

1 General information

1.1 About this manual

This manual describes the installation, function and operation of an integrated solar control system, which is suitable for split pressurized solar heating system. Before installing and operating the device, please read the following information carefully.

1.2 Safety regulations

- ◆ Installation, commissioning and maintenance of the device may only be performed by 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 device must not be installed in rooms where easily inflammable material (e.g. gas or oil) mixtures are present or may occur.
- ◆ Before connecting the system, make sure that the energy supply matches the specifications of the device. Protect the solar control system against overloading and short-circuiting.
- ◆ All devices connected to the solar control system must conform to the technical specifications of the device.
- ◆ As soon as it becomes evident that safe operation is no longer possible, please immediately take the device out of operation.
- ◆ Without lightning rod, please don't use this device during a thunderstorm.

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 customer 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 data 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.



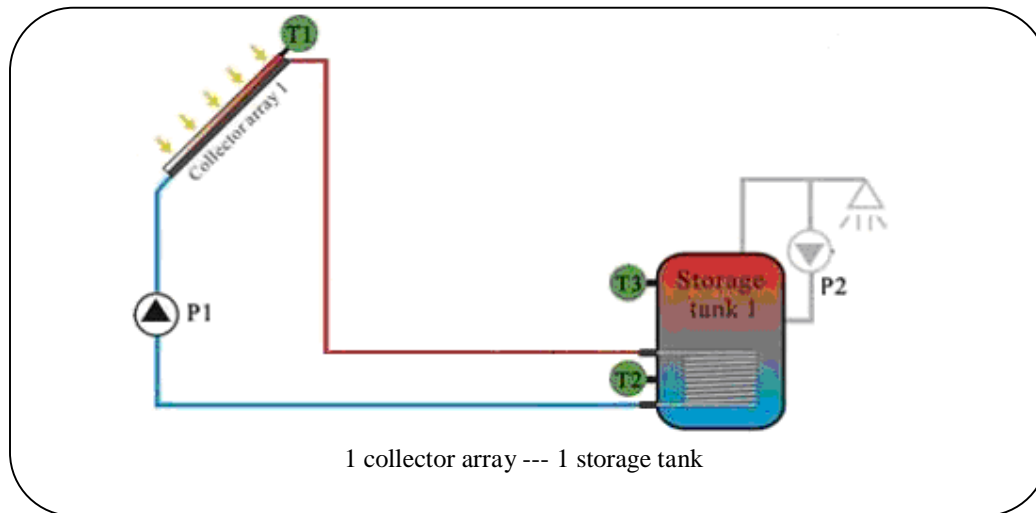
Operation steps: Indication of operation steps.

2 Product information

2.1 System description

The solar collector pump (P1) is activated as soon as the 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 (T3) reaches the maximum storage temperature, the solar pump (P1) will be switched off.

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



T1: Temperature sensor for collector array

T2: Temperature sensor in bottom part of storage tank

T3: Temperature sensor in top part of storage tank


P1: Solar collector pump

P2: Solar circulation pump



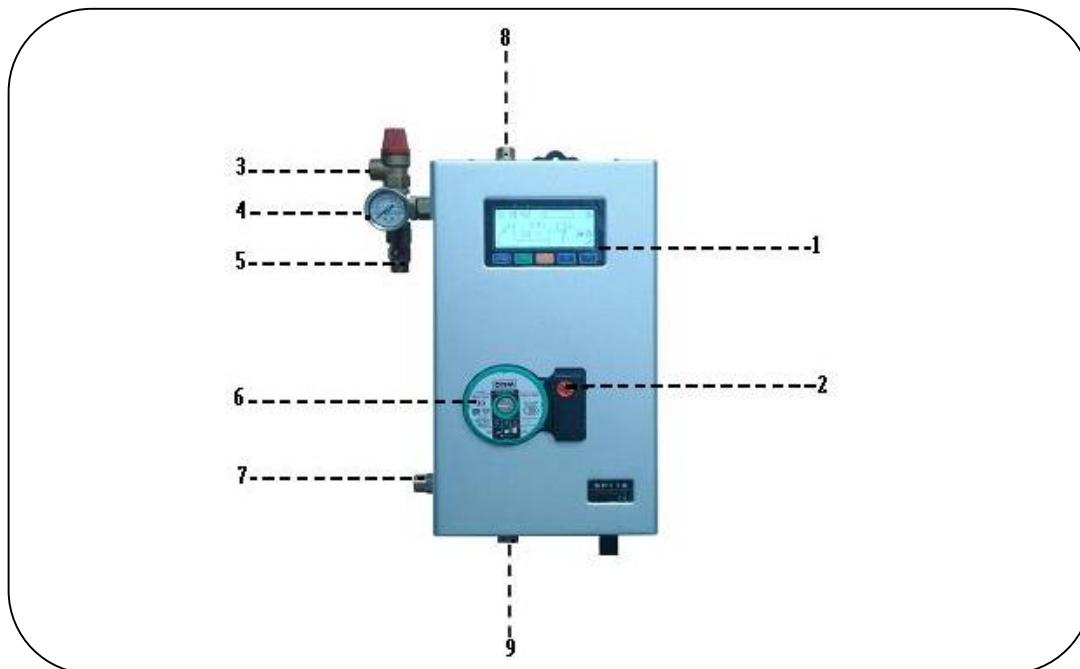
Danger: If there is only one temperature sensor in water storage tank (usually in bottom part T2), it is possible, that the auxiliary heating function will not be activated or deactivated at a right time, because the water temperature in top part of the tank (T3) cannot be measured. In this case, if you still want to use auxiliary heating function, control program will automatically take the signal from bottom temperature sensor (T2) instead of (T3). However, water in top part of tank might 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.



Note: To lock this function, please press “System Setting” button until the signal “” appears on the screen (see details in 3.6 Forbid/Permit using auxiliary heating).

2.2 Single-pipeline solar control system: SP116

2.2.1 Components



1	Operating screen	2	Pump speed regulation	3	Security valve
4	Manometer	5	Filling and flushing connector	6	WILO pump
7	Expansion vessel connector	8	Output connector	9	Input connector

2.2.2 Installation description
















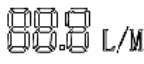
SP116 should be installed in return flow of the solar circuit, as indicated above. Please see detailed installation instruction in attached manual.

2.2.3 Technical data

Rated voltage	AC 220V (optional: AC110V)
Externality size	550mm*350mm*240mm
Weight	11 kg/carton
Max. own consumption	≤3W
Range of temperature measuring	NTC: 0~199℃; PT1000: 0~199℃
Accuracy of temperature measuring	±1℃
Power of pumps (solar collector pump P1 and circulation pump P2)	< 600W
Power of auxiliary heating	≤3000W (optional: ≤6000W)
System working pressure	8 bar
Safety valve response pressure	6 bar
Ambient temperature	-20~60℃
Input signals	T1~T3 (solar collector; top part of water tank; bottom part of water tank)
Output signals	3 (auxiliary heating; solar collector pump; solar circulation pump)

2.3 Display symbols

	Weekday. 7days of week can be set (e.g. Week 1 means “Monday”).
	Time. Setting hours and minutes.
	Time-controlled auxiliary heating. Setting three heating time periods.
	Time-controlled hot water circulation. Setting three time periods.
	Tank temperature. As turning-on/off temperature value for auxiliary heating.
	Frost protection signal.
	Overheating protection for storage tank.
	High temperature protection for solar collector.
	Holiday function signal.
	Switch on/off auxiliary heating manually.


	Forbid/permit using auxiliary heating.
	Reset signal.
	Temperature display.
	Flow rate display.

3 Functions and operation





Danger: Before connecting the power supply, make sure that the water tank, solar collector, solar control system and all temperature sensors are good connected!

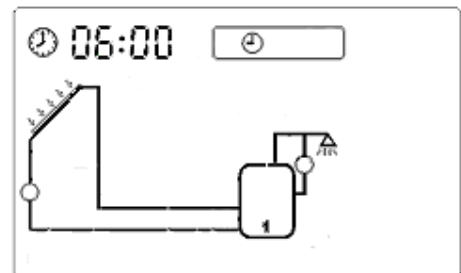
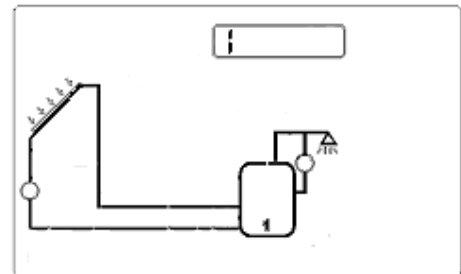


Note: For safety, auxiliary heating is locked at delivery state. The single “” displays on the screen. If you want to use this function, please see operation: 3.6 Forbid/Permit using auxiliary heating.

3.1 Setting week and time

After power supply is switched on, please firstly set the week of the system.

- ì Press “System Setting” button until the signal “” displays on the screen.
- ì Press “+” “-” button to set weekday. (range: 0-6, e.g. 1 means “Monday”)
- ì Press “Confirm” button to save the setting; press “Cancel” button to cancel the setting.
- ì Press “System Setting” button again until “” displays on the screen.
- ì Press “+” button to set hour, press “-” button to set minute.
- ì Press “Confirm” button to save the setting; press “Cancel” button to cancel the setting.




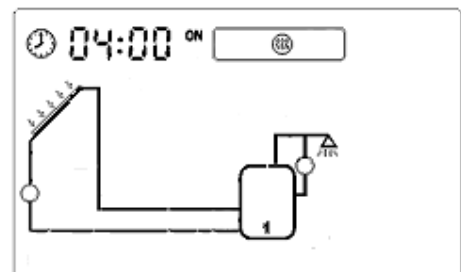
3.2 Time-controlled auxiliary heating

Solar control system can be combined with electric boiler or gas/oil boiler. The system is supported with a default program which can be customized to meet your individual needs. You can create a timer program with up to three time periods to heat the water to a desired value. During the three preset time periods, auxiliary heating starts working, when the water temperature in top part of storage tank (T3) is below preset turning-on temperature, and it stops working, when T3 exceeds the required temperature.



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

- ì Press “System Setting” button until the signal “” appears.
- ì Press “+” “-” button to set the start time of the first time period. Press “+” to adjust hours, press “-” button to adjust minutes.
- ì Press “Confirm” button to save the settings, press “Cancel” button to cancel the settings.




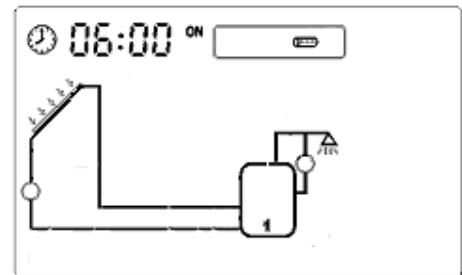
- ⓘ Immediately after setting the first time period, the display enters into the operating menu of next time period.
- ⓘ Perform like above steps, the other two time periods can be set.
- ! **Note:** If you want to shut off one of the three time periods, you can set a same value for both start time and end time, e.g., you can set both the start and end time of second time period at 10:00 am.

3.3 Time-controlled circulation function

This function needs an extra circulation pump (P2). You can set up a timer program with up to three time periods. This pump can be triggered at times when hot water will be needed.

- ! **Note:** Within the preset three time periods, pump P2 always stops for 15 minutes after operating for 3 minutes.
- ! **Note:** Default setting: the first time period: 6:00 turning-on, 8:00 turning-off; the second time period: 10:00 ~10:00; the third time period: 19:00 turning-on, 21:00 turning-off. Three time periods should be set within one day (24 hours).


- ⓘ Press “System Setting”, until “” displays on the screen.
- ⓘ Press “+” “-” button to adjust the start time and end time of first time period. Press “+” button to adjust hours, press “-” button to adjust minutes.
- ⓘ Press “Confirm” button to confirm the setting, press “Cancel” button to cancel this setting.
- ⓘ Immediately after setting the first time period, the display enters into the operating menu of next time period.
- ⓘ Perform like above steps, the other two time periods can be set.

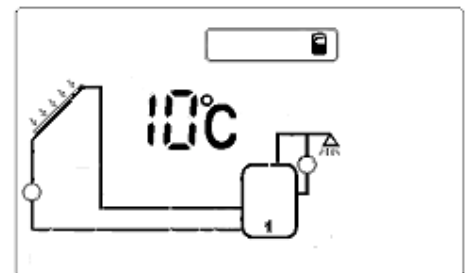


- ! **Note:** If you want to shut off one of the three time periods, you can set a same value for both start time and end time, e.g., you can set both the start and end time of second time period at 10:00 am.

3.4 Temperature difference circulation function

The solar control program works on the principle of temperature difference circulation. Solar pump P1 is triggered, as soon as the preset temperature difference between collector and tank is reached.

- ⓘ Press “System Setting” button, until “” displays on the screen.
- ⓘ Press “+” “-” button to adjust storage tank temperature. Default value: 60°C, setting range: 45~75°C.
- ⓘ Press “Confirm” button to save the setting. Press “Cancel” button to cancel this function.
- ⓘ At the same time the menu shows “10°C”, the default value of switch-on temperature difference.
- ⓘ Press “+” “-” button to adjust it. Setting range: 5~20°C.
- ⓘ Press “Confirm” button to save the setting. Press “Cancel” button to cancel this function.
- ⓘ Then the menu shows “5°C”, the default value of switch-off temperature difference.
- ⓘ Press “+” “-” button to adjust it, adjustable range: 2~12°C.
- ⓘ Press “Confirm” button to confirm the setting. Press “Cancel” button to cancel the function.




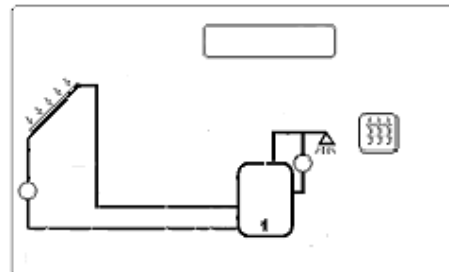


Note: Between 60~70°C scale can form more easily, we usually set the water tank temperature at 60°C.



3.5 Switching on/off auxiliary heating manually

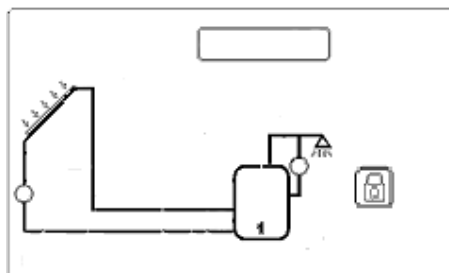
If you want to use hot water immediately, but the water temperature doesn't reach the desired value, you can switch on/off the auxiliary heating manually.

- i Press “confirm” button, until “” displays on the screen to switch on auxiliary heating manually.
- i Press “Cancel” button to switch off auxiliary heating manually.



3.6 Forbid/Permit using auxiliary heating


- i Press “System Setting” button, until “” displays on the screen.
- i Press “Confirm” button to save the setting and forbid auxiliary heating.
- i Press “System Setting” button until “” displays on the screen.
- i Press “Cancel” button to cancel the setting and permit auxiliary heating.

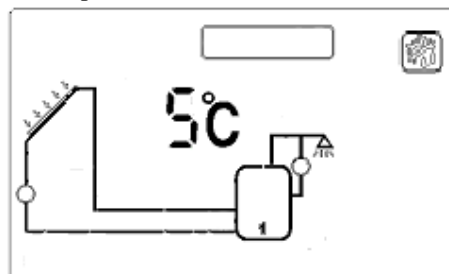


Note: When forbid auxiliary heating, customer can't switch on/off auxiliary heating manually and time-controlled auxiliary heating function is also automatically deactivated.

3.7 Frost protection


In winter, when the temperature of collector drops below the preprogrammed starting temperature of frost protection (default value 5°C), solar pump P1 starts working. When collector temperature exceeds the switch-off temperature of frost protection, pump P1 stops working and the system exits frost protection.

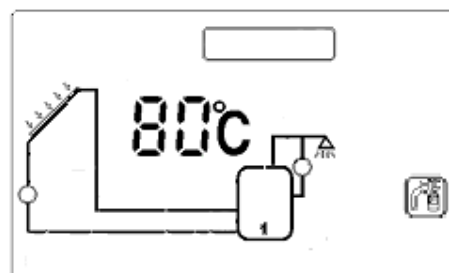
- i Press “System Setting”, until “” displays on the screen.
- i Press “+” “-” button to adjust the temperature of frost protection. Setting range: 3°C–10°C.
- i Press “Confirm” button to confirm the setting, press “Cancel” button to deactivate this function.



3.8 Storage tank overheating protection

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


- i Press “System Setting” button, until “” displays on the screen.
- i Press “+” “-” button to adjust the maximum tank temperature. Default value: 80°C, setting range: 60°C–90°C.

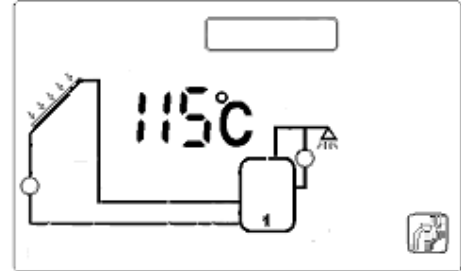


- ⓘ Press “Confirm” button to confirm the setting, press “Cancel” button to quit the function.

3.9 High temperature protection of solar system


When collector temperature reaches 115°C, and meanwhile the storage tank doesn't reach the max. tank temperature, the high temperature protection function of solar system will be activated.

- ⓘ Press “System Setting”, until  displays on the screen.
- ⓘ Press “+” “-” button to adjust the maximum collector temperature. Default value: 115°C, adjustable range: 100°C–130°C.
- ⓘ Press “Confirm” button to confirm the setting, press “Cancel” button to quit this function.



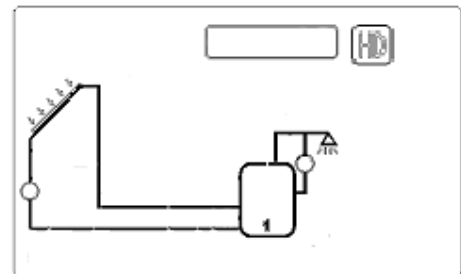
3.10 Holiday function

If you intend to be absent for an extended period (holiday), or hot water is not required for an extended period, you can activate the holiday function. This function is activated nightly (22:00-6:00) to re-cool the storage tank and to prevent high thermal loads of the solar system due to completely heated storage tank.

- ⓘ Press “System Setting”, until “” displays on the screen, it indicates that the function is active.
- ⓘ Press “Confirm” button to confirm this setting. Press “Cancel” button to deactivate this function.



Note: When using holiday function, system will lock auxiliary heating automatically.



3.11 Anti-legionella protection

To safeguard the water hygiene, solar system will monitor the storage tank temperature. If the temperature never reaches 70°C in every 7 days, auxiliary heating will be activated automatically and heats the tank water to 70°C.

3.12 Collector emergency cut-off

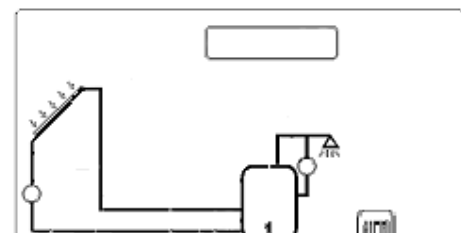
When the temperature of collector reaches or exceeds 120°C, in order to prevent evaporation of heat medium liquid and protect other components of solar system, solar circulation pump will be stopped compulsively, until the temperature of collector gets lower.


3.13 Memory function

In case of power failure, solar control system is able to remain the preset parameters unchanged.


3.14 Reset Function

If necessary, all the settings (except time setting) can be reset to the factory settings.

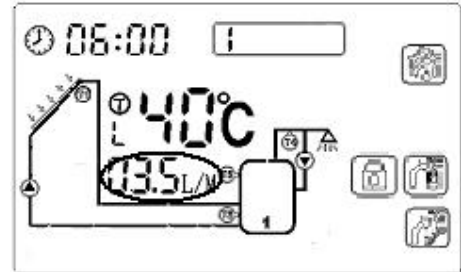


- ì Press “System Setting” button, until “” displays on the screen.
- ì Press “Confirm” button, all of parameters will be reset to factory settings.

3.15 Manual operations

Customers can monitor the flow rate anytime by viewing the signal “ L/h” on main operating menu. And when there are no other operations and it returns to main menu, they can also activate some functions by pressing different buttons directly.

- ì Press “Confirm” button 2 second to switch on/off solar collector pump (P1) manually.
- ì Press “Cancel” button 2 second to switch on/off solar hot water circulation pump (P2) manually.
- ì Press “+” “-” button repeatedly to check the temperature values in different part of solar system.




4 Error messages



Danger: Never try to repair the solar control system 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.

No.	Familiar problem	Possible reason	Solution
1	Pump works but no flow rate displays.	There is probably too much air in the pipeline.	Replenish heat medium liquid and exhaust the air.
2	System has temperature difference but pump doesn't work.	Storage tank reaches max. tank temperature.	When tank temperature drops, pump starts working.
		Solar collector reaches its max. temperature.	When collector temperature drops, pump starts working.
3	Auxiliary heating doesn't work.	Auxiliary heating is forbidden.	Activate it manually.
		Temperature sensor has broken circuit or short circuit.	Check sensor connection and make the wiring again.
4	Auxiliary heating still operates at 23:00.	Anti-legionella function starts up.	It's normal.
5	System pressure drops.	There is air leakage in solar system.	Check the pipeline and exhaust the air.
6	Pump works but system doesn't have temperature difference, meanwhile auxiliary heating function starts up.	Frost protection function is activated,  signal blinks.	After collector temperature rises, pump stops working.

The solar pumping station SP116 shows error messages in the main operating menu if there is a problem with temperature sensor.

Error message	meaning	Possible cause	Error rectification
<FF °C>	There is broken circuit with sensor connections.	Sensor wiring interrupted, not connected or short circuit.	Check resistance value, replace sensor if necessary.
<FE °C>	There is a short circuit with sensor connections.	Sensor wiring interrupted, not connected or short circuit.	Check resistance value, replace sensor if necessary.



Note: A potentially defective sensor can be checked using an ohmmeter. To do this, the sensor must be disconnected. Its resistance value can be compared with the figures below, small deviation is acceptable.

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