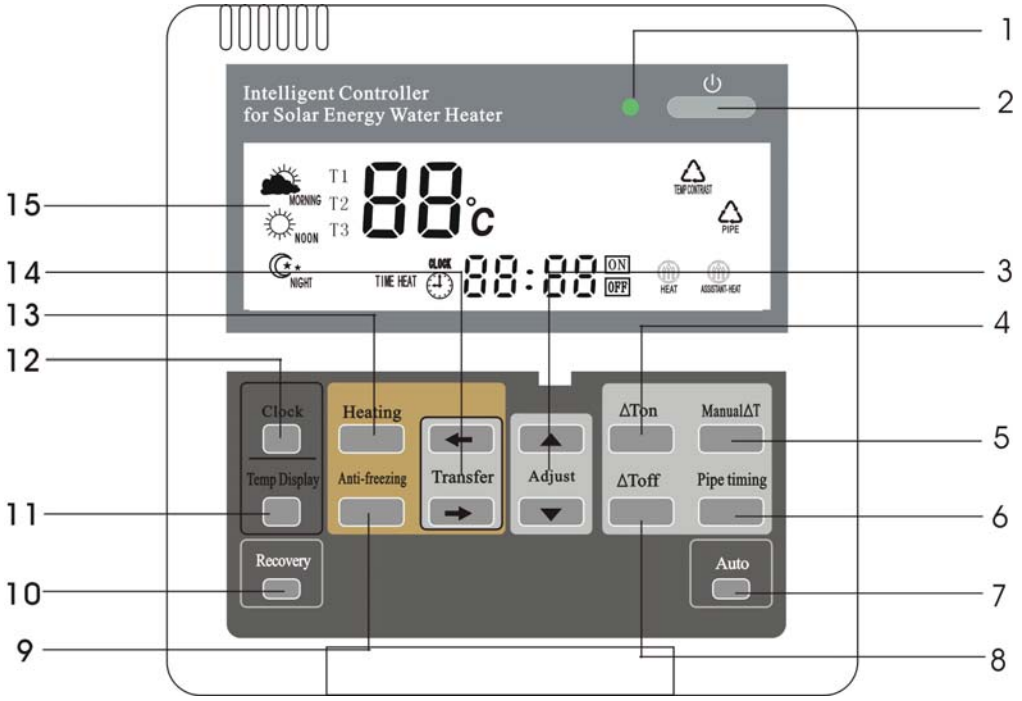
Installation and Operating Manual

TRX868C3E-1

Display and Controller Board

System Regulator for Solar Thermal Systems

Display Panel Illustration



Pos.	Button on Display Panel	Function
1	**Green lamp**	Power indication lamp
2	**On/Off**	Power “switch on/off” button
3	**“▲””▼” adjust**	Adjusting button
4	**△Ton**	To Set switch-on temperature difference of solar circulation
5	**Manual △T**	Manual commissioning to trigger temperature difference controlled solar circulation
6	**Pipe timing**	To set time for hot water pipe circulation
7	**Auto**	Parameter recover to factory set
8	**△Toff**	To set switch-off temperature difference of solar circulation
9	**Anti - Freezing**	Anti freezing protection set
10	**Recovery**	To recovery the display to factory set mode.
11	**Temp. Display**	Display temperature in different position one by one
12	**Clock**	Clock set
13	**Heating**	Electrical heating time set
14	**“ →” “←”**	Transfer button
15		LCD display screen

Connection Terminal Illustration

Content

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
- 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 yellow warning triangle. They indicate measures which can lead to injury of persons or safety risks.

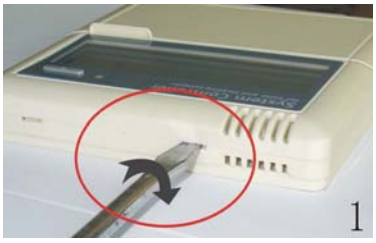
Operation steps: small triangle “►”is used to indicate operation step.

Note: contains important information for operation or function, it is written in blue color

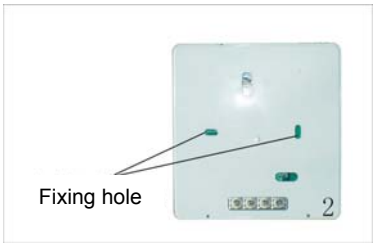
2. Installation

2.1 Installation of display panel

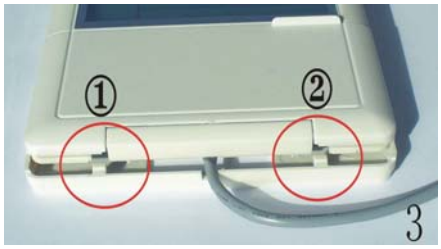
►Remove the back panel from display with screw in direction showed on picture 1
►Fix the back panel with screw on the wall, please note don't drill hole on controller, see picture 2
►Insert the upper case of display into the grooves ① ②of back panel, fasten them, see picture 3



Picture 1



Picture 2



Picture 3

2.2 Installation of controller

Note：Controller must only be installed in an area having an adequate level of protection.

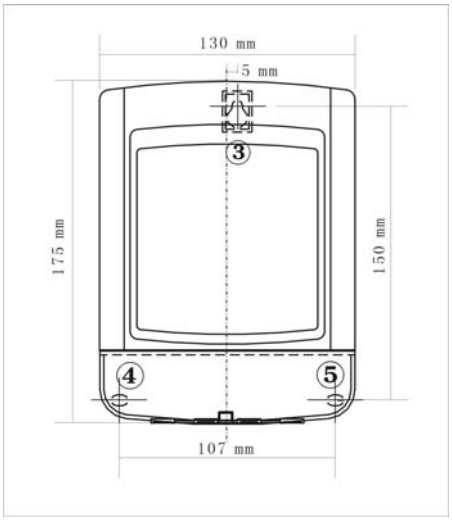
Open and close the cover of terminal panel

► Loosen the screw ① and remove the upper case ② in an upwards direction.， see picture 4
► Close the cover: insert the groove of upper case into recess
► downwards close the cover
► fasten with screw

Picture 4

Fixing controller on wall

►Choose a suitable location
►Drill the upper fastening hole
►Screw in the screw
►Hang the bottom case in the recess ③ in picture 5
►Mark the position of the lower fastening holes ④and ⑤
►Remove the controller again
►Drill the lower fastening holes
►Re-hang the case in the recess ③
►Screw the case firmly using the lower fastening holes ④ and ⑤



Picture 5

2.3 Connection of power

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

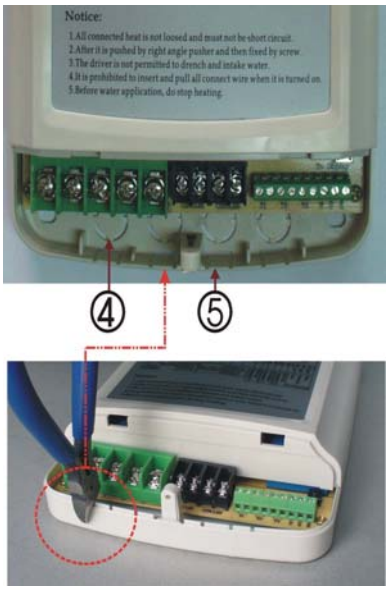
2.3.1 Preparation before connection

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 ④or the lower side of the case ⑤.

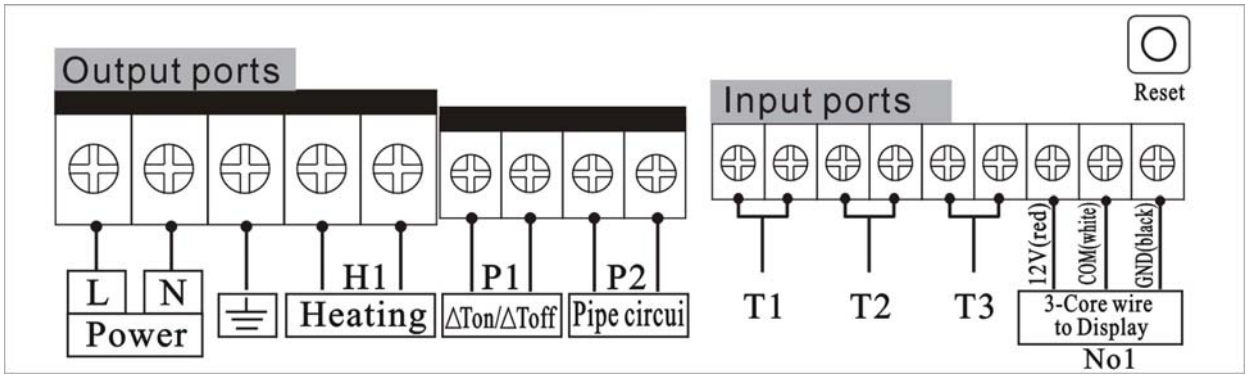
Cable come from the rear ④: remove the plastic flaps from the rear side of the case using an appropriate tool.

Cable come from the below⑤: cut the left and right plastic flaps using an appropriate tool (e.g. knife) and break them out of the case.



Picture 6

2.3.2 Terminals connection



Abbreviation	Function
T1	Input port of tank temperature sensor T1
T2	Input port of collector temperature sensor T2
T3	Input port of tank temperature sensor T3
No1	Connection port for display panel
Power	Power input port
Heating	Output port of electrical heating H1
△Ton/△Toff	Output port of temperature difference circulation pump P1
Pipe circuit	Output port of hot water pipe circulation pump P2

Input ports	Output ports	Power connection
1. Inputs **T1,T2** and **T3**: are temperature sensors. 2. Inputs **No1** is 3-core wire connected with display.	1. Outputs **P1** and **P2**: electromagnetic relays max. switching current:5A 2. Output **H1**: electromagnetic relay, max switching current 16A.	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

Reset: This button is on the terminal connection panel, when system program is out of working, press "Reset" to recover the program of system to the factory settings.

Advice regarding the installation of temperature sensors:

Only original factory equipped Pt1000 temperature sensors are approved for use with 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^{o}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^{o}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 ca. 100 meter, when cable's length is up to 50m, and then 0.75mm^2 cable should be used. When cable's length is up to 100m, and then 1.5mm^2 cable should be used.

3. Commissioning

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

After switching on power to the controller, firstly it will ask to set "time"

3.1 Time set

After power is switched on, "00:00" displays on LCD screen.
► Press "**Clock**" button, hour selection area "00" blinks on display screen.
► Press "▲""▼" button to adjust hour of clock
► Press "**Clock**" button again, the minute selection area "00" blinks
► Press "▲""▼" button to adjust minute of clock
After 3 seconds controller confirms the setting automatically, the current time is displayed on the screen.

3.2 Manual operation

When operating the device first time, or when testing the function, the outputs of controller can be operated manually. To do like the following steps:

Temperature difference controlled pump operated manually

►Press " **Manual △T**" button to trigger temperature difference controlled circulation pump ,the relevant signal is lighted.

►Press ""**Manual △T** " button again to shut off this output immediately, or program switches off the pump in 10 minutes automatically.

Hot water pipe circulation pump operated manually

► In the status that power is on, press "**On/Off** " button, the hot water pipe circulation pump is triggered, The relevant signal is lighted.

► 3 minutes later program stops pump automatically.

Heating operated manually

►Press "**Heating** " button for 3 seconds, the auxiliary electricity heating or gas, oil boiler is triggered.

►Press "**Heating**" button again to shut off this output immediately.

3.3 Temperature query

►Press "**Temp. Display**" button to check different temperature value of tank (T1), collector (T2), hot water pipe circulation (T3) one by one. Temperature of tank (T1) is displayed automatically when no more operation within 3 seconds.

4. Device setup

4.1Clock set

► Press "**Clock**" button, the hour selection area "00" blinks on display screen.
► Press "▲""▼" button to adjust hour of clock
► Press "**Clock**" button again, the minute selection area "00" blinks
► Press "▲""▼" button to adjust minute of clock

After 3 seconds controller confirms the setting automatically, the current time is displayed on the screen

4.2 On/Off button operation

After power is switched-on, as default set controller is open, and displays water temperature and clock time, all functional buttons are ready for setting operational parameters.

► Press "**On/Off** " button one time, 3 minutes water circulation function becomes into affect (hot water pipe circulation pump), circulation signal is indicated on screen, 3 minutes later program stops water circulation pump automatically.
► Press "**On/Off** " button for 3 seconds, controller is closed, only tank temperature and time are displayed on screen. Press this button again, controller reopened.

4.3 System description

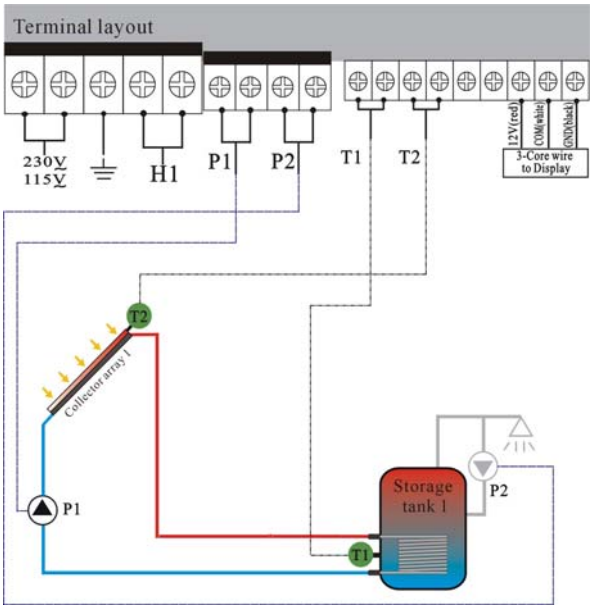
4.3.1 1 collector array – 1 storage tank – 1 pump (1 sensor on tank)

Description:

The solar circuit pump (P1) is triggered immediately when the switch-on temperature difference (△**Ton**) between the collector array (T2) and the storage tank (T1) is reached. When the temperature difference between the collector array (T2) and storage tank (T1) drops below the switch-off temperature difference（△**Toff**), then the solar circuit pump (P1) is ceased.
T2: Temperature sensor for collector
T1: Temperature sensor in the bottom part of tank (for controlling temperature difference circulation and auxiliary heating).
P1: Temperature difference solar circuit pump
P2: Hot water circuit pump

Note:

H1 is port for cable connecting with auxiliary electrical heating booster,



4.3.2 1 collector array – 1 storage tank – 1 pump (2 sensors on tank)

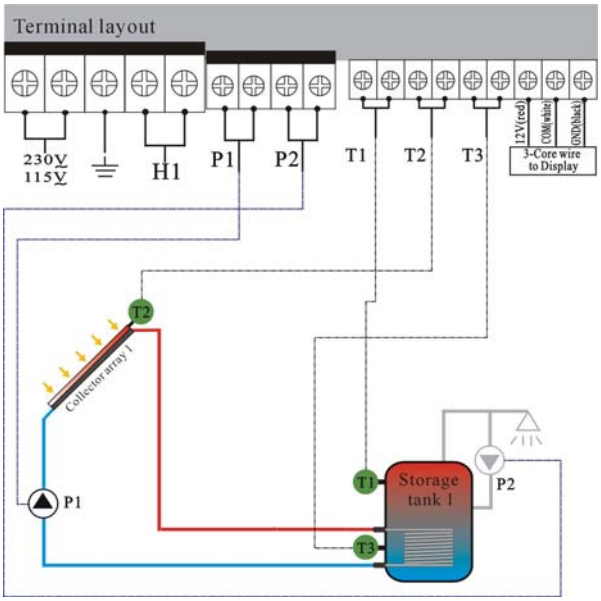
Description:

The solar circuit pump (P1) is triggered when the switch-on temperature difference （△**Ton**) between the collector array (T2) and the storage tank (T3) is reached. when the temperature difference between the collector array (T2) and storage tank (T3) drops below the switch-off temperature difference（△**Toff**), then the solar circuit pump (P1) is ceased.

T2: Temperature sensor for collector
T1: Temperature sensor in the top part of tank (for auxiliary heating).
T3: Temperature sensor in the bottom part of tank (for temperature difference circulation)
P1: Temperature difference solar circuit pump 1
P2: Hot water circuit pump

Note:

H1 is port for cable connecting with auxiliary electrical heating booster,



4.4 Temperature difference controlling function

Functional description:

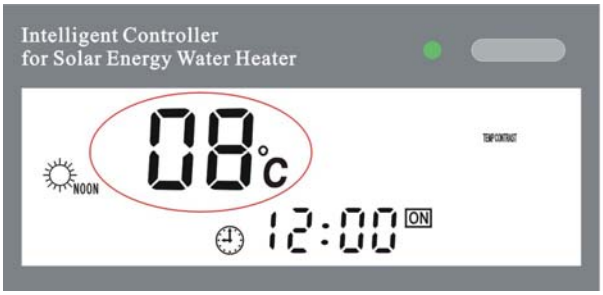
Solar circuit pump P1 is triggered by temperature difference, so long as the preset temperature difference between collector and tank is reached, solar pump is switched on.

For example: if we set the switch-on temperature difference is 10 °C, the switch-off temperature difference is 5°C. Then when the temperature in bottom part of tank is 20°C, the collector temperature must rise up to 30°C, pump is triggered, when collector temperature falls below 25°C, pump stops.

Important information: the switch-on temperature difference 8°C and the switch-off temperature 4°C are standard system setting according to many years' experiences. Only in special application cases it is possible to change (e.g. far distance heat transferring), switch-on and switch-off temperature difference are alternating set.

Note: to avoid mistake the minimum difference between two temperature differences (ΔT_{on} - ΔT_{off}) is set as 2°C.

Setup steps:



► Press ""△**Ton**" button, switch-on △**Ton** setting area blinks.

► Adjust the "△**Ton** " temperature by press "△**Ton**" button, per press the "△**Ton** " temperature difference increases 1 °C, 3 seconds later program confirms the setting and transfers to display tank temperature automatically, adjustable range: 2°C ~ 15°C, default valve is 10°C.

► Press "△**Toff**" button, switch –off △**Toff** setting area blinks

►Adjust the "△**Toff** " temperature by press "△**Toff**" button, per press the "△**Toff** " temperature difference increases 1 °C , 3 seconds later program confirms the setting and transfers to display tank temperature automatically, adjustable range: 0°C ~ 10°C, default valve is 5°C.

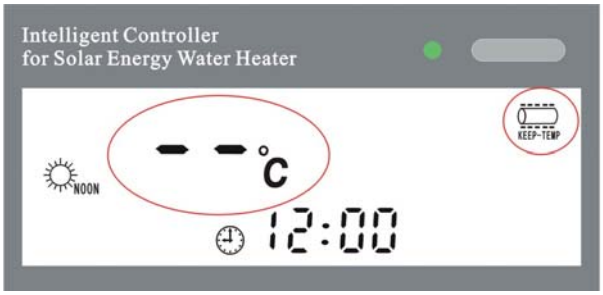
After 3 seconds, controller confirms the setting.

4.5 Anti freezing protection of collector

Functional description:

In Winter when the temperature of collector is below the preset start temperature of anti-freezing protection (2-10°C), Solar circuit pump is triggered. While the anti-freezing protection function works, if the tank temperature is less than 10°C, electrical booster will be triggered immediately; it is switched off until water is heated up to 15oC or when frost protection function is deactivated. When temperature of collector is 5°C higher than preset start temperature of frost protection, controller stops solar circuit pump and exits the program.

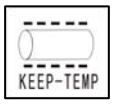
Activate/deactivate this function:



►Press "**Anti Freezing**" button 1 time, the frost protection setting area blinks; default setting off, display "----".

► Press"▲""▼" button to adjust the switch-on temperature of frost protection, (adjustable range: 2°C –10°C), after 3 seconds, controller confirms the setting automatically.

►In the status of setting frost protection temperature, press "▼" button to adjust until "----" appears, then this function is deactivate.

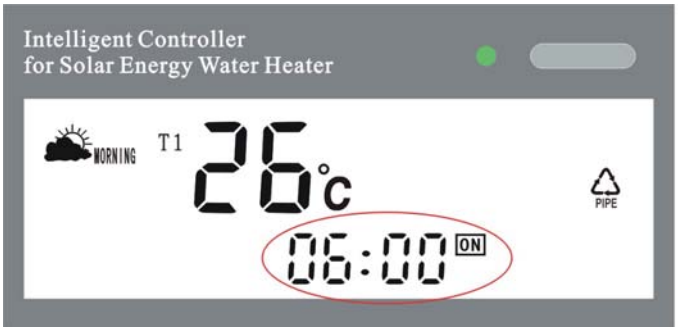


When the signal of frost protection displays on screen, it indicates frost protection function is activated.

4.6 Time controlled hot water pipe circulation

Function description:

Solar system can provide time-controlled hot water pipe circulation function; through this function can realize to get hot water immediately when man opens the tap. This function needs an extra circulation pump (P2), and this pump can be triggered by preset time. Within the preset time section pump operates for three minutes, and then stops for 15 minutes, then it triggers again for 3 minutes, stops for 15 minutes, same process continues so. Three time sections can be set within one day.



Setup steps:

►Press "**Pipe timing**" button, timing setting area blinks, to set the start time of circulation.

►Press "▲""▼" button to adjust hour

►Press "←"、"→" transfer button to minute area

► Press "▲""▼" button to adjust minute

► Press "**Pipe timing**" button again to set the end time of circulation

► Press "▲""▼" button to adjust hour

►Press "←"、"→" transfer button to minute area

► Press "▲""▼" button to adjust minute

- After 3 seconds, controller confirms setting automatically
- Doing like above steps. Within one day, three time sections can be set (AM, PM, Night displays on screen to indicate set time)
- 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)

- Controller has memory function, the setting is remembered, don't need to set everyday. Everyday when the set time is coming, water circuit pump is triggered automatically.
- The setting can be checked by pressing "**Pipe timing**" button after setting.

Manual operation: At the status that controller is in operation, hot water circuit pump can be triggered immediately by pressing "On/Off" button, pipe circulation signal displays. If the time of this operation is happened at the preset time section, it works as normal situation, namely works for 3 minutes, then stops for 15 minutes, same process continues within the time section. If the time of this operation is not within the preset time section, it works for 3 minutes, and then it stops automatically, no more restart.

At the status that hot water circuit pump is in operation, press " **Pipe timing**" again to stop pump immediately.

4.7 Temperature controlled auxiliary heating during three time sections

Functional description:

Solar system can be combined with electrical booster or gas, oil boiler, controller can achieve automatically temperature and time controlled heating, during the preset time sections electrical booster is triggered when the temperature (T1) of top part of tank is 6°C below the preset temperature of electrical booster. When T1 exceeds or equals the preset temperature, electrical booster stops heating.

Note:
When it is outside of the preset time section, electrical booster doesn't work automatically even when the tank temperature reaches the start temperature of electrical heating.

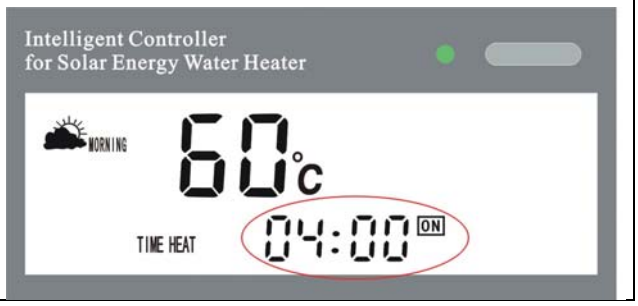
Setup steps:

►Press "**Heating**" button, timing area blinks on display, you can set turning on time and temperature of electrical heating now,
►Press "▲""▼" button to set hour,
►Press"←"、"→" button to shift to minute setting,
►Press "▲""▼" to set minute.
►Press "←"、"→"again to shift to temperature area,
►Press "▲""▼" to set turning off temperature of electrical heating.
►Press "**Heating**" button again, you can set turning off time of electrical heating
► Press "▲""▼" button to set hour,
► Press"←"、"→" button to shift to minute setting,
► Press "▲""▼" to set minute.

- 3 seconds later controller confirms the settings
- Doing like above described steps, three timing sections can be set. (AM, PM, Night displays on screen to indicate set time)
- 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
  - Default turning off temperature of electrical booster is 60°C.
- 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.
- The setting can be checked by pressing "**Heating**" button.

Manual operation:

►Press "**Heating**" button for three seconds, electrical booster is triggered immediately, the corresponding signal is lighted,
►Press "**Heating**" button again, electrical booster switches off immediately.



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

4.8 Auto function

Press " **Auto**" button, all values of system parameters are set to the factory set automatically mode.

4.9 Protection function

a. Memory protection when power is failure

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

b. System comeback

When mistakes or problems occur in system, press "**Recovery**" button, which is on display panel, to recover system to factory set.

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 error messages and error rectification indication. "Warning "signal is displayed on screen.

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

Error message	Meaning	Cause of error	Error rectification
E1 blinks	T1 sensor fault	Sensor wiring interrupted, not connected or short circuit	Check resistance value, replace sensor if necessary
E2 blinks	T2 sensor fault	Sensor wiring interrupted, not connected or short circuit	Check resistance value, replace sensor if necessary
99°C blinks	T3 sensor fault	Sensor wiring interrupted, not connected or short circuit	Check resistance value, replace sensor if necessary
E0	Connection fault between Display and controller	Connection cable is interrupted or short circuit	Check and replace if necessary

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

5.3 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

oC	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

oC	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 all	Display shows nothing, no display illumination	Controller power supply is interrupted	Check the controller power cable and connection cable between controller and display.
The solar pump doesn't operate, 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, error message signal "E" 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 frost protection function is activated.	No problem, it is normal. If necessary to deactivate the corresponding functions.

C. Guarantee

The warranty expires within 24 months after the date of purchasing the controller.

6. Technical data

- Appearance of display see product itself (dimension: 120mm x120mm x18mm)
- Appearance of controller: see product itself (dimension: 170mm x130m x 48mm)
- Power supply：AC220V ±10%
- Power consumption：< 3W
- Accuracy of temperature measuring： ± 2°C
- Range of temperature measuring： 0 ~150 °C
- Suitable power of pump： 2 pumps possible to be connected, power of each pump < 600W
- Suitable power of electrical booster：standard ≤ 2000W,
- Inputs： 2 or 3 sensors,
  1 Pt1000 sensor (≤500°C) for collector (silicon cable≤280°C),
  1 or 2 NTC10K, B3950 sensor (≤ 135°C) for tank, (PVC cable ≤105°C),
- Outputs：3 relays, one for electrical booster, 2 for circulation pumps
- Ambient temperature ：-10°C ~ 50°C.
- Water proof grade：IP40.
- Socket ： Choice by customer (Europe, American, Chinese or others, please note in order)