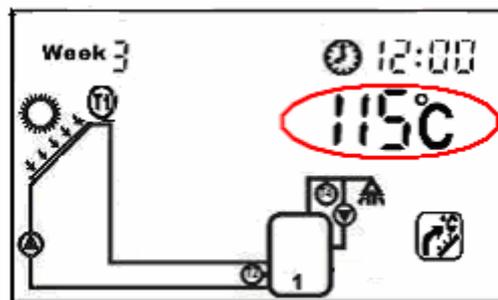
If the hot water in tank isn't used, temperature in solar circulation will rise automatically after long time sunshine. The heat loss through the collector will increase with the rising of temperature of heat transfer liquid; Through setting the maximal temperature of collector can realize the cooling of collector.

Activate/deactivate this function:

- ▶ Press "choose function", when  display on the screen.
- ▶ Press "▲" "▼" button to adjust the maximum collector temperature (adjustable range: 100°C~140°C), default value is 115°C.
- ▶ Press "confirm" button to confirm the setting, press "cancel" button to deactivate this function.



When signal of maximum collector temperature displays on the screen, it indicates this function activated. When the signal isn't displays on the screen, it indicated this function is deactivated.



4.14 Collector emergency cut-off

Functional description:

When the temperature of collector exceeds 130°C, in order to protect the other components of solar circuit, solar circuit pump is shut off compulsively.

Restart conditions: when the temperature of collector drops below 100°C and tank temperature drops below the maximum tank temperature.

4.15 Protection for collector at low temperature

Functional description:

When the temperature of collector is below 15°C, even when the temperature difference exceeds switch-on

temperature difference, solar pump doesn't work.

When the temperature of collector is exceeds 20°C, solar pump restarts to work.

4.16 Collector frost protection

Functional description:

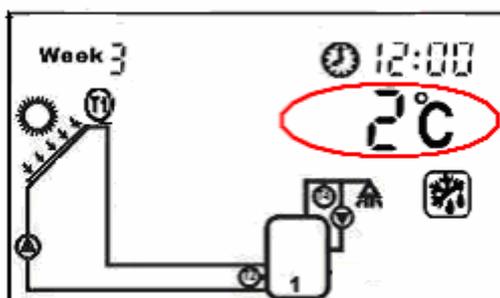
In Winter when the temperature of collector is below the preset frost protection temperature (2°C~15°C), solar pump starts work. When the temperature of collector exceeds the switch-off temperature of frost protection, switch-off circulation pump and exit frost protection. After starts frost protection, when water tank temperature below 5°C of switch-off frost protection, immediately start up auxiliary heating until 20°C or exit the program.

Activate/deactivate this function:

- ▶ Press “choose function”, the  display on the screen.
- ▶ Press “▲” “▼” button to adjust the temperature of frost protection, (adjustable range: 0°C~15°C), default value is 2°C.
- ▶ Press “confirm” button to confirm the setting, press “cancel” button to deactivate this function.



When the signal displays on screen, it indicates frost protection function is activated. When the signal isn't display on screen, it indicated this function is deactivated.



4.17 Temperature-setting for hot water circulation pump

Functional description:

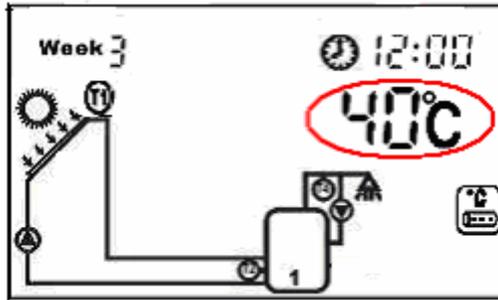
Solar system can provide temperature-controlled hot water circulation pump function. This function needs an extra hot water circulation pump (P2) and a sensor (T4), which is positioned on the return hot water pipe. When the temperature signal of sensor T4 is less than the preset turning on temperature, the hot water circulation pump (P2) triggers and works till the temperature exceeds the turning off temperature.

The default turning on temperature is 39°C; default turning off temperature is 45°C.

Activate/deactivate this function:

- ▶ Press “choose function”, the  “ display on the screen.
- ▶ Press “▲” “▼” button to adjust the temperature of circulation pump, (adjustable range: 20°C~50°C).
- ▶ Press “confirm” button to confirm the setting, press “cancel” button to deactivate this function.

Note: the position of the sensor T4 should be minimum 1.5m far from tank, so that avoid the measuring error.



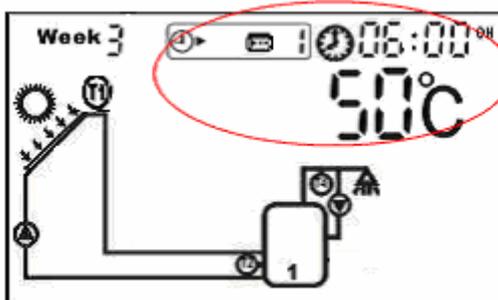
4.18 Time-setting for hot water circulation pump

Function description:

Solar system can provide time-controlled hot water circulation function, this function needs an extra circulation pump (P2), this pump can be triggered by preset time. Within the preset time section pump operates for three minutes, and then stops for 15 minutes, same process continues so. Three time sections can be set within one day.

Setup steps:

- ▶ Press “ system setting”, when “☰” display on the screen.
 - ▶ Press “▲”“▼” button to adjust the first time section of switch on, Press “▲” button to adjust hour of clock, Press “▼” button to adjust minute of clock. Press “confirm” button to confirm the setting, Press “cancel” button to cancel this setting.
 - ▶ Press “▲”“▼” button to adjust the first time section of switch off. Press “▲” button to adjust hour of clock, press “▼” button to adjust minute of clock. Press “confirm” button to confirm the setting, Press “cancel” button to cancel this setting.
 - ▶ Press “▲” “▼” button to adjust the second time section of switch on/off. Press “confirm” button to confirm the setting, Press “cancel” button to cancel this setting.
 - ▶ Press “▲” “▼” button to adjust the third time section of switch on/off. Press “confirm” button to confirm the setting, Press “cancel” button to cancel this setting.
- l Doing like above steps. Within one day, three time sections can be set.
 - l Default setting: First time section: 6:00 turning on, 8:00 turning off. Second time section: don't work, setting is 10:00 ~10:00. Third time section: 19:00 turning on, 21:00 turning off.
 - l If you want to shut off one timing circulation, then you set the turning on time and turning off time same value (for example, deactivate the function in the second time section, then you can set turning on/off time is 10:00 ~ 10:00).



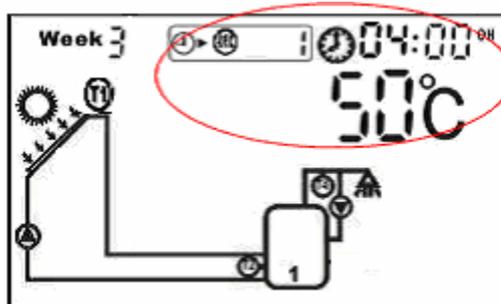
4.19 Time controlled auxiliary heating at preset time sections

Functional description:

Controller can be combined with auxiliary heating or gas, oil boiler, controller can achieve automatically temperature and timing controlled heating, during the preset time sections auxiliary heating starts working when the temperature (T3) of top part of tank is below the preset turning on temperature, when T3 exceeds the preset turning off temperature, auxiliary heating stops heating.

Setup steps:

- ▶ Press “system setting”, when “” display on the screen.
- ▶ Press “▲”“▼” button to adjust the first time section of switch on, Press “▲” button to adjust hour of clock, press “▼” button to adjust minute of clock. Press “confirm” button to confirm the setting, Press “cancel” button to cancel this setting.
- ▶ Press “▲”“▼” button to adjust the first time section of switch off. Press “▲” button to adjust hour of clock, press “▼” button to adjust minute of clock. Press “confirm” button to confirm the setting, Press “cancel” button to cancel this setting.
- ▶ Press “▲” “▼” button to adjust the second time section of switch on/off,. Press “confirm” button to confirm the setting, Press “cancel” button to cancel this setting.
- ▶ Press “▲” “▼” button to adjust the third time section of switch on/off. Press “confirm” button to confirm the setting, Press “cancel” button to cancel this setting.
- Doing like above described steps, three timing sections can be set (1-3 displays)
- Default setting: First heating time section: 4:00 turning on, 5:00 turning off Second heating time section: not working, setting is 10:00 ~10:00. Third heating time section: 17:00 turning on, 22:00 turning off.
- If you want to shut off one timing heating, then you set the turning on time and turning off time same value (for example, the second time section no this function, then you can set turning on/off time is 10:00 ~ 10:00)
- Controller has memory function, your setting is remembered, and you don’t need to set everyday.



Note: when no temperature sensor (T3) is installed in the top part of tank or T3 is damaged, controller will take the signal from bottom temperature sensor (T2) automatically and control auxiliary heating function.

When this signal displays on the screen, it indicates the function activated. When the signal isn’t display on the screen, it indicates this function is deactivated.

4.20 Holiday function

Function description:

This function activated nightly storage tank back cooling and prevents high thermal loads of the solar system due to completely heated storage tank. The function is activated when the collector temperature falls 8°C below the storage tank temperature at night between 10 pm and 6 am.

Activate this function :

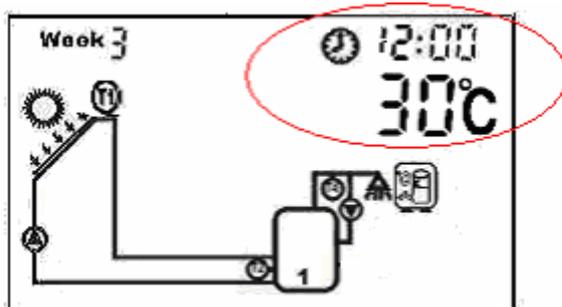
- You intend to be absent for an extended period (holiday).
- No hot water is required for an extended period.

The function is deactivated when the temperature in lower section of storage tank falls down to 35°C.

Activating/deactivating the function

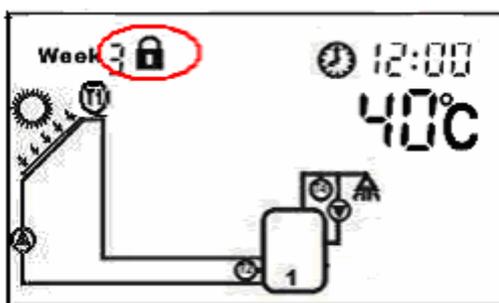


- ▶ Press “choose function”, when “” display on the screen, it indicates the function is activated.
- ▶ Press “confirm” button to confirm this setting. Press “cancel” button to deactivate this function.



4.21 Permit / prohibit auxiliary heating

- ▶ Press “choose function” button, when “” display on the screen.
- ▶ Press “confirm” button to confirm the setting, when “” blinks on screen. It indicates prohibit to use the auxiliary heating.
- ▶ Press “cancel” button to cancel this function, and “” will disappear, it indicates permit to use auxiliary heating.



4.22 Switch on /off auxiliary heating manually

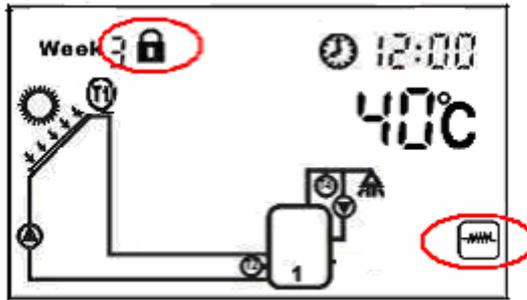
Functional description:

When auxiliary heating working at anytime, use this function, you can Switch on /off auxiliary heating.

Setup steps:



- ▶ Press “choose function” button, when “” display on the screen.
- ▶ Press “confirm” button to switch on the auxiliary heating
- ▶ Press “cancel” button to switch off the auxiliary heating



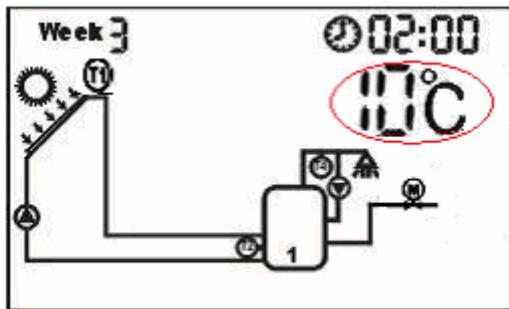
4.23 Auxiliary function

Note: the following described functions need an extra output R2 to control pump or electromagnetic valve, when all output are occupied, the desired function can't be activated.

a Temperature difference controlling

When T0, T5, R2 are not display on the screen. The temperature difference controlling function start up.

- ▶ Press “choose function” button, when “” display on the screen.
- ▶ Press “confirm” button to start up this function. Press “cancel” to cancel this function.

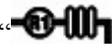


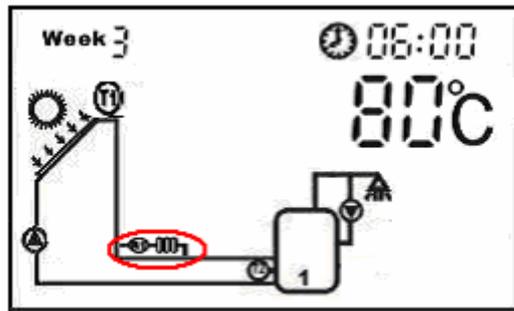
When this signal displays on the screen, it indicates the function activated. When the signal isn't display on screen, it indicated this function is deactivated.

b. High temperature by-pass

Function description:

This function allows reducing the temperature in tank by using radiator, if the temperature in tank is too high, this function is triggered.

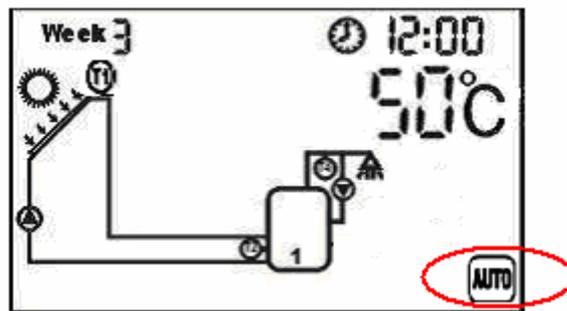
- ▶ Press “choose function” button, when “” display on the screen.
- ▶ Press “▲” “▼” to adjust the switch-on temperature (T2) for high temperature by-pass. Adjustable range: 50°C ~ 99°C.
- ▶ Press “confirm” button to confirm the setting. Press “cancel” button to deactivate this function.



4.24 Auto function



- ▶ Press “choose function” button, when “” display on the screen.
- ▶ Press “confirm” button, all values of system parameters are set to the factory settings.



4.25 Protection function

a. Memory protection when power is failure

In case power failure occurs, controller keeps the parameter setting unchanged.

b. Anti -bacteria protection

In order not to effect the health of customer and to prevent to occur bacteria when tank temperature is lower for a long time, controller will check the temperature of tank every 7 days in a period automatically, if the temperature of tank is never over 70°C during the period, then at the default time of 23:00 on the seventh day the period of auxiliary heating system is triggered automatically, when the temperature rise up to 70°C, the auxiliary heating stops, bacteria is killed.

5. Trouble shooting

5.1 Trouble protection

a. When there is a break or short circuit between the connection of temperature sensors, controller switches off the corresponding functions and no more output signals are given, at the same time error indications are showed on the display.

b. Error messages indication

If control unit does not work correctly, please check following points, “warning “signal is displayed on screen.

Error messages and handling indication (LCD display warning signal blinks)

| Error message | Meaning | Cause of error | Error rectification |
|--|--|---|---|
| T0  blinks | There is a break or short circuit between sensor connections | Sensor wiring interrupted, not connected or short circuit | Check resistance value, replace sensor if necessary |
| T1  blinks | There is a break or short circuit between sensor connections | Sensor wiring interrupted, not connected or short circuit | Check resistance value, replace sensor if necessary |
| T2  blinks | There is a break or short circuit between sensor connections | Sensor wiring interrupted, not connected or short circuit | Check resistance value, replace sensor if necessary |
| T3  blinks | There is a break or short circuit between sensor connections | Sensor wiring interrupted, not connected or short circuit | Check resistance value, replace sensor if necessary |
| T4  blinks | There is a break or short circuit between sensor connections | Sensor wiring interrupted, not connected or short circuit | Check resistance value, replace sensor if necessary |
| T5  blinks | There is a break or short circuit between sensor connections | Sensor wiring interrupted, not connected or short circuit | Check resistance value, replace sensor if necessary |

Note: when the error of sensor appears, its corresponding function will be switched off automatically.

5.2 Error checking

The controller is quality product, conceived for years of continuous trouble-free operation. If a problem occurs, the cause of the problem very often lies not in the controller but in the peripheral components. The following description of some well-known problems should help the installer and operator to isolate the problem, so that the system can be place back into operation as quickly as possible and to avoid unnecessary costs. Of course, not all possible problems can be listed here. However, most of the normal problems encountered with the controller can be found in the list below, only return the controller when you are absolutely sure that none of the problems listed below is responsible for the fault.

a. A potentially defective sensor can be checked using an ohmmeter. To do this, the sensor must be disconnected, its resistance measured, and the value compared with the figures in the table below, small deviation are acceptable,

note: remove the device from the mains supply before opening the case

PT1000 resistance value

| | | | | | | | | | | | | | |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| °C | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| Ω | 1000 | 1039 | 1077 | 1116 | 1155 | 1194 | 1232 | 1270 | 1309 | 1347 | 1385 | 1422 | 1460 |

NTC 10K B=3950 resistance value

| | | | | | | | | | | | | | |
|----|-------|-------|-------|------|------|------|------|------|------|-----|-----|-----|-----|
| °C | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| Ω | 33620 | 20174 | 12535 | 8037 | 5301 | 3588 | 2486 | 1759 | 1270 | 933 | 697 | 529 | 407 |

b. Cause of failures

| Symptoms | Secondary symptoms | Possible cause | Procedure |
|---|-----------------------------------|---|----------------------------------|
| Controller does not appear to function at | Display shows nothing, no display | Controller power supply is interrupted. | Check the controller power cable |

| | | | |
|---|---|--|---|
| all | illumination. | | |
| The solar pump doesn't operated, despite the fact that switch-on conditions are satisfied | The pump symbol in the display blinks. | Pump power supply is interrupted. | Check the pump power cable |
| Pump doesn't operate | The pump symbol in the display doesn't blink. | The maximum storage tank temperature has been reached Then maximum collector temperature has been reached | No fault |
| | The pump symbol in the display doesn't blink, error message signal "T_" blinks on  the display screen. | Fault (short circuit or open circuit) in a temperature sensor. | On the controller, request the current values from all connected temperature sensors, replace all defective sensors and/or cabling. |
| The solar pumps operated, despite the fact that the switch-on conditions are not satisfied. | The pump symbol in the display blinks. | The holiday function is activated. The frost protection function is activated. | No problem, it is normal. If necessary to deactivate the corresponding functions. |

6. Technical data

- Appearance of controller: see product itself (dimension: 210mm x145mm x48mm)
 - Power supply: AC220V \pm 10%
 - Power consumption: < 3W
 - Accuracy of temperature measuring: \pm 2°C
 - Range of temperature measuring: 0 ~150°C
 - Suitable power of pump: 4 pumps possible to be connected, power of each pump < 600W
 - Suitable power of electrical booster: standard \leq 2000W, selectable variant \leq 3000W (must be noted in order)
 - Inputs: 6 sensors, Pt1000 sensor (\leq 500°C) for collector (silicon cable \leq 280°C), NTC10K, B3950 sensor (\leq 135°C) for tank, (PVC cable \leq 105°C),
 - Outputs: 5 relays, one for electrical booster, 4 for circulation pumps or 3-way electromagnetic valve
 - Ambient temperature : -20°C ~ 60°C.
 - Water proof grade: IP40.
- Socket: choice by customer

Annex: parameters setting

| Nr. | Function | Factory setting | Remark |
|-----|--|-----------------|--|
| 1 | Collector frost protection | On | See. Chapter 4. 16 |
| 2 | Tank maximum temperature protection | On | See. Chapter 4. 12 |
| 3 | Collector maximum temperature | On | See. Chapter 4. 13 |
| 4 | Temperature controlled hot water Circulation. | Off | See. Chapter 4. 17 |
| 5 | System mode | System1 | Available system mode 1~ 8 |
| 6 | Temperature sensors T0,T1: PT1000 T2,T3,T4,T5: NTC 10K, B=3950 | | T3: If T3 is not installed or is damaged, controller uses sensor T2 automatically. |