SP106 Manual

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1 General information

1.1 About this manual

This manual describes the installation, function and operation of a solar thermal controller. Before installing and operating the controller, please read the following information carefully.

1.2 Safety regulations

- Installation, commissioning and maintenance of the controller may only be performed by trained professional personal.
- All operations that require opening the device are only to be conducted cleared from the power supply. All safety regulations for working on the power supply are valid.
- The controller must not be installed in rooms where easily inflammable material (e.g. gas or oil) mixtures are present or may occur.
- Before connecting the device, make sure that the energy supply matches the specifications of controller.
- All devices connected to the controller must conform to the technical specifications of the controller.
- As soon as it becomes evident that safe operation is no longer possible. Please immediately take the device out of operation.

1.3 Liability waiver

- Improper installation or operation can cause damages to material and persons. The manufacturer cannot monitor the compliance with these instructions or the circumstances and methods used for installation, operation, utilization and maintenance of this controller. Damage by mishandling or improper installation on costumer site is immediately leading to warranty exclusion.
- As faults can never be excluded, we don't offer a guarantee for the completeness of the drawings and texts of this manual, they only represent some examples. They can only be used on own risk. No liability is assumed for incorrect, incomplete or false information and the resulting damages.
- The manufacturer preserves the right to put changes to product, technical date or installation and operation instructions without prior notice.

1.4 Symbols used

Danger: Failure to observe these instructions can lead to injury of persons or safety risks.

Attention: Failure to observe these instructions can result in damage to the product or environment.

Note: Useful information and instructions.

† **Operation steps:** Indication of operation step.

1.5 Scope of delivery

1×Controller SP24; 1×Sensor Pt1000; 2×Sensor NTC10K; 1×Power connection; 3×Screw;1×Manual

2 Installation

2.1 Mounting

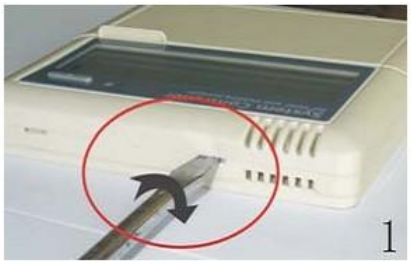
Attention:
Controller must only be installed in a place having an adequate level of protection.

2.1.1 Installation of display panel

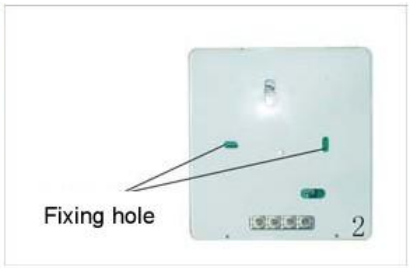
† Remove the back panel from display with screwdriver in direction showed on picture 1.

† Fix the back panel with screw on the wall. Please note, don't drill hole direct on the controller, see picture 2.

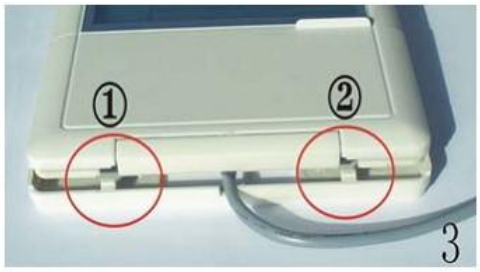
† Insert the upper case of display into the grooves of rear panel ①②, see picture 3.



Picture 1



Picture 2



Picture 3

2.1.2 Fixing the hang-panel of controller

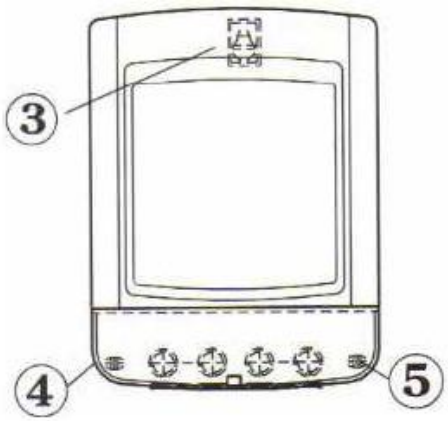
† Take out the screw ① from the bottom case of controller, see picture 4.

† Remove the upper case ②, open the case (see picture 4) and the connection ports are showed.

† Firstly fix the screw ③ on wall ,and then hang the controller on it. Last, through the other two holes ④⑤, fix the controller, see picture 5.

Attention: Don't drill holes on the case of controller

Picture 4



Picture 5

2.2 Connection of power

Danger: Remove the device from the power supply before opening the case!

2.2.1 Opening / closing the cover of terminal panel

† Loosen the screw and remove the upper case in the upward direction.

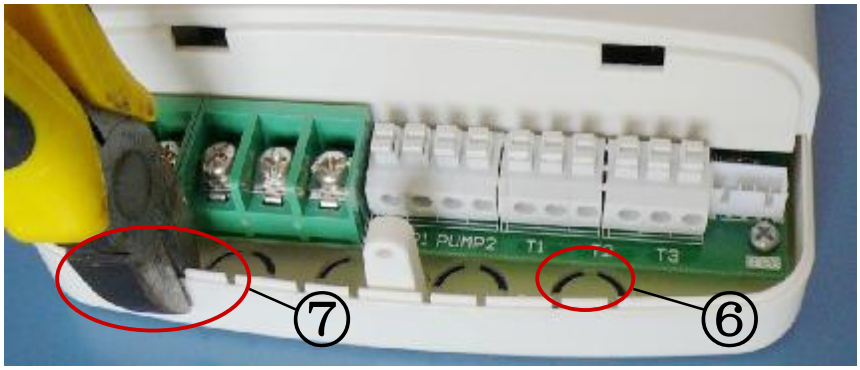
† Close the cover downwards and fasten with screw.

2.2.2 Preparation before connection

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

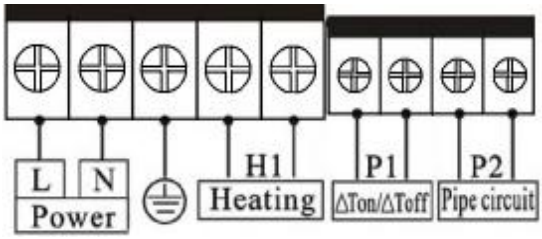
† Before connecting wires, please remove the plastic flaps from the bottom ⑥ or from the foreside ⑦ of the case for passing wires. Please use an appropriate tool (better with pliers or knife) to cut the plastic. See picture 6.

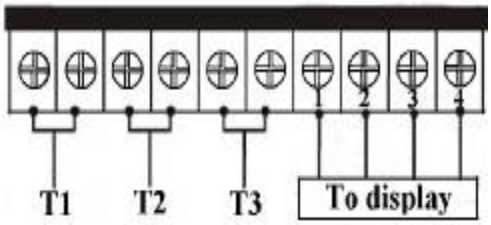
† Connect the wires/sensors like the indications in "terminals connection".



Picture 6

2.2.3 Terminals connection





Power Connection:	**Outputs:**	**Inputs:**
1.Please note the type of power supply required from the type label on the case of the device. 2.The protective conducting wire (earth wire) must also be connected.	1.Outputs **P1** (circulation pump of temperature difference) and **P2** (circulation pump of pipeline): electromagnetic relays, max. switching current: 3A. 2.Output H1: electromagnetic relay, max. switching current: 16A.	1.Inputs T1, T2, T3: temperature sensors. 2.Inputs 1,2,3,4: connected with display. **Note for sensors:** T1,T3: NTC; T2: Pt 1000

Attention:

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

Attention:

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

Attention:

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

Attention:

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

Attention:

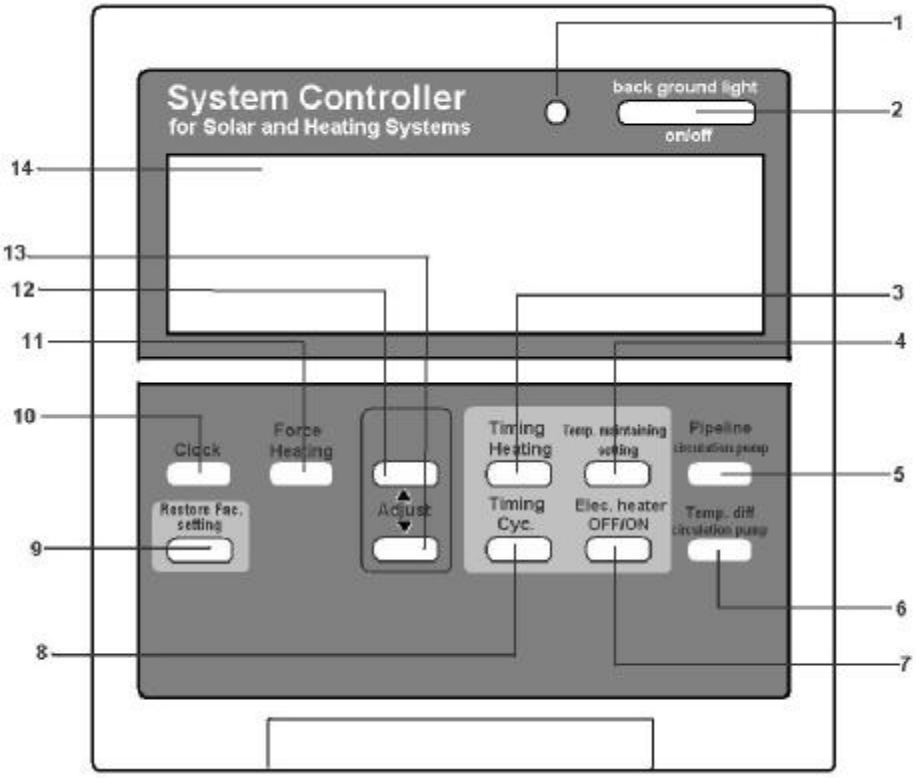
Sensor cables may be extended to a maximum length of 100 meter. When cable's length is up to 50m, and then 0.75m ㎡ cable should be used. When cable's length is up to 100m, and then 1.5m ㎡ cable should be used.

Note:

PT1000 and NTC10k, B=3950 are different kinds of temperature sensors, measurement error may exist between these twos at the same ambient temperature, but it doesn't effect the operation of system.

3 Description of the controller

3.1 Case overview



POS.	Buttons on display	Button description
1	Green lamp	Power indication lamp
2	Background light on/off	Switch on/off the light of background
3	Timing heating	Program for time controlled auxiliary heating
4	Temp. Maintaining setting	Adjust button for the temperature-difference controlling function, the overheating protection for storage tank, the frost protection for collector and pipeline
5	Pipeline circulation pump	To trigger the hot water pipe circulation pump
6	Temp. diff. circulation pump	To trigger the temperature difference controlled circulation pump
7	Elec. heater off/on	To forbid or permit to use the auxiliary heating
8	Timing Cyc.	Program for time controlled hot water pipe circulation
9	Restore Fac. setting	Back to the factory settings
10	Clock	Button for time setting, displays 24 hours clock time
11	Force heating	To switch on/off the auxiliary heating function
12	Adjust "▲"	Adjust button
13	Adjust "▼"	Adjust button
14	LCD display	

3.2 Display symbols

	Morning
	Noon
	Night
T1	Temperature sensor for the bottom part of water tank
T2	Temperature sensor for the solar collector
T3	Temperature sensor for the top part of water tank
	Indication for ban on the use of auxiliary heating
	Indication for switch-on of "Force heating"
CLOCK 	Indication for time setting
	Indication for switch-on of "Temperature difference circulation pump"
	Indication for switch-on of "Pipeline circulation pump"
ON	Indication for adjusting the turning-on time of timer program
OFF	Indication for adjusting the turning-off time of timer program

3.3 System description

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

T3 is used to measure the temperature value of the top tank. If the turning-on condition for auxiliary heating is filled, the auxiliary heating program will be activated.

Danger: When there is only one insert port for temperature sensor in the water storage tank (usually in the bottom part, see **3.3.1**), the temperature in top part of the tank (T3) cannot be measured. Thus, it is possible, that the auxiliary heating function will not be activated/deactivated at the right time and water in top part will often be overheated. It may cause damages to material and persons. So it is highly recommended not to use auxiliary heating in such a case. To lock this function, please press the "Force heating" button until "  " shows on the screen (see **5.7 Time controlled auxiliary heating**).

3.3.1 System with 1 collector, 1 storage tank and 2 sensors

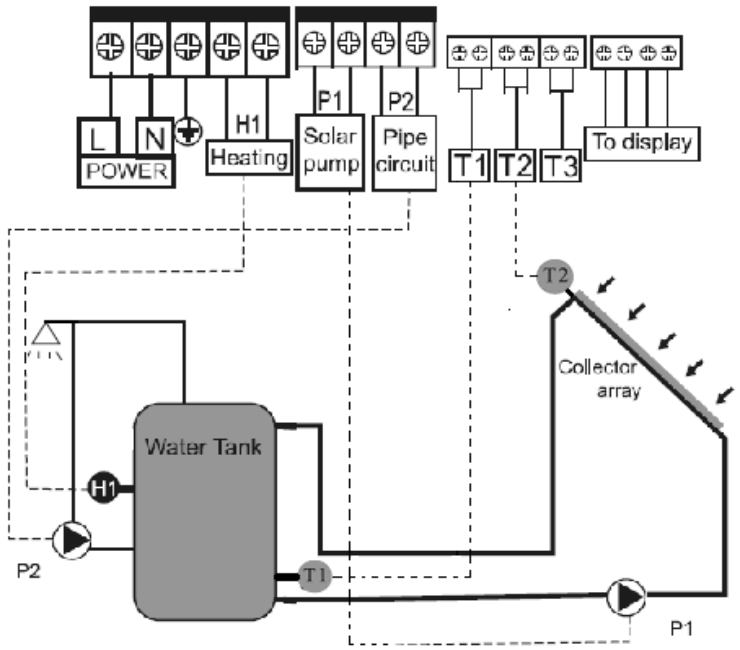


Illustration:

T1: Temperature sensor in the bottom part of storage tank (For temperature difference circulation)

T2: Temperature sensor for collector.

P1: Temperature difference circulation pump

P2: Pipeline circulation pump

H1: Port for connecting with auxiliary electrical heating

3.3.2 System with 1 collector, 1 storage tank and 3 sensors

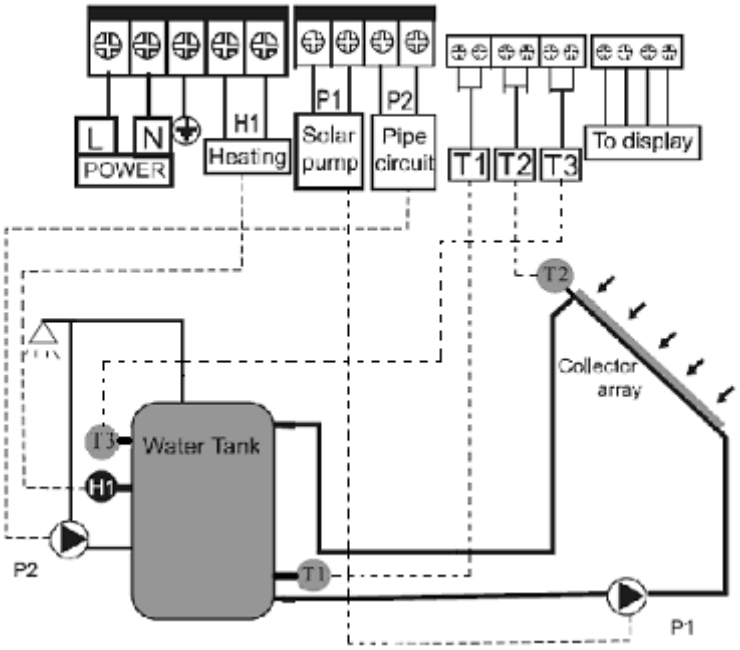


Illustration:

T1: Temperature sensor in the bottom part of storage tank (For temperature difference circulation)

T2: Temperature sensor for collector

T3: Temperature sensor in the top part of tank (For control auxiliary heating)

P1: Temperature difference circulation pump

P2: Pipeline circulation pump

H1: Port for connecting with auxiliary electrical heating.

3.4 Technical data

- Display dimension: 120mm x120mm x20mm
- Power supply：AC220V±20% or AC110V±20% (must be noted in order)
- Power consumption：< 3W
- Accuracy of temperature measuring: ± 2℃
- Range of temperature measuring：0℃ - 99℃
- Suitable power of pump：2 pumps possible to be connected, power of each pump < 600W
- Suitable power of electrical booster：Standard ≤ 2000W, selectable variant ≤ 3000W (must be noted in order)
- Inputs： 3 sensors, Pt1000 sensor (≤500℃) for collector (silicon cable≤280℃), NTC10K, B3950 sensor (≤ 135℃) for tank, (PVC cable ≤105℃)
- Outputs：3 relays, one for auxiliary heating, two for circulation pumps
- Ambient temperature：-20℃ ~ 60℃
- Protection classification：IP40

4 Commissioning

Activate the AC power supply and start the commissioning, so that you can check if all components of the controller are connected correctly.

Danger: Connect the sensors, pumps or switching valves to the controller before you connect the power supply!

4.1 Background light

† Press "**Background light on/off**" button, the background light shines.

† Press "**Background light on/off**" button again, the background light will be shut off, or the light turns to dark automatically after 3 minutes, if you don't press the button.

4.2 Manual operation

When testing the function, or when operating the device for the first time, the output of controller can be operated manually.

4.2.1 Manual operation of temperature difference controlled pump

† Press "**Temp. diff. Circulation pump**" button to activate the temperature difference circulation pump.

† Press "**Temp. diff. Circulation pump**" button again, the pump stops working, or it will stops automatically after 3 minutes without pressing.

4.2.2 Manual operation of hot water pipe circulation pump

† Press "**Pipeline circulation pump**" button, the pipeline circulation pump is triggered,

† Press "**Pipeline circulation pump**" button again to stop the pump

4.2.3 Manual operation of force heating

† Press " **Force heating** " button, the auxiliary heating with electricity or gas/oil is triggered.

† Press " **Force heating**" button again to shut off this output immediately.

Attention: Out of consideration for safety, the electric heating function is switched off at delivery. This sign "🔒" displays on the screen. If you want to use auxiliary heating, please see: **5.5 Time controlled auxiliary heating**.

4.3 Temperature display function

† Press adjust button "▲" "▼" to see the temperature value of tank bottom (T1), collector (T2) and tank top (T3) one by one.

† If there is no temperature value showed on the screen, check the connection of the sensors (see indications in "**Error messages**").

5 Operation and functions

5.1 Setting time

After switching on power supply to the controller, please firstly set the time of the controller.

† Press "**clock**" button, clock area blinks on display screen.

† Press "▲" button to set hour of clock.

† Press "▼" button to set minute of clock.

† Press "**clock**" again to confirm the setting.

5.2 Temperature-difference controlling function

Solar circulation pump P1 is triggered, as soon as the preset temperature difference between collector and tank is reached. Default beginning and ending value for the temperature difference circulation is 10℃ and 5℃.

† Press "**Temp. Maintaining Setting**" button, the symbol "**60℃**" (default value) displays in the LCD, which means user can set the wanted temperature of the storage tank. Setting range: 45℃-75℃.Press "▲" "▼" button to adjust it.

Note: If the water temperature in the tank is higher set than 60℃, scale can form more easily.

† Press "**Temp. Maintaining Setting**" again to save the setting.

† At the same time, the LCD shows the value "**10℃**" (default value). That means user can adjust the beginning value for the temperature difference circulation. Setting range: 5℃-20℃. Press "▲" "▼" button to adjust it.

† Press "**Temp. Maintaining Setting**" button one more time to save the setting, and the LCD display shows "**5℃**" (default value), which means user can adjust the ending value for the temperature difference circulation. Setting range: 2℃-12℃. Press "▲" "▼" button to adjust it.

† Press "**Temp. Maintaining Setting**" button again, save the setting.

5.3 Overheating protection for storage tank

To avoid overheating of the storage tank, system is equipped with an overheating protection function. When the temperature of the storage tank (T3) is higher than the maximum tank temperature, even if the condition of temperature difference circulation is reached, solar pump is still forbidden to trigger.

System checks the temperature at the top part of tank (T3) and compares it with starting temperature of the overheating protection function. When the temperature (T3) is higher than the starting temperature, solar circuit pump will be locked automatically; when it drops below the starting temperature, solar circuit pump will be triggered again.

† After saving the setting of the ending value for the temperature difference circulation, it enters directly into the overheating protection function. The display shows "**80℃**" (default value) on the screen.

† Press "▲" "▼" button to adjust the maximum tank temperature, setting range: 50℃-95℃.

† Press "**Temp. Maintaining Setting**" button to save the setting.

5.4 Frost protection for collector/pipeline

In winter, when the temperature of collector drops below the programmed starting temperature of frost protection (default value: 5℃), the circulation pump (P1) starts working to transport the medium liquid to warm the collector and pipelines. When the temperature of collector reaches the switch-off value of frost protection, solar pump is switched off and the system exits this protection function.

After starting frost protection of the collector, if meanwhile the water tank temperature is below 8℃, the auxiliary heating will be triggered immediately to heat the water till 20℃, and then stops.

† After saving the setting of the maximum tank temperature, it enters directly into frost protection for collector/pipeline. The default value "**5**℃" will be showed on the screen.
† Press "▲" "▼" button to adjust the temperature of frost protection, setting range: 1℃-15℃.
† Press "**Temp. Maintaining Setting**" button to save the setting.

Note:
If you don't want to use this frost protection, you can set the value to **0**℃.

5.5 Time controlled auxiliary heating

Attention: When the symbol "🔒" shows on the screen, it indicates that the time controlled auxiliary heating function is compellent shut off.

If you want to use this function,

† Press "**Electrical heater off/on**" button, the symbol "🔒" disappears and the auxiliary heating function is allowed.
† Press "**Electrical heater off/on**" button again, "🔒" blinks which indicates ban on using the auxiliary heating.

Solar system can be combined with electrical booster, gas or oil boiler. The controller is equipped with a default program which can be customized to meet your individual needs. You can create a timer program with up to three time sections for heating the water. During the preset time sections auxiliary heating starts working, when the temperature of the top part of storage tank (T3) is below the preset turning-on temperature. When T3 exceeds the preset turning-off temperature, electrical booster stops heating.

Note:
Default setting: the first heating time section: 4:00 turning on, 5:00 turning off; the second heating time section: 10:00~10:00; the third heating time section: 17:00 turning on, 22:00 turning off.

† Press "**Timing heating**" button to set the first time section, the symbol "**on**" displays.
† Press "▲" "▼" button to set the start time.
† Press "**Timing heating**" button again to confirm the setting. The first time section "**off**" shows on the screen at the same time.

† Press "▲" "▼" button to set the end time.

† Perform like above description, the other time sections can be set.

Note: If you want to shut off the auxiliary heating in one of the three time sections, then you can set a same value for both start time and end time (e.g. if you set both start and end time at 10:00 hour, then the auxiliary heating in the second time section will not be triggered).

5.6 Force heating

If you want to use warm water immediately, but the temperature doesn't reach the value you want (see **5.2** to set the wanted temperature),

† Press "**Force heating**" button to make the auxiliary heating switch on manually.

† Press "**Force heating**" button again to switch off the heating.

Attention: when heating signal "" displays on screen, it means this function is in operation.

5.7 Time controlled hot water pipe circulation

To use the water efficiently, our controller provides time controlled hot water circulation function. This function needs an extra circulation pump (P2), it can be triggered at the preset time. Within the preset time sections pump works for three minutes, and then stops for 15 minutes, the same process reruns like this.

Note:
Default setting: the first time section: 6:00 turning on, 8:00 turning off; the second time section: 10:00~10:00; the third time section: 19:00 turning on, 21:00 turning off.

† Press "**Timing cyc.**" Button to adjust the first time section, "**on**" displays.

† Press adjust button "▲" "▼" to set the start time.

† Press "**Timing cyc.**" button again to confirm the setting. The first time section "**off**" shows on the screen at the same time.

† Press adjust button "▲" "▼" to set the end time.

† Perform like above steps. Three time sections can be set.

Note: If you want to shut off one of the three time circulation sections, then you can set a same value for both start time and end time (e.g. if you want to deactivate this function in the second time section, then you can set both start and end time at 10:00 hour).

Note: Pipeline circulation pump can also be triggered immediately, thus user can have warm water from the pipeline directly. Just press "**Pipeline circulation pump**" button, if the signal "" displays on the screen, that means this function is activated. The pump works for three minutes and then it stops automatically. Without Activation, no more restart.

5.8 Special functions

5.8.1 Emergency cut-off of solar system

When the temperature of collector exceeds 120℃, in order to protect the other components of solar system, solar circulation pump will be shut off compulsively. Restart conditions: the temperature of collector falls below 100℃ and the tank temperature falls below the maximum tank temperature.

5.8.2 Memory function

In case that power failure occurs, the controller will keep the parameter settings unchanged. When power supply is connected again, controller will work at previous status.

Note: This function works automatically after power failure, you don't need to set it.

5.9 Reset

All of the settings (besides the time setting) that have been made can be reset, if it is required (e.g. when system program is out of working).

† Press "**Restore Fac. Setting**" button to set the parameters of system back to the factory settings.

6 Error messages

If there is a problem with the controller or temperature sensor, the error messages will be displayed on the screen.

Danger: Never try to repair the controller yourself! Consult a specialist in case of an error!

The following table explains the error messages and corresponding handling indication. Most of the problems can be found in the list below.

Symptoms	Possible cause	Handling
Nothing shows on the display.	Controller power supply is interrupted.	Check the controller power connection.
The solar pump doesn't work, even though the switch-on conditions are satisfied. And the pump symbol blinks on the display.	Pump power supply is interrupted.	Check the pump power connection.
The solar pump doesn't work, and the pump symbol doesn't blink either, but error message signal blinks on the display screen.	Fault in a temperature sensor.	Call up the current values from all connected temperature sensors, and replace the defective sensors.
The solar pump works, despite the fact that the switch-on conditions are not satisfied. And the pump symbol blinks on the display.	The recooling function for collector or frost protection function for collector and pipeline is activated.	It is normal. If necessary, deactivate the corresponding functions.

When problem with sensors occurs, the following messages will be showed on the display.

Display	<FF>	<99>	<00>	<99>
Message	The connection wire of sensors and controller is out of service.	Sensor of tank (T1) is out of service.	Sensor of collector pipe (T2) is out of service.	Sensor of tank (T3) is out of service.
Solution	Check the connection or resistance value of the sensor, replace it if necessary			

Note:
Sensor characteristics are listed in the following tables.

PT1000 resistance value

℃	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

℃	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