D22 TECHNICAL SPECIFICATIONS

AES LUMINARY COLLECTOR
Models 1.5AR, 1.9AR, 2.5AR

AES Solar
Established 1979

The AES Luminary is a flat plate solar thermal collector combining solar innovation with our long term experience in solar design and manufacturing. We are proud to introduce our market leading collector which demonstrates our in-house ability to apply world class technical and visual design with state of the art technology.

EFFICIENT
High efficiency collector with anti-reflective technology and up to 97.5% solar transmission level.

DURABLE
Tested to international engineering standard EN ISO 9806 for durability and peformance.

ATTRACTIVE
70mm thick and weighing 23-35kg. In roof options are available for seamless integration with most roof coverings and the colour blends well with tile and slate.

VERSATILE
Portrait, landscape, ground, wall or roof mounted, including flat roofs. A range of sizes and fixings are available.

EASY INSTALLATION
The AES sliding nut fixing method allows easy adjustment and fitting onto roof. The roof integration system fits together like a jigsaw, hardly any measuring required. The Luminary is one of the lightest glass covered flat plate collectors per square meter available.

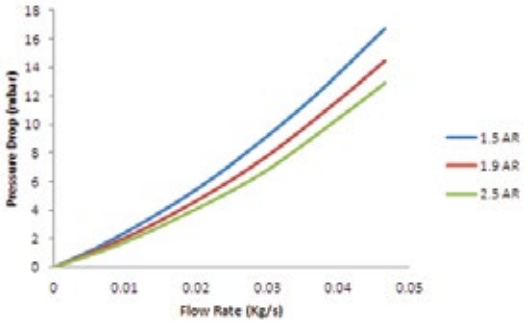
The AES Luminary is Solar Keymark certified and tested to the ISO EN 9806 global standard for solar thermal collectors. You can be assured it satisfies the highest standards of construction quality and it comes with a 10 year warranty.

Solar Keymark certification also means that the collector qualifies for Government incentives including the UK domestic and non-domestic Renewable Heat Incentive (RHI) schemes.

In Roof

On Roof

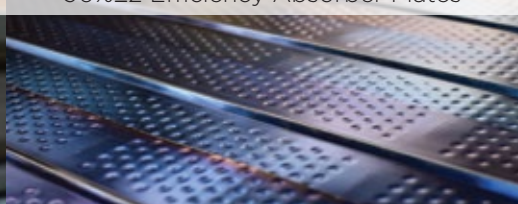
A - Frame



Custom Extrusion

Captive Nut Fixing

96%±2 Efficiency Absorber Plates



D22 TECHNICAL SPECIFICATIONS

AES LUMINARY COLLECTOR
Models 1.5AR, 1.9AR, 2.5AR

AES Solar
Established 1979

	1.5AR	1.9AR	2.5AR
Gross Area	1.5m²	1.9m²	2.5m²
Height	1300mm	1650mm	2150mm
Width	1150mm	1150mm	1150mm
Thickness	70mm		
Aperture Area	1.38m²	1.76m²	2.31m²
Weight	23Kg	28Kg	35Kg
Absorber	Aluminium fins metallurgically bonded to rhombic copper waterways providing large water to wall contact for maximum heat transfer. Sputter coated selective surface: solar absorption = 96%±2, thermal emission = 7% ±2.		
Glazing	3.2mm low iron, tempered (EN 12150) solar glass with double sided anti reflective surface. +2 Matt textured surface. Solar transmission 95.5% -1.5		
Frame	Custom designed aluminium extrusion with all round fixing channels and sliding nuts for easy fitting. Coloured RAL 7012 dark grey.		
Insulation	Rigid PIR foam, manufactured with zero ODP. Class O fire rating. Thermal conductivity 0.021W/mK		
Flow and Return Connections	Flow = 15mm copper pipe. Return = AES connection kit including external sensor pocket required – connection is to 15mm copper compression fitting.		
Fluid Content	0.86L	1.03L*	1.29L
Recommended Flow Rate	0.25 – 1 L/min/m²		
Transfer Fluid	Premixed solar antifreeze with inhibitors. (100% Tyfocor antifreeze mixture recommended)		
Max. Working Pressure	10 bar (tested to 15 bar)		
Zero loss Efficiency, η	0.788	0.785*	0.781
Heat loss coefficient	a1= 5.028, a2= 0.009	a1= 4.621*, a2= 0.014*	a1= 4.021, a2= 0.022
Peak Power Output (at irradiance of 1000W/m²)	1.082kW	1.372kW	1.808kW
Tilt angle range	20° - 90°		
Stagnation Temperature	170.1°C		
Maximum snow loading	≤2.4kN/m²		
Maximum wind loading	≤1.2kN/m²		
Testing	ISO EN 9806 by CENER, Spain. Solar Keymark certification by DIN CERTO, Germany.		
Certification	Solar Keymark - registration number: 011-7S2383 F		
Life expectancy	In excess of 25 years		
Warranty	10 years		
Applications	Small to large domestic hot water systems, industrial processes and swimming pool heating.		
*Interpolated from test data for 1.5 AR and 2.5 AR models			

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AES Ltd
AES Building
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FORRES
IV36 1AU

AES Solar Thermal Kit

Pump Station Twin Line (6m Head)

Weather Slates, Solar Flashing

AES Deltasol SLL Controller

Solar Expansion Vessel 18L

Solar Fluid - Solaris PG20, 20 Litre

Solar Safety Valve Discharge Container

AES Luminary 1.5 - Solar Thermal Collector

AES Solar

Established 1979

AES SOLAR

INSTALLATION MANUAL
AES SUPREMACY

CONTENTS:

1. GENERAL DATA

1.1 Health and Safety

Always assess risks prior to commencement of any work on the solar system. Take all necessary precautions to eliminate, or minimise to a safe level, any potential risks. Potential hazards can result from high temperatures of solar components (including escaping steam), working at height / roofwork, electrical work, manual handling and working in confined spaces. Keep the solar collector covered during any works. Wear appropriate PPE at all times.

Safety precautions: All works should be carried out in accordance with current health and safety regulations and recommendations.

The failure to use proper fall prevention systems may result in serious or lethal injuries. Prevention systems need to be certified and tested by relevant bodies. Systems are to be fixed above the users and to load bearing structures.

Be aware of live cables and connections.

Safety helmets should be worn on site during installation.

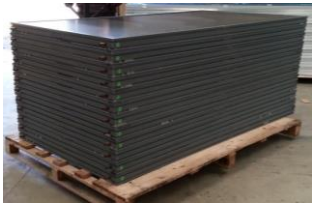
Safety boots should be worn on site during installation.

Safety goggles should be worn when drilling and cutting during installation.

Wear cut-resistant safety gloves during installation.

Please refer to appendix no.1 for a full list of Standards and Regulations relevant to the design, installation, commissioning and maintenance of a solar water heating system.

1.2 Delivery and Handling



All solar components are supplied from the factory securely packaged. The solar collector should be handled with care. Always store the collector in its original packaging and in the indicated upright position. The collector and packaging should be kept dry during transport and until installation and the packaging should not be exposed to water at any time. Water in combination with the chemicals in most paper and cardboard can cause discolouration of the AR glass. Placing anything on the front or back of the collector may cause damage. Proprietary lifting equipment should be considered where the collector is to be installed in generally less accessible positions. At least two persons should be in charge of the collector when manoeuvring about site.

1.3 Inspection

Before beginning the installation of the system examine the contents and determine that all components are correct and present, taking care when removing from the packaging. The basic, standard AES solar system includes:

High Performance, thin profile solar collector
-Supplied with external sensor pocket T-piece, this must always be fitted with this collector on the flow connection

Fixing brackets (flat bar as standard).

Solar Pump Station: Twin **Line** complete with built in de-aerator and flowmeter.

Purpose built solar cylinder (Brand & specification varies).

Differential temperature controller.

Solar rated expansion vessel.

Approved solar premixed antifreeze solution.

Upon requesting an AES Solar kit, we can also provide all additional accessories deemed necessary to complete your bespoke system including insulated pipework, connection fittings and weathering slates.

1.4 Important Installer Information:

Only competent person(s) should undertake the installation of the solar water heating system. Necessary skills are required in plumbing, electrical, roof work and access work. Installers should have a high level of technical knowledge, be familiar with tools of the trade and have experience in current best practice.

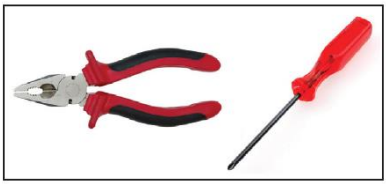
- Temperatures within the solar circuit can be in excess of 100°C, therefore suitable pipework, supports, fittings and insulation should be used, copper tubing is the most appropriate, or stainless steel flexi. For sizing see section 4.1 Pipe Sizing and Materials. Design to minimize pipe runs and bends in the pipework.
- Under no circumstances should plastic pipes or pipe clips, soft solder fittings or standard insulation be employed.
- We recommend the use of compression fittings, brazing or solar rated press fit within the solar system. Do not use soft solder.
- Insulation of the Domestic Hot Water cylinder should be at least equivalent to current best practice. All pipework should be insulated with high temperature insulation able to withstand temperatures up to 150°C.
- Use a fused switch for the electric wiring.
- The solar collector can reach very high temperatures when exposed to sunlight. Cover the collector during system installation. Do not remove covering until the system is ready for commissioning.
- The solar system should have adequate frost protection: Fill the system with a suitable solar antifreeze fluid with corrosion inhibitors. Always read the solar antifreeze fluid label; water should not be added to any premixed anitifreeze fluid under any circumstances.
- The mains water supply should not be connected to the closed loop solar circuit.
- In hard water areas, the high temperatures experienced in solar cylinders can give rise to the accumulation of limescale. Using the differential controller the system can be set to a maximum store temperature of 60°C. Limescale build-up will not occur within the loop of the indirect solar circuit.
- Between 20°C and 46°C there is an increased risk of legionella bacterial growth within the DHW system. Solar water heating systems must have an auxiliary means of raising the temperature to at least 60°C during winter months or days with little solar availability.
- The solar water heating system must meet the requirements for electrical earthing and bonding in accordance with IEE Wiring Regulations.

1.5 Tools you will need for the job:

To ensure a problem free installation of the system the following tools and equipment are recommended:

Safety Equipment

Claw Hammer & Adjustable Wrench



Pliers and Screwdriver(s)

Wire Cutters & Crimpers

Measuring Tape

Spirit Level & Ladder

Pipe Bender, Cutter & De-burrer

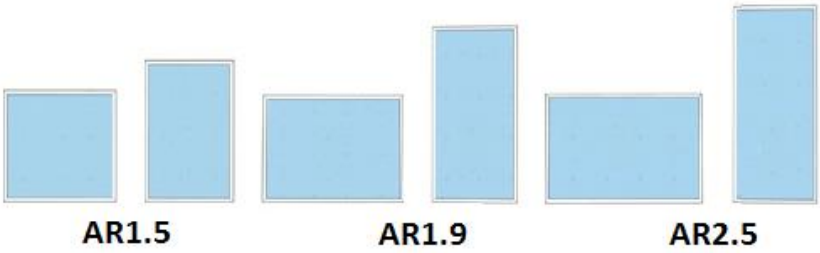
Power Drill

Stillson Wrench & PTFE Tape

Chalk & Chalk Line

Slaters Ripper

2. TECHNICAL SPECIFICATION:



MODEL	HEIGHT	WIDTH	GROSS AREA	APERTURE AREA	NET WEIGHT
	mm	mm	m^2	m^2	kgs
1.5AR	1300	1150	1.5	1.38	23
1.9AR	1650	1150	1.9	1.76	28
2.5AR	2150	1150	2.5	2.31	35
All collector models have a maximum depth of 70mm					

Collector type:	Flat Plate, tube in fin - metallurgically bonded.
Test pressure:	15bar
Min. Collector Pressure:	0.5bar
Max. operating pressure:	10bar
Pressure drop:	See graphs on technical datasheet
Fluid content:	1.5AR; 0.86L / 1.9AR; 1.03L / 2.5AR; 1.29L
Transfer fluid:	Premixed high temperature antifreeze fluid
Absorber insulation:	Rigid PIR foam, manufactured with zero ODP
Connections:	15mm copper, flow connection using sensor pocket/15mm compression tee supplied
Max. stagnation temp.:	170.1ºC
Minimum tilt angle:	5°
Maximum tilt angle:	90°

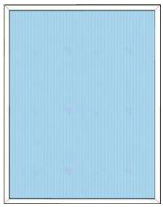
Maximum positive pressure from snow and wind load: 2400Pa
Maximum negative pressure from wind Load: 1200Pa

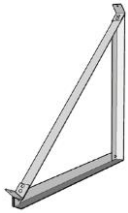
3. ABOVE ROOF WORK - 1ST FIX:

3.1 Roof Mounting

Determine the position of the collectors on the roof, having regard for appearance and any potential shading. To maximise the solar gain of the system in the UK the preferred angle for fixing AES collectors is in the range of 15 to 50 degrees within the orientation of southeast to southwest, due south being the optimum. The tilt angle range must be within Installations outside these parameters are possible. Contact AES for advice.

Each collector is supplied complete with fixing brackets (flat bar as standard), which should be secured tightly to the main structure of the building. The number of fixings varies according to the size of the collector. The following bracket requirements are recommended, as outline guidance only, for buildings of less than 15m height, in areas of insignificant topography and wind speeds, at an altitude below 300m. Any concerns regarding snow and wind loads, please refer to 'BS6399 Loading for Buildings', or you can contact AES for further advice.

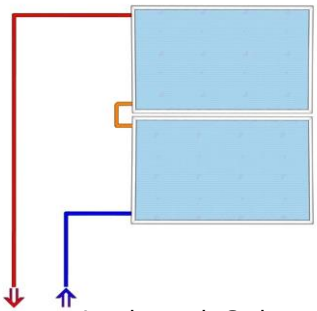




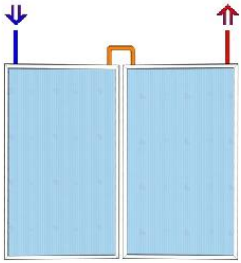
Collector Type	Flat Bracket Kit	A-Frames (Flat Roof/ Wall mounting)
1.5AR, 1.9AR, 2.5AR	4 Brackets (2 top, 2 bottom)	2 Frames

3.2 Collector Arrays

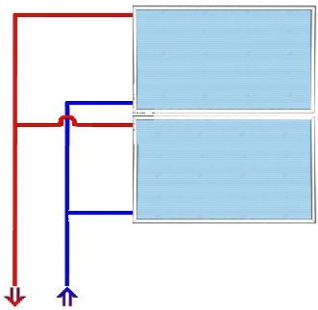
As a guideline, dependent upon pipe layout and pump design, collector arrays of up to 6m² can be connected in series, thereafter arrays greater than 6m² the collectors should be connected in parallel. Should the pump station you choose not incorporate a de-aerator, automatic air vents should be fitted at the highest point on the solar circuit. Similarly, if the pump station does not incorporate a flow rate adjuster or in systems where collectors are plumber in parallel, install such a component on the cold feed to each collector. Observe slight rises in the pipework to remove air pockets in the system.



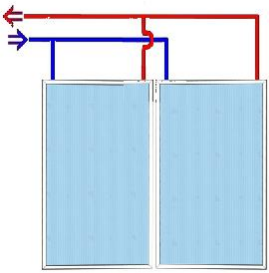
Landscape in Series



Portrait in Series

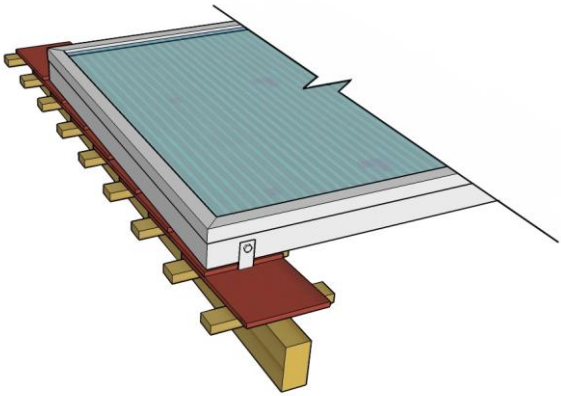


Landscape in Parallel



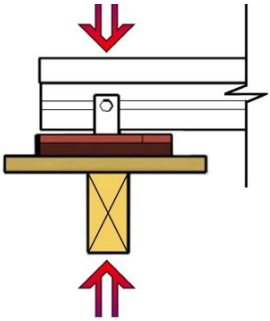
Portrait in Parallel

3.3 Flat Bar Brackets - Pitched tiled / slated roofs

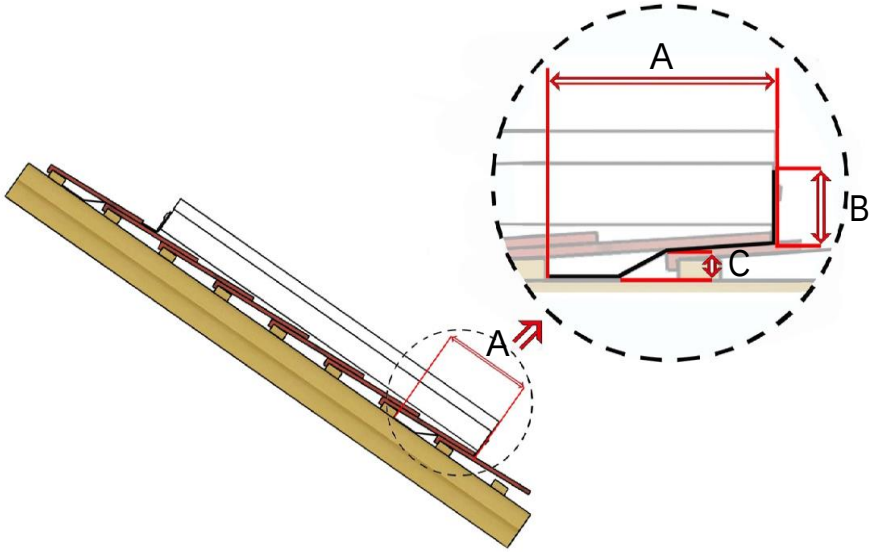


Captive nuts are located on the top and bottom edges of the collector. These nuts are moveable along the sides of the collector, so brackets can be spaced to suit. Each collector is supplied complete with fixing brackets; the number of fixings should be according to the specification for the size of the collector. The collectors need to be positioned horizontally to ensure no air can be trapped in the system:

- Mark with chalk the position of each fixing bracket on the roof to suit the size of the collector. It is the tile above the chalk line that you will be removing.
- Along these two horizontal chalk levels you need to locate the rafters beneath to ensure a firm interface between collector and building. Rafters typically have a centre-to-centre span of either 400mm, 450mm or 600mm.
- Once the tiles are removed the rafters will be easily recognisable. Take care not to damage any weatherproof membrane. If the roof has sarking you will be able to locate the rafters below by the nailing patterns on the surface, but be sure to cross reference with your initial measurements before any drilling takes place.

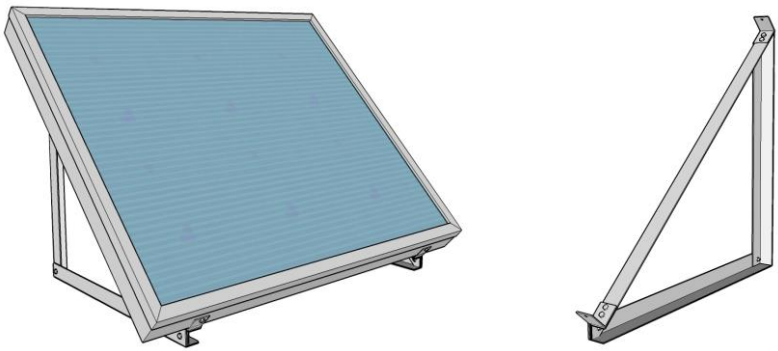


- Begin with the lower brackets: With the tile/slate removed, measure the distance between the mark on the front of the tile lathe supporting the raised tile and the front of the collector(A).
- Measure the height between the rafter/sarking and the top of the marked tile (C) and note the height between the lowest part of the tile and the fixing channel on the side of the collector (B), this upturned length being a minimum of 60mm.
- At ground level, using a mallet and block of wood, carefully form the end of the fixing brackets through 90° to give dimension (B).



- All the lower brackets will be of this same dimension and may be similarly formed.
- Screw the brackets into the rafters to a depth of at least 75mm using two zinc-plated woodscrews and fix the upper tile back into place.
- The process may now be repeated with the upper fixings, however in this instance dimension (A) will need to be fine-tuned to suit the dimensions of the collector, ensuring a close fit.
- The collector should now be lifted on to the roof, placed in between the fixing brackets and fixed in place by means of the M8 x12 set screws and captive nut. You need to leave a minimum gap of 5mm between roof and collector to maintain an airflow, thus preventing the collection of debris whilst also allowing snowmelt to drain between the collector and tiles.

3.4 A-Frame



AES manufacture an A-frame bracket suitable for tilting collectors at the optimum angle on flat roofs or on the side of buildings. The flat roof A-frame must be adequately bolted or weighted down. If screwing or bolting into the structure use metal sleeved anchors combined with rubber washers to provide a strong weatherproof seal.
If the supporting frame is secured by weights, rather than being screwed down, ensure permissible roof loads are not exceeded under any circumstances, if necessary a structural engineer must be consulted beforehand. If the collector is to be mounted to an external wall ensure that the wall is suitable to carry the load. When allocating where to site the collectors in all instances design to minimise the pipe runs to maximise system efficiency.

3.5 Other Roof Types

For other roof types (e.g. Steel Profile) AES can supply an L-Bracket fixing that can be bolted/screwed through the roof fabric. Mount the shorter face of the 'L' to the fabric of the building using three coach screws or bolts. Both the holes in the bracket and the roof should be pre-drilled. Mount the collector to the longer face of the 'L' with two M8 x 12 set screws into the captive nuts. The lower brackets should be orientated to have the collector covering the roof fixing screws/bolts, the upper bracket are left at your discretion.
If the substructure has been penetrated, it must be carefully re-sealed in accordance with the roofing manufacturer's specification. Specialist roof manufacturers may have specific seam clips for their roof types, which can be bolted to the collector, contact the roof manufacturer direct.
There is the option of using the L-Bracket for a tiled or slated roof, however great care must be taken to ensure weather tightness. We recommend the use of an appropriate waterproof roofing sealant, elastomeric to flex with any movement, applied liberally to the underside of the bracket before fixing down.

3.6 Running Pipework through the Roof

Make a suitably sized hole through through which to run the pipework and sensor cable.

Place a lead or aluminium-weathering slate directly above the hole, available from AES, ensuring when positioning that the top edge is lapped under the tile above and dress to shape. Run the pipework and sensor cable through the rubber sheaths.

Fit the sensor pocket T-piece at the flow connection (normally highest connection on the array) and secure the temperature sensor into the sensor pocket, pushing it in as far as it will go and making sure it is secured tightly by tightening the locking nut. Fit the flow pipe to the T-piece using a 15mm male compression connection or short length of 15mm copper to female compression fitting or other fitting as appropriate. Fit the return pipe to the return 15mm pipe connection (usually the lowest array connection).

All AES collectors have 15mm copper inlets and outlets.

3.7 Lightning Protection:

I most cases the number of thunderstorm days per year for a given installation location in the UK does not reach a level at which particular protective measures need to be applied. However where buildings or structures are considered to be at greater risk, for example very tall, or in an exposed location, the designer of the designer of the a.c. electrical system together with the designer of the solar thermal system, may choose to design or apply protective measures such as installation of conductive air rods or tapes.

In particular, it is recommended that you use an adequate lightning protection device should the assessed risk on the site be greater than 1 in 100,000.

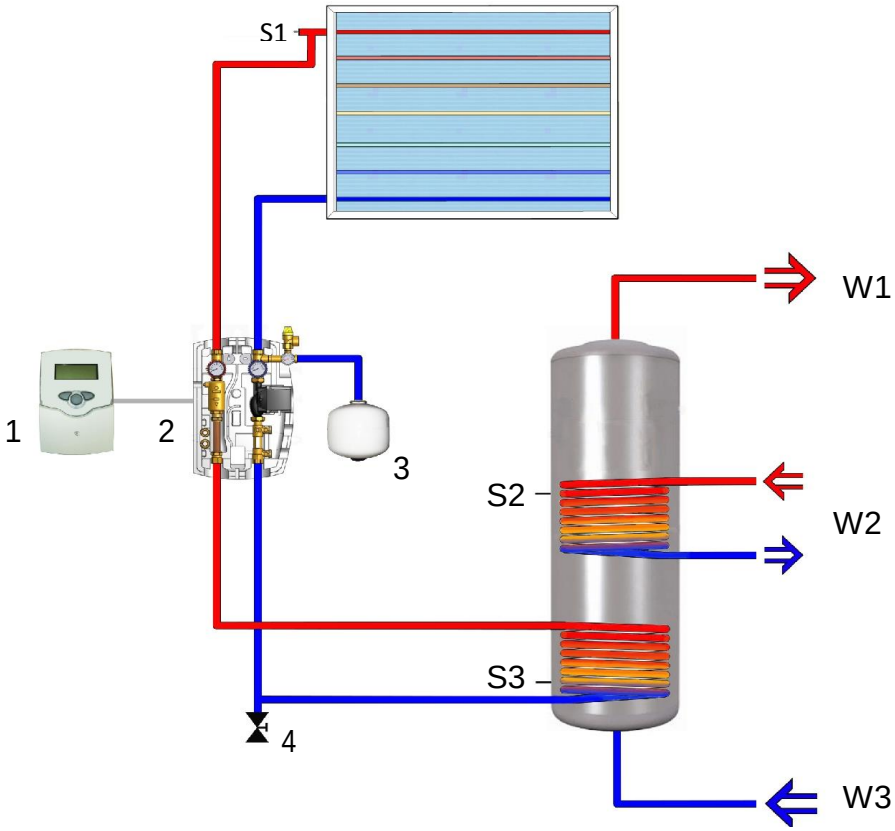
If the building or dwelling is fitted with a lightning protection system (LPS), a suitably qualified
person should be consulted as to whether, in this particular case, the solar collector frame and any associated metal parts such as fixing brackets or A-Frames, should be connected to the LPS, and if so what size conductor should be used.

Where an LPS is fitted, solar thermal system components should be mounted away from lightning rods and associated conductors where reasonably practical (see BS EN 62305). Where there is a perceived increase in risk of direct lightning strike as a consequence of the installation of the solar thermal system, specialists in lightning protection should be consulted with a view to installing a separate lightning protection system in accordance with BS EN 62305.

Note: It is generally accepted that the installation of a typical roof-mounted solar thermal system presents a very small increased risk of a direct lightning strike. However, this may not necessarily be the case where the solar thermal system is particularly large, where the solar thermal system is installed on the top of a tall building, where the solar thermal system becomes the tallest structure in the vicinity, or where the solar thermal system is installed in an open area such as a field.

4. PLUMBING - 2ND FIX:

AES systems are easily integrated with all kinds of conventional heating systems. We provide schematics for various systems (e.g. swimming pool, heat exchanger, multiple store systems etc.), please contact us.
The diagram below shows a standard system layout incorporating our Solar Thermal Collector with a Twin Coil Cylinder.



1) Differential Temperature Controller
2) Pump Station inc. de-aerator and flowmeter
3) Expansion Vessel
4) Drain Valve
S1) Collector Temp. Sensor
S2) Store Temp. Sensor [Top]
S3) Store Temp. Sensor [Bottom]
W1) Supply to hot water system
W2) Flow and Return from boiler
W3) Cold water supply to cylinder

4.1 Pipe Sizing and Materials

The following pipe diameters (mm) are outline guidelines for pipe sizes for collector arrays.

Array Size	Pipe Diameter
Up to and including 8m²	15mm
Greater than 8m² up to 20m²	22mm

For systems greater in size than this please contact for design assistance

As temperatures within the solar circuit can exceed 100°C we recommend the use of Copper or Stainless Steel tubing throughout the solar system circuit, do not use soft solder or plastic.

4.2 Suitable Fittings

The following fittings are deemed appropriate for use in the solar system circuit. Soldered or plastic fittings are not recommended:

- Brazed fittings
- Press fittings (rated to withstand temperatures above 150°C)
- Compression fittings
- Stainless Steel fittings

4.3 Sequence of Work

It is important when choosing the location of the equipment to keep the pipe runs as short as possible.

1. Isolate the electrical supply to the boiler and turn off the cold water supply to the heating and hot water systems.
2. Partially drain down the central heating circuit then disconnect and remove the existing cylinder. Replace with the new unit.
3. Connect the boiler flow and return pipework to the upper coil connections.
4. Refill the central heating circuit and bleed off all air as necessary. Check for leaks.

5. Thoroughly flush out and refill the new cylinder, checking all connections for leaks.
6. Connect the solar primary circuit components in the order shown in the layout drawing. If necessary, the pump and expansion vessel may be located in the roof space. A fused spur should be close to the Differential Temperature Controller. 7.

Automatic air vents should be located at each high point on the system. No vent is required if filling with a high velocity solar pump filling station. Drain valves should be located at all low points.

8. The discharge port from the pressure safety valve should be piped to a place of safety.
9. All pipework should rise to vent and fall to drain and be adequately supported with pipe clips (do not use plastic clips).

4.4 Notes on Solar Circuit Components

- Automatic air vent & ball valve - Fit at the highest point on the solar circuit. More than one may be required, normally closed after commission. Not always required if the pump station incorporates an air scoop and a pumped, pressurized filling station is used.
- Cylinder - In open vented systems where less than 1m head is available the cold feed diameter should be increased to the next size up to avoid drawing air down the vent pipe. For unvented systems the instructions contained in the cylinder manufacturer's installation manual must be followed.
  In mains pressure applications it should be noted that a competent person must undertake installation of the cylinder and a legal requirement that the relevant local authority be informed of the intention to install an unvented hot water - storage system. To achieve satisfactory outlet flow rate for an unvented system it is essential to check the flow rate available from the incoming cold mains.
- Differential temperature controller - To ensure that the customer can easily see the display, choose a convenient location. The sensor cables carry low voltage only and polarity is not important. The sensor cables may be extended using twin core flex / bell wire. Refer to the manufacturer's operating and installation instructions for wiring connections.
- Expansion Vessel - Refer to the manufacturer's instructions. To be located on a 0.5m uninsulated falling spur.
- Fill valve - Under no circumstances should this be connected to the mains water supply.
- Flow setter - The recommended flow rate for a domestic hot water system is 0.5 litre/min/1m² of collector absorber area. When the system is in operation, the flow rate should not exceed 1.0m/s, to ensure noise levels remain comfortable.
- Pressure Safety Valve - Refer to the manufacturer's instructions.
- Pump Station - Refer to the manufacturer's instructions. In most instances this unit will contain the flow setter for the system.
- Drain Valve - To be located at the lowest point of the solar circuit.

5. COMMISSIONING:

Ideally, you want to fill the system when the collector is cold, due to the high temperatures that can be attained, be sure to cover the collector in any case. We recommend that the system is filled with a 40% antifreeze solution containing corrosion inhibitors, this is essential in climates where frost and freezing ambient temperatures can be encountered.

Before commissioning takes place it is important to flush the system fully with the anti-freeze solution to remove any impurities, contaminants or debris prior to the final fill:

1. On completion of the primary circuit pipework make sure of the following: -
- All drain cocks are closed.
- Pump isolating valves are fully open.
- Caps on all automatic air vents are slackened one turn.
- Ensure the pressure on the gas side of the expansion vessel is reduced to:

0.5bar + (0.1bar x geodetic height i.e. height from expansion vessel & system high point m)

2. Connect the inlet of the fill valve to a pump filled with antifreeze. Unscrew the knurled knob on the underside of the fill valve and fill the system until a pressure of:

   0.5bar + (0.1bar x geodetic height)

3. Check that all fittings are free from leaks.
4. Drain the system through the primary circuit drain valve.
5. Flush and back flush primary circuit until clean and clear.
6. Ensure all fluid is drained completely from the primary circuit (Note: De-activate any non-return valves).
7. Refill the system as previously to required pressure with antifreeze. Always read the solar antifreeze fluid label. Under no circumstances should water be added to premixed antifreeze fluid.
8. Switch on the electrical supply to activate the system. If there is insufficient solar energy the override switch on the controller should be activated. Any air in the primary circuit will now be dissipated through the automatic air vent.
9. The system should be re-pressurised.
10. The circulating pump should be set to operate at the lowest speed possible to achieve the required flow rate: 0.5litres/min/m^2
11. Once commissioned the DTC must be left on automatic operation and any automatic air vents isolated.
12. Pipework insulation may now be applied. It is essential to use only high temperature insulation (resistant up to 150°C). Secure in place with cable ties or insulation tape.

On completion of the solar water heating system, the installer must fully explain the function and operation of the system to the end user. The installation, commissioning and maintenance instructions should be passed on to the end user.

An AES commissioning checklist can be found in Appendix 2.

6. MAINTENANCE, (To BS 5918 : 1989):

While a properly designed and installed heating system should be expected to give a service life comparable to that of other types of heating systems, some maintenance may be necessary to maintain the efficiency of the installation.

Periodically check the collector for dirt or grime. If required, clean using a soft cloth with a solution of mild soap and lukewarm water followed by rinsing with clean water.

A maintenance inspection should be carried out annually when the following items should be checked: -

1. The collector for damage both to the glazing and the absorber plate ensuring the glazing seals are weathertight and sound.
2. That the roof fixings are firm and the roof covering is free from cracks.
3. That both the flow and return legs to the collector circuit are free from air.
4. That the weathering is still properly protecting the structure.
5. That all insulation is firmly attached.
6. That no condensation or damp spots are apparent, particularly around the pipes and fixings in the roof.
7. That circulating pump is operating without undue noise or vibration.
8. That electrical controls are operating correctly to manufacturer's instructions.
9. That all sensing devices are firmly and properly in place.
10. That all air eliminators, non-return valves, and solenoid valves and motorised valves are operating correctly.
11. That unions and glands are free from weeps.
12. Ensure that the operating pressure is not dropping below 0.5 bar.
13. That the correct solar fluid volume is maintained.
14. That all covers are in place.

The anti-freeze solution should be replaced at least once every 5-years.

7. WARRANTY:

AES warranty covers the solar collectors against faults in manufacture or material failure up to 10 years, providing that the solar collectors were installed in accordance with the AES Installation Manual and the Microgeneration Installation Standard 3001.
No liability can be assumed by AES for improper use or unsanctioned alterations to the system.

8. NOTES FOR THE USER:

You have just become a user of the most important energy source of the future - and yet the oldest one in existence. Correctly installed, it will provide many years of reliable service. The system revolves around the lightweight yet highly efficient AES collector. AES has more than 30 years of experience in this specialist field and selects only the highest quality components for their systems. The solar system contains fluid which transfers heat from the solar collectors to the hot water storage cylinder.
The pipework circuit is subject to a small pressure and should be fitted with all the necessary safety features i.e. expansion vessel and pressure safety valve.
Fully automatic control is by a differential temperature controller (DTC). This unit measures the temperature in the solar collector and, when this is (typically) 6°C hotter than the temperature in the lower half of the cylinder switches on a circulating pump in order to transfer the heat. When the temperature difference has fallen to 4°C the pump is switched off. The collectors are protected and solar benefit will be had all year round because the fluid in the system contains anti-freeze. The DTC automatically controls the operation of the circulating pump and, at the same time, provides a digital temperature read-out. Please refer to the DTC manufacturers instruction manual for operation of the controller.

For satisfactory operation of the system the following points should be observed: -

- The system should always be left switched on even when the house is unoccupied. This will ensure that the fluid in the collectors does not boil and evaporate, which will possibly result in a service call.
- If the property is to remain unoccupied for a lengthy period of time then the solar panels should be covered.
- Periodically check the pressure gauge. When installed, the system is pressurised. This will vary continually according to the temperature in the collectors. If the pressure falls below 0.5 bar, however, a service call will be required.
- To maximise solar gain, it is advised that auxiliary heating (e.g. gas boiler) is switched off during daylight hours.

Important Information:

Limescale

In hard water areas the high temperatures experienced in solar cylinders can result in the accumulation of limescale. As a means of control, the differential controller can be set with a maximum store temperature of 60°C. Limescale build-up will not occur within the closed loop of an indirect solar circuit.

Legionella

At temperatures between 20°C and 46°C there is an increased risk of legionella bacteria growth within the DHW system. In order to combat the risk of legionella bacteria growth, the water temperature needs to be raised to at least 60°C once per day. For days with little solar availability and for winter months there needs to be an auxiliary means of raising the temperature of the domestic hot water to at least 60°C. This form of sterilisation should be accurately controlled by time and temperature to maximize solar gain e.g. the electric immersion or boiler should operate during non-daylight hours or periods of peak DHW draw-off.
The following formula is used to determine the minimum time of operation for the auxiliary heating to ensure sterilisation:

Minutes = (Cylinder capacity in litres x 4.2) / kW

Temperature Controls

A solar system can at times produce scalding water or even high pressure steam. For your safety within the primary circuit a suitably sized expansion vessel and pressure relief valve are fitted. The secondary circuit safety features include a dedicated solar volume of no less than 25 litres per 1m² of solar collector aperture and a maximum store temperature on the differential temperature controller, factory preset at 60°C. A further safety feature for vulnerable groups, such as children or the infirm, is the use of a thermostatic mixing valve either at or within 450 mm of the point of use set no greater than 46°C or at the hot water cylinder set at 55 - 60°C.

General

The solar water heating system should meet the requirements for electrical earthing and bonding in accordance with IEE Wiring Regulations.
Only competent person(s) should undertake any maintenance, decommissioning or repair work. Necessary skills are required in plumbing, electrical, roof work and access work. Individuals should have a high level of technical knowledge, be familiar with tools of the trade and have experience in current best practice.

9. DECOMMISSIONING

1) Cover the collectors.
2) Switch off the electricity supply to the differential controller and pump.
3) Release the pressure in the solar circuit loop. This can be done by manually releasing the pressure relief valve.
4) Remove the air vent.
5) Drain system from the drain valve, located at the bottom of the solar circuit loop.
6) The system is now decommissioned.

Decommissioning the system in the early morning or late evening is recommended as the panel will not have had the chance to heat up fully, so there will be less chance of burning yourself on steam or pipe work. If this can not be done then take great care, and be aware that there could be a burst of steam when you take any component off.

Remember that the non-return valve will have liquid above it so it will not naturally drain. You will need to remove / bypass / disable it, too fully drain the system.

Even after the solar water collector(s) has been drained, residual hot water or steam may still come out, sometimes in sudden bursts, for hours or days afterwards, more so on particularly in bright or sunny weather. Pipes connected to the collector may get very hot, up to and above 100°C. The solar collector(s) should remain covered with the air vent(s) removed.

10. TROUBLESHOOTING

Problems:
Controller display blank
Fault reading on LCD Display
Pump will not run
Pump is running continuously
Pump switches on-off for short moments
System has no circulation
Pressure drops in system
Overheating
Performance Loss
Temperature sensor showing incorrect reading
Domestic hot water too hot
Domestic hot water not hot enough
Store Cools down at night

Causes:	Actions:
No power supply	Check wiring between supply and controller
Fuse blown	Replace Fuse
Thermal cut-out activated	Reset
Sensor lead connections are loose	Check connections on sensors
Sensor faulty	Replace sensor
Collector sensor at maximum	No action necessary
Pump wiring faulty	Check wiring between controller and pump
Pump rotor damaged	See pump manufacturers instructions
Collector Temperature and ΔT not satisfied	No action required
Minimum collector temperature activated	Deactivate function/No action necessary
Maximum collector temp met	No action necessary
Collector temp.below frost protection temp.	Deactivate function
Loose connection or faulty collector sensor	Check connections and sensor wires
Collector cooling/holiday function activated	No action necessary/Deactivate function
Temperature difference too small	Change ΔT'on' and ΔT'off' accordingly
Tube collector function activated	Deactivate function
Pump isolating valves are closed Auto	Open valves
air-vent closed	Open auto air-vent and check it over
Air lock at pressure relief valve Air	Vent the air
lock in system	Check all return pipework rises, check it falls on flow side, clear manual vents
Non-return valve jammed	Free the valve or replace if required
System in stagnation	Wait for system to reach normal operating conditions
Leak in system	Check all joints
Drain/filling valve not closed	Fully close the valve
Automatic air-vent is passing water	Clean or replace if necessary
Faulty pressure relief valve	Replace
Damaged expansion vessel	Replace
Prolonged period of low hot water use	Divert heat to a heat sink for storage
Air in system	Vent the system
Leak in collector	Contact AES for engineer options
Damaged insulation	Replace damaged parts
Limescale build-up	Drain and clean the system thoroughly
Dirty/Grime build up on glazing	Use soft cloth, clean with solution of mild soap or household detergent and lukewarm water
Temp. sensor not fully inserted in place	Fully insert, secure and insulate
Storage cylinder temperature too high	Set lower storage tank and temp. limit
Temp. control on boiler or heating programmer is set too low	Set temperature accordingly 60˚C
Insufficient store insulation	Increase store insulation
Non-return valve faulty	Check and if necessary replace

11. APPENDIX:

Solar standards:

BS 7431 - Method for assessing solar water heaters. Elastomeric materials for absorbers, connecting pipes and fittings
BS 5918 - Solar heating for domestic hot water
BS 6785 - Code of practice for solar heating systems for swimming pools
BS EN 12975 - Thermal solar systems and components - Solar collectors
BS EN 12976 - Thermal solar systems and components - Factory made systems
DD CEN/TS 12977 - Thermal solar systems and components - Custom built systems

Other relevant standards:

BS 1566 - Copper indirect cylinders for domestic purposes
BS EN 13831 - Specifications for expansion vessels using an internal diagraph for sealed hot water heating systems BS 5422 - Methods of specifying thermal insulation materials on pipes, ductwork and equipment in the temperature range of -40ºC to 700ºC
BS EN 12828 - Specification of forced circulation hot water central heating systems for domestic premises. (Also BS EN12831, BS EN 14336)
BS 5534 - Code of practice for roofing and tiling - Design.
BS 5546 - Specification for installation of hot water supplies for domestic purposes,
using gas-fired appliances of rated input not exceeding 70 kW
BS 5970 - Code of practice for thermal insulation of pipes and equipment BS
EN 1991-1-4 - Actions on structures. General actions. Wind actions. BS EN
62305 - Protection against lighting. General principles
BS EN 806-4:2010 - Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.
BS 6701 - Telecommunications equipment and telecommunications cabling
BS 6920 - Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water
BS 7074 - Application, selection and installation of expansion vessels and ancillary equipment for sealed water systems
BS EN 12897 - Water supply. Specification for indirectly heated unvented (closed) storage water heaters BS
7671 - Requirements for electrical installations. IEE Wiring Regulations
BS 8000 - Workmanship on building sites.
BS EN 12828 - Heating systems in buildings - Design for water-based heating systems
BS EN 12831 - Heating systems in buildings - Method for calculation of the design heat load

Regulations:

Confined Spaces Regulations 1997
Construction (Design and Management) Regulations 1994
Construction (Health, Safety & Welfare) Regulations 1996
Construction Regulations (Head Protection) 1989
Control of Substances Hazardous to Health Regulations 1994
Electricity at Work Regulations 1989
Health & Safety at Work Act 1974
Health and Safety (First Aid) Regulations 1981
Lifting Operations and Lifting Equipment Regulations 1998
Local Building Regulations
Local Water Bylaws
Management Health & Safety at Work Regulations 1999
Manual Handling Operations Regulations 1992
Noise at Work Regulations 1989
Personal Protective Equipment at Work Regulations 1992
Provision and Use of Work Equipment Regulations 1998
Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995

Commissioning Checklist

Customer Details	
Name	
Installation Address	
Town & Post Code	
Telephone Number	

Installer / Sub-Contractor Details	
Name of Technician	
Company Name	
Address	
Town & Post Code	
Telephone Number	
e-mail address	
Website	

System Summary	
Solar Collector	
Cylinder	
Pump Station	
Purpose of Installation (i.e. DHW only or any other purposes)	

Commissioning Checklist			
No	Check	Entry	Units/Comments
1	Panel Serial Number		
2	Primary pressure limit of weakest component		Bar
3	System pressure setting adjusted when cold		Bar
4	Primary circuit operating pressure		Bar
5	Minimum primary pressure limit before user action required		Bar
6	Fuse Rating		Amps
7	Glycol / water % (or alternative method of preventing freezing)		%
9	DTC Δ_t setting to switch on		°C
10	DTC Δ_t setting to switch off		°C
11	DTC setting of high temperature limit		°C
11	Expansion vessel pre-charge		Bar
12	Expansion vessel capacity		Liters
13	Circulation rate setting		Liters/minute

14	Primary circuit volume		Liters
15	System has been flushed		Tick
16	System is free of leaks		Tick
17	Earth bonding present		Tick
18	Cylinder & collector temperature sensors secured in correct locations		Tick
19	Operation of pressure safety valve		Tick
20	Operation and direction of non-return valve		Tick
21	Collector fixings properly constructed, adequately ballasted or fixed into suitable structural member and durable for period of 20 years.		Tick
22	Proper weather sealing of roof / wall penetrations		Tick
23	All insulation in place in accordance with MIS:3001		Tick
24	Function of automatic air vent		Tick
25	Pump operation tested		Tick
26	Controls and sensors operating correctly including– Pump deactivates when Tcol is less than Tcyl and when Tcyl exceeds set maximum and DT switch on/switch off control method functioning correctly		Tick
27	Confirm system will auto resume after stagnation without user intervention		Tick
28	Control interlock exists such that the auxiliary heating is switched off when there is no demand for space heating or water heating		Tick
29	Confirm that: (i) System conforms to design (ii) Manufacturer's instructions have been followed (iii) Where requirements of MIS 3001 exceed those of manufacturer, they have been met		Tick
30	WHERE UNVENTED CYLINDER IS INSTALLED: Pump is connected through high limit stat.		Tick or N/A
31	WHERE PRE-HEATED WATER IS SUPPLIED TO INSTANTANEOUS WATER HEATING APPLIANCE, CONFIRM: (i) Written instructions have been provided by manufacturer (ii) Written instructions have been followed in full (iii) Written instructions have been left on site for the user		Tick or N/A
32	IF INTENDED AS A DOMESTIC RHI INSTALLATION: (i) Installation conforms fully to MCS domestic RHI metering guidance (ii) Installation meter ready according to MCS domestic RHI metering guidance		Tick or N/A
33	Auto air vent isolated from system after commissioning (if installed)		Tick
34	Pump speed		1, 2 or 3
29	Method of anti-scalding in DHW distribution		
30	Method of preventing bacterial growth		
	Method of preventing mineral deposits within system		
31	Location of DHW isolation valve		

32	Location of primary system pressure gauge		
33	Location of pressure safety device		
34	Location of fused isolating switch		
35	Location of automatic air vent		
36	System has been installed in compliance with relevant local & national building legislation and associated guidance		Tick
37	System has been fully commissioned in accordance with MIS 3001		Tick
38	Label attached to system in accordance with MIS 3001		Tick
39	System demonstrated to customer		Yes, Name / No
40	Customer documentation explained and handed over		Yes / No

Declaration (to be completed by the Commissioning Engineer):
I confirm that the above system has been installed and commissioned at the above address. The system design is in line with current best practice and the system is installed in such a manner as to comply with the Microgeneration Certification Scheme Standard MIS3001 and with all legal requirements. All notifiable works have been carried out by suitably qualified personnel and have been notified to the relevant authorities.

Signed: _____ Print Name: _____

Date of Commissioning: _____

Declaration (to be completed by the client):
I confirm that the above system has been installed at the above address. The system has been explained and demonstrated to me and I am satisfied that the installation is complete.

Signed: _____ Print Name: _____

Date: _____

Acknowledgements:

Photographs - Second photograph on page 3: Copyright of Lister Housing Cooperative, Edinburgh. All of the remaining photographs AES copyright.

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DeltaSol® SLL

beginning with firmware version 1.05

Solar controller

Manual for the
specialised craftsman

Installation
Operation
Functions and options
Troubleshooting

VBus.net

The Internet portal for easy and secure access to your system data – www.vbus.net

Thank you for buying this RESOL product.
Please read this manual carefully to get the best performance from this unit.
Please keep this manual safe.

11205585

en
Manual
www.resol.com

Safety advice

Please pay attention to the following safety advice in order to avoid danger and damage to people and property.

Instructions

Attention must be paid to the valid local standards, regulations and directives!

Information about the product

Proper usage

The solar controller is designed for electronically controlling standard solar thermal systems and heating systems in compliance with the technical data specified in this manual.

Improper use excludes all liability claims.

CE Declaration of conformity

The product complies with the relevant directives and is therefore labelled with the CE mark. The Declaration of Conformity is available upon request, please contact RESOL.

Note

Strong electromagnetic fields can impair the function of the controller.

➔ Make sure the controller as well as the system are not exposed to strong electromagnetic fields.

Subject to technical change. Errors excepted.

Target group

These instructions are exclusively addressed to authorised skilled personnel.

Only qualified electricians should carry out electrical works.

Initial installation must be effected by the system owner or qualified personnel named by the system owner.

Description of symbols

WARNING! Warnings are indicated with a warning triangle!

➔ **They contain information on how to avoid the danger described.**

Signal words describe the danger that may occur, when it is not avoided.

- **WARNING** means that injury, possibly life-threatening injury, can occur.
- **ATTENTION** means that damage to the appliance can occur.

Note

Notes are indicated with an information symbol.

➔ Arrows indicate instruction steps that should be carried out.

Disposal

- Dispose of the packaging in an environmentally sound manner.
- Dispose of old appliances in an environmentally sound manner. Upon request we will take back your old appliances bought from us and guarantee an environmentally sound disposal of the devices.

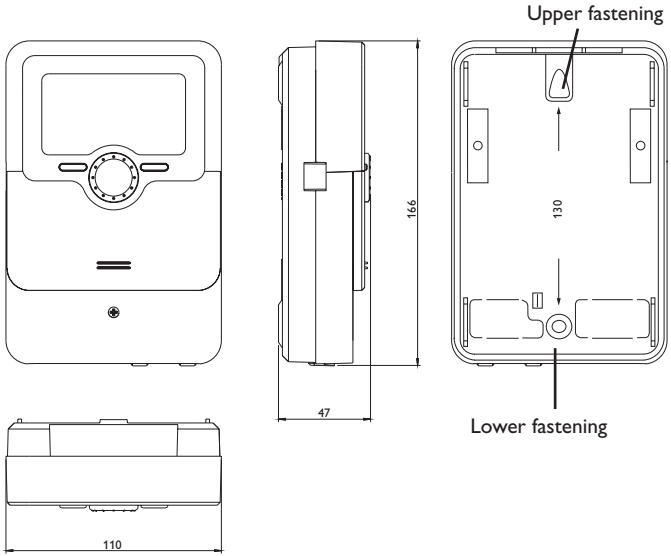
The DeltaSol® SLL is the smallest controller of the SL series. Its equipment is optimised for small and medium-sized solar thermal and heating systems, 10 pre-configured basic systems are available The DeltaSol® SLL is also the first controller of its category to offer the automatic function control according to the VDI 2169 directive.

Additionally, it is equipped with a potential-free extra-low voltage relay for after-heating demand and a V40 flowmeter input for heat quantity measurement.

Contents

1 Overview

- **3 relay outputs (incl. 1 extra-low voltage relay)**
- **4 inputs for Pt1000, Pt500 or KTY temperature sensors**
- **1 V40 impulse input**
- **2 PWM outputs for speed control of high-efficiency pumps**
- **10 basic systems to choose from**
- **Automatic function control according to VDI 2169**



Technical data

Inputs:
4 inputs for Pt1000, Pt500 or KTY temperature sensors, 1 V40 impulse input

Outputs:
2 semiconductor relays, 1 potential-free extra-low voltage relay, 2 PWM outputs

PWM frequency: 1000 Hz

PWM voltage: 10,5 V

Switching capacity:
1 (1) A 240 V~ (semiconductor relay)
1 (1) A 30 V⎓ (potential-free relay)

Total switching capacity: 2 A 240 V~

Power supply: 100 … 240 V~ (50 … 60 Hz)

Supply connection: Y

Standby: 0.71 W

Temperature controls class: I

Energy efficiency contribution: 1 %

Mode of operation: Type 1.B.C.Y

Rated impulse voltage: 2.5 kV

Data interface: RESOL VBus®

VBus® current supply: 60 mA

Functions: operating hours counter, tube collector function, thermostat function, pump speed control, heat quantity measurement, adjustable system parameters and optional functions (menu-driven), balance and diagnostics function, function control according to VDI 2169

Housing: plastic, PC-ABS and PMMA

Mounting: wall mounting, also suitable for mounting into patch panels

Indication / Display: System-Monitoring-Display, for visualisation of the systems, 16-segment-display, 8 symbols for indication of the system status, Lightwheel® (adjustment dial) and background illumination

Operation: 4 push buttons at the front and 1 Lightwheel®)

Protection type: IP 20 / DIN EN 60529

Protection class: I

Ambient temperature: 0 … 40 °C

Degree of pollution: 2

Dimensions: 110 x 166 x 47 mm

2 Installation

2.1 Mounting

WARNING! **Electric shock!**

Upon opening the housing, live parts are exposed!

➔ **Always disconnect the controller from power supply before opening the housing!**

Note

Strong electromagnetic fields can impair the function of the controller.

➔ Make sure the controller as well as the system are not exposed to strong electromagnetic fields.

The unit must only be located in dry interior rooms.

The controller must additionally be supplied from a double pole switch with contact gap of at least 3 mm.

Please pay attention to separate routing of sensor cables and mains cables.

In order to mount the device to the wall, carry out the following steps:

➔ Unscrew the crosshead screw from the cover and remove it along with the cover from the housing.

➔ Mark the upper fastening point on the wall. Drill and fasten the enclosed wall plug and screw leaving the head protruding.

➔ Hang the housing from the upper fastening point and mark the lower fastening points (centres 130 mm).

➔ Insert lower wall plugs.

➔ Fasten the housing to the wall with the lower fastening screw and tighten.

➔ Carry out the electrical wiring in accordance with the terminal allocation (see chap. 2.2).

➔ Put the cover on the housing.

➔ Attach with the fastening screw.

2.2 Electrical connection

WARNING! **Electric shock!**

Upon opening the housing, live parts are exposed!

➔ **Always disconnect the controller from power supply before opening the housing!**

ATTENTION! **ESD damage!**

Electrostatic discharge can lead to damage to electronic components!

➔ **Take care to discharge properly before touching the inside of the device! To do so, touch a grounded surface such as a radiator or tap!**

Note

Connecting the device to the power supply must always be the last step of the installation!

Note

The pump speed must be set to 100 % when auxiliary relays or valves are connected.

The controller is supplied with power via a mains cable. The power supply of the device must be 100 … 240 V~ (50 … 60 Hz).

The controller is equipped with 3 relays in total to which loads such as pumps, valves, etc. can be connected:

- Relays 1 … 2 are semiconductor relays, designed for pump speed control:
  Conductor R1 … R2
  Neutral conductor N
  Protective conductor ⏚
- Relay 4 is a potential-free low voltage relay

Note

The terminal R3 has no function!

Depending on the product version, mains cables and sensor cables are already connected to the device. If that is not the case, please proceed as follows:

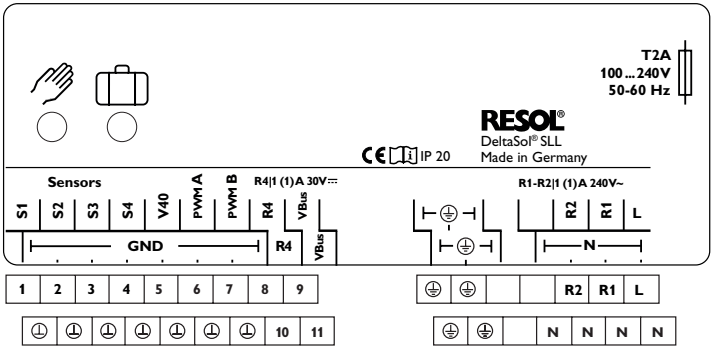
Connect the **temperature sensors** (S1 to S5) to the corresponding terminals with either polarity:

S1 = Sensor 1 (collector sensor)
S2 = Sensor 2 (store sensor base)
S3 = Sensor 3 (e. g. store sensor top)
S4 = Sensor 4 (e. g. store sensor store 2)

A **V40** flowmeter can be connected to the terminals V40 and GND (either polarity).

The terminals marked **PWM** are control outputs for a high-efficiency pump (see page 18).

Relay allocation for PWM outputs:
PWM A - Relay 1
PWM B - Relay 2



The **mains connection** is at the terminals:
Neutral conductor N
Conductor L
Protective conductor ⏚

Note
The connection depends on the system layout selected (see page 7).

Note
For more details about the initial commissioning procedure see page 23.

2.3 Data communication / Bus

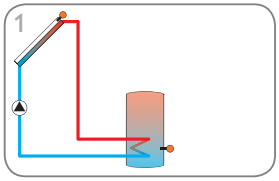
The controller is equipped with the **RESOL VBus®** for data transfer and energy supply to external modules. The connection is to be carried out at the two terminals marked **VBus** (any polarity).

One or more **RESOL VBus®** modules can be connected via this data bus, such as:

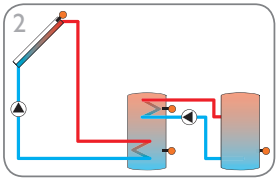
- RESOL DL2 Datalogger
- RESOL DL3 Datalogger

Furthermore, the controller can be connected to a PC or integrated into a network via the RESOL VBus®/USB or VBus®/LAN interface adapter (not included). Different solutions for visualisation and remote parameterisation are available on the RESOL website www.resol.com.

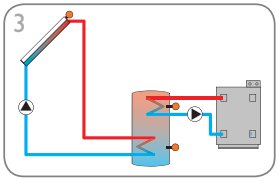
Note
More accessories on page 55.



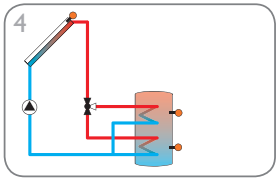
Solar system with 1 store (page 8)



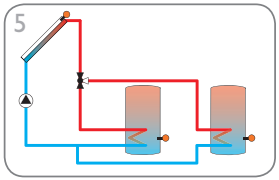
Solar system with 2 stores and heat exchange (page 9)



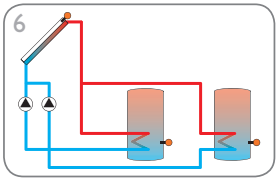
Solar system with 1 store and afterheating (page 10)



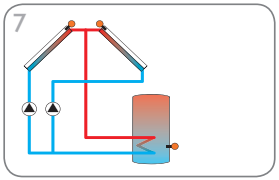
Solar system with 1 store and 3-port valve for store loading in layers (page 11)



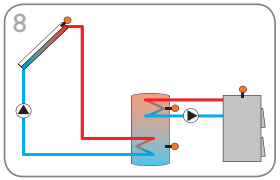
Solar system with 2 stores and valve control (page 12)



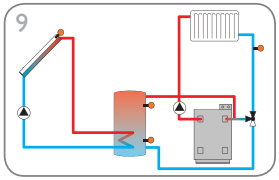
Solar system with 2 stores and pump control (page 13)



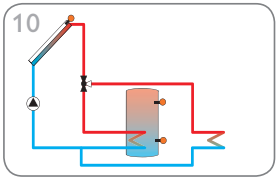
Solar system with east-/west collectors (page 14)



Solar system with 1 store and solid fuel boiler (page 15)



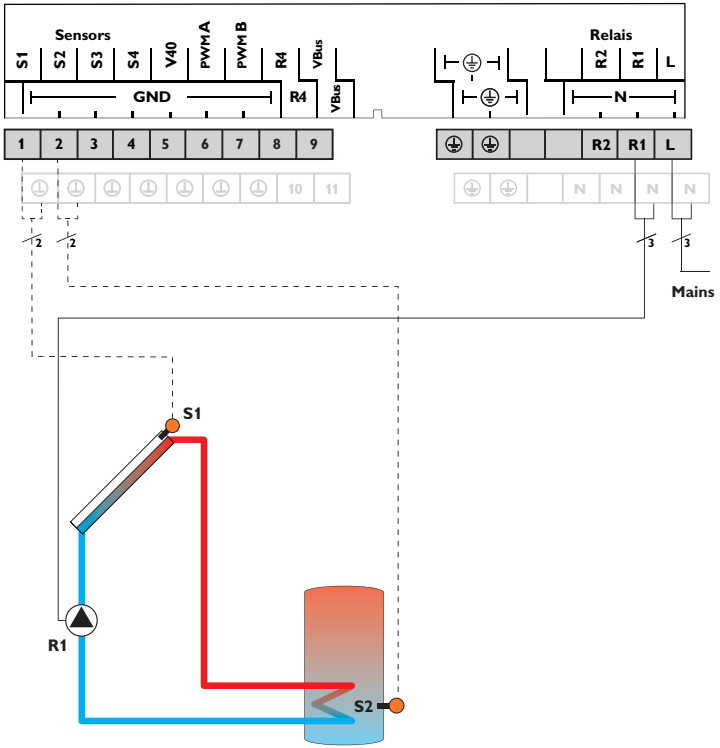
Solar system with 1 store and return preheating (page 16)



Solar system with 1 store and heat dump (page 17)

2.5 Systems

System 1: Standard solar system with 1 store

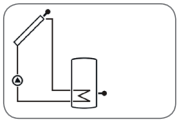


Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Free	3/GND
S4	Free	4/GND

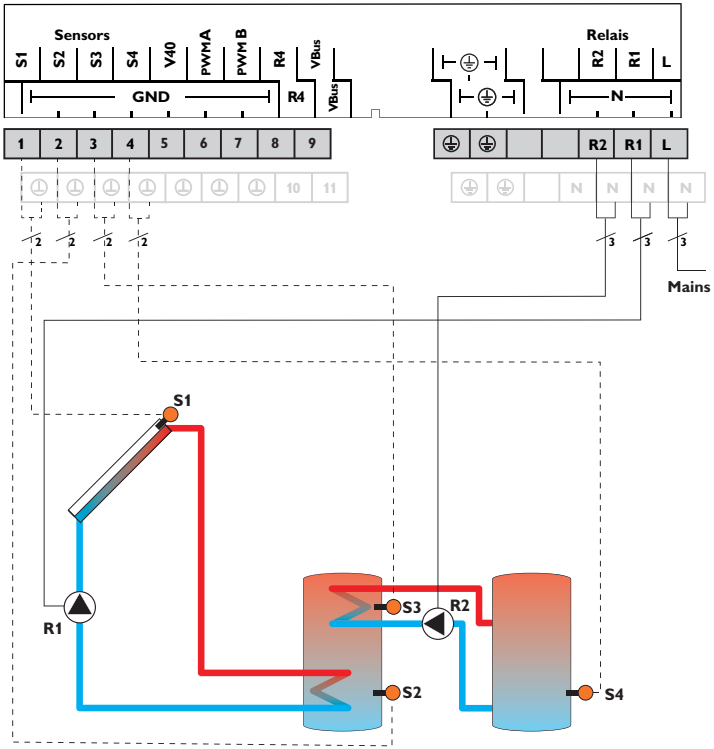
Relay		
R1	Solar pump	R1/N/PE
R2	Free	R2/N/PE
R4	Free	R4/R4

The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the store will be loaded until the switch-off temperature difference or the maximum store temperature is reached.

System 1 system screen



System 2: Solar system with 2 stores and heat exchange



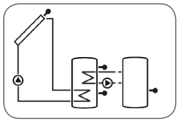
Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Temperature heat exchange source	3/GND
S4	Temperature heat exchange sink	4/GND

Relay		
R1	Solar pump	R1/N/PE
R2	Store loading pump	R2/N/PE
R4	Free	R4/R4

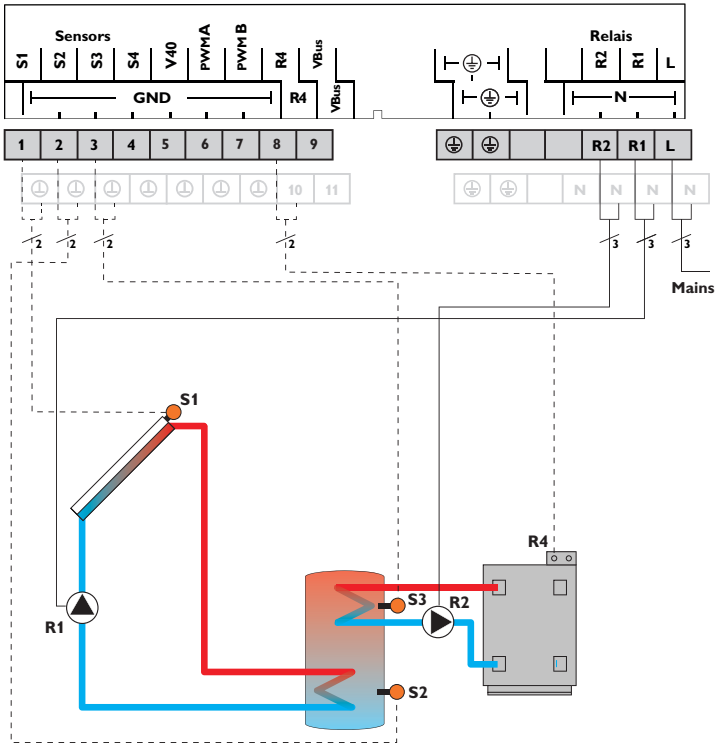
The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the store will be loaded until the switch-off temperature difference or the maximum store temperature is reached.

Heat exchange control to an existent store via an additional pump (R2) can be carried out with another temperature differential function (S3 heat source/S4 heat sink).

System 2 system screen



System 3: Solar system with 1 store and afterheating



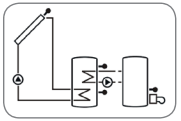
Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Temperature afterheating	3/GND
S4	Free	4/GND

Relay		
R1	Solar pump	R1/N/PE
R2	Store loading pump	R2/N/PE
R4	Afterheating demand	R4/R4

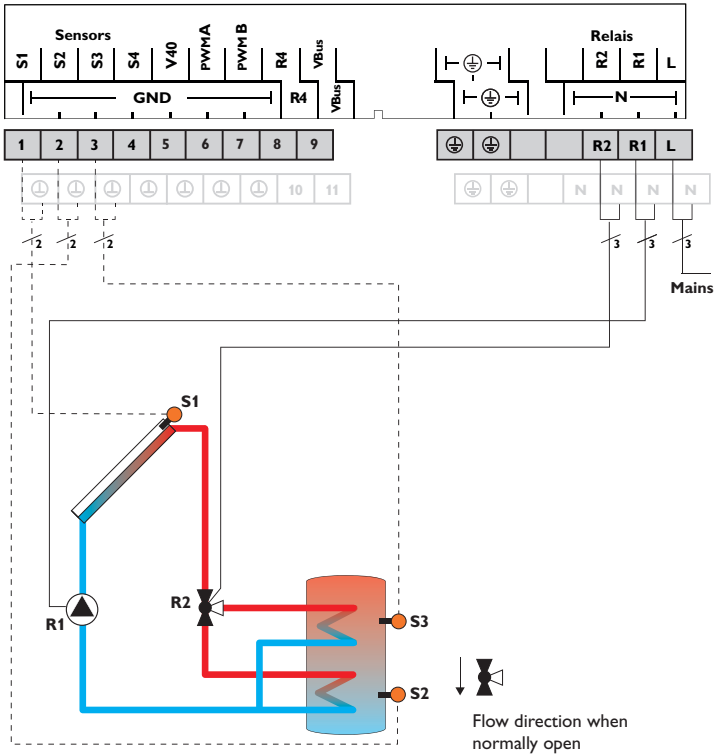
The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the store will be loaded until the switch-off temperature difference or the maximum store temperature is reached.

Afterheating (R2 and R4) can be carried out with a thermostat function (S3). If the value at S3 reaches the switch-on temperature for the afterheating, the relay is switched on. If the value exceeds the switch-off temperature for the afterheating, the relay is switched off again.

System 3 system screen



System 4: Solar system with 1 store and 3-port valve for store loading in layers

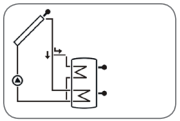


Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Temperature store top	3/GND
S4	Free	4/GND

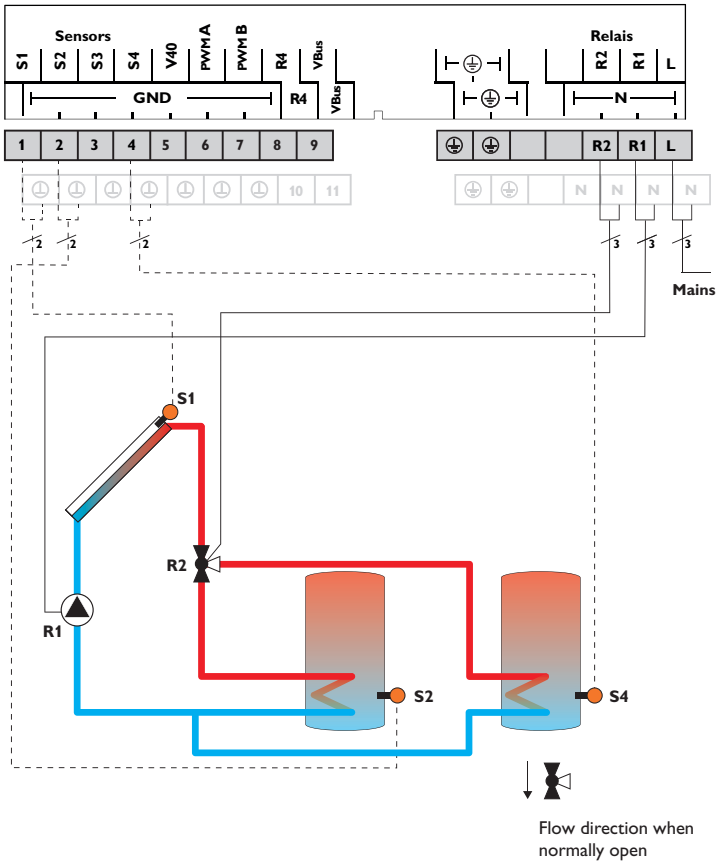
Relay		
R1	Solar pump	R1/N/PE
R2	Valve Solar	R2/N/PE
R4	Free	R4/R4

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S3. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding store zone will be loaded up to the adjusted store maximum or set temperature respectively via the valve (R2). The priority logic effects prior loading of the upper zone of the store.

System 4 system screen



System 5: 2-store system with valve logic, 1 pump, 3 sensors and 3-port valve

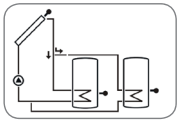


Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Free	3/GND
S4	Temperature store 2 base	4/GND

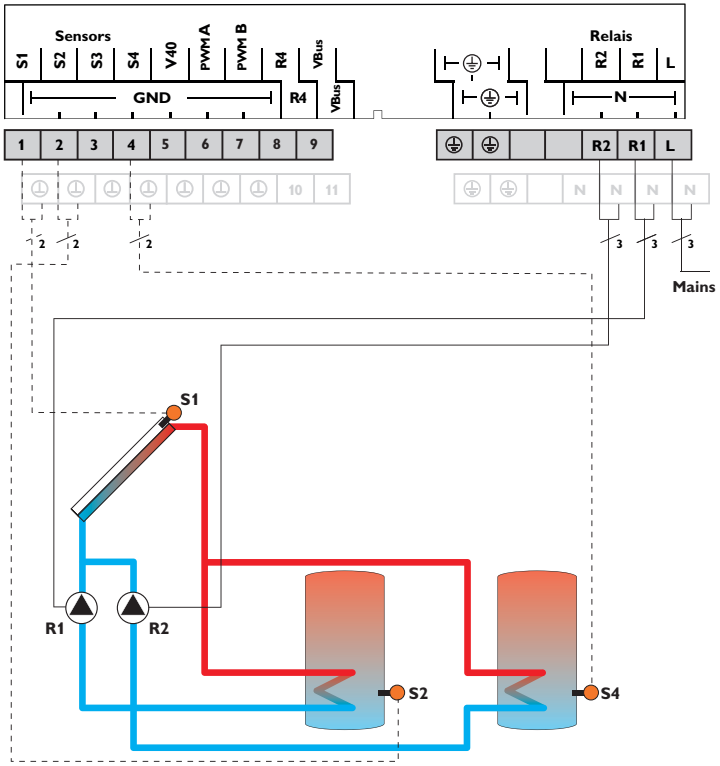
Relay		
R1	Solar pump	R1/N/PE
R2	Valve Solar	R2/N/PE
R4	Free	R4/R4

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S4. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1) will be activated and the corresponding store will be loaded up to the adjusted store maximum or set temperature respectively via the valve (R2). The priority logic effects prior loading of store 1.

System 5 system screen



System 6: 2-store solar system with pump logic

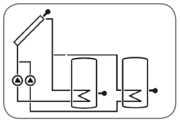


Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Free	3/GND
S4	Temperature store 2 base	4/GND

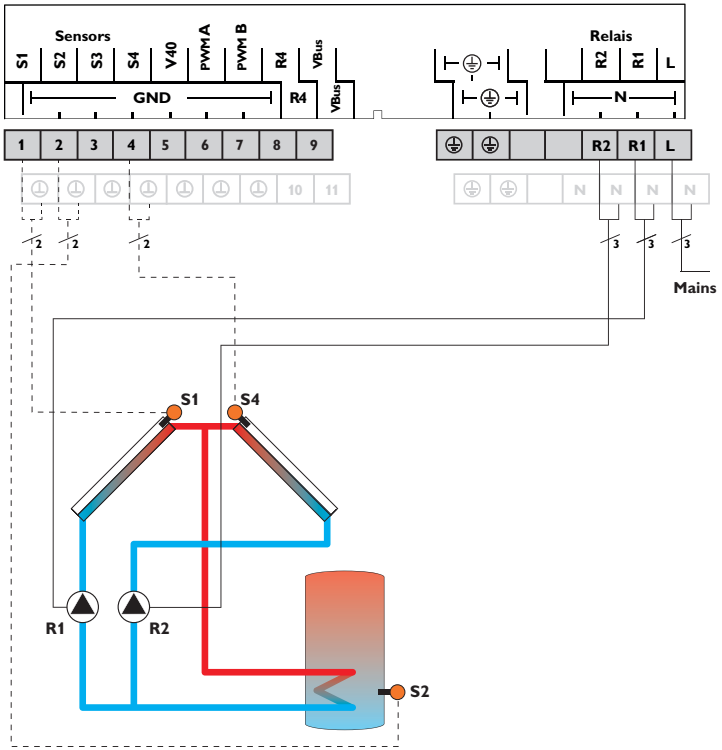
Relay		
R1	Solar pump store	R1/N/PE
R2	Solar pump store 2	R2/N/PE
R4	Free	R4/R4

The controller compares the temperature at sensor S1 to the temperatures at sensors S2 and S4. If the measured temperature differences are higher than the adjusted switch-on temperature differences, the pump (R1 and/or R2) will be activated and the corresponding store will be loaded up to the adjusted store maximum or set temperature respectively at most. The priority logic effects prior loading of store 1.

System 6 system screen



System 7: Solar system with east-/ west collectors

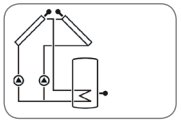


Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Free	3/GND
S4	Temperature collector 2	4/GND

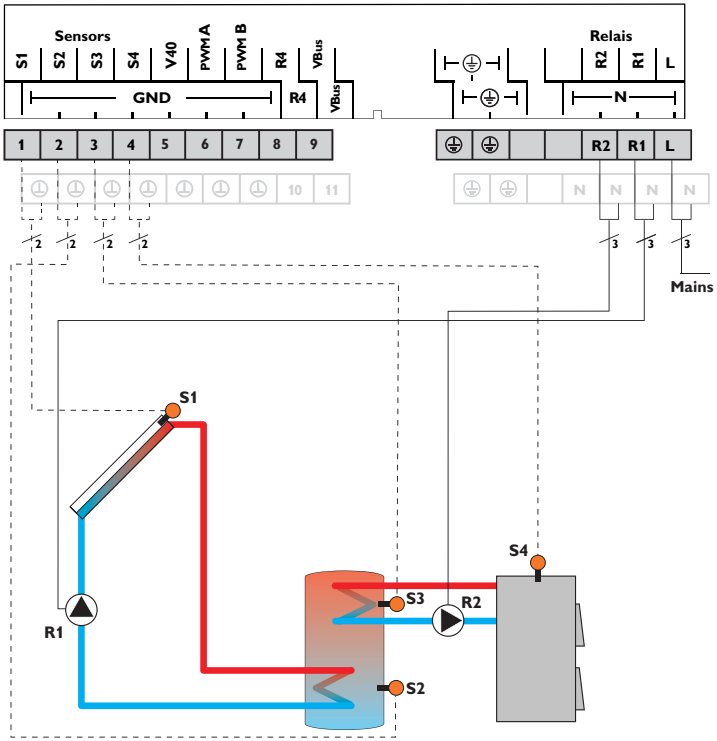
Relay		
R1	Solar pump collector	R1/N/PE
R2	Solar pump collector 2	R2/N/PE
R4	Free	R4/R4

The controller compares the temperatures at the collector sensors S1 and S4 to the store temperature at sensor S2. If one of the measured temperature difference is higher than the adusted switch-on temperature difference, the corresponding pump (R1 and/or R2) will be switched on, thus loading the store until either the switch-off temperature difference or the store maximum temperature is reached.

System 7 system screen



System 8: Solar system with 1 store and afterheating with solid fuel boiler



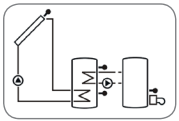
Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Temperature store top	3/GND
S4	Temperature solid fuel boiler	4/GND

Relay		
R1	Solar pump	R1/N/PE
R2	Loading pump solid fuel boiler	R2/N/PE
R4	Free	R4/R4

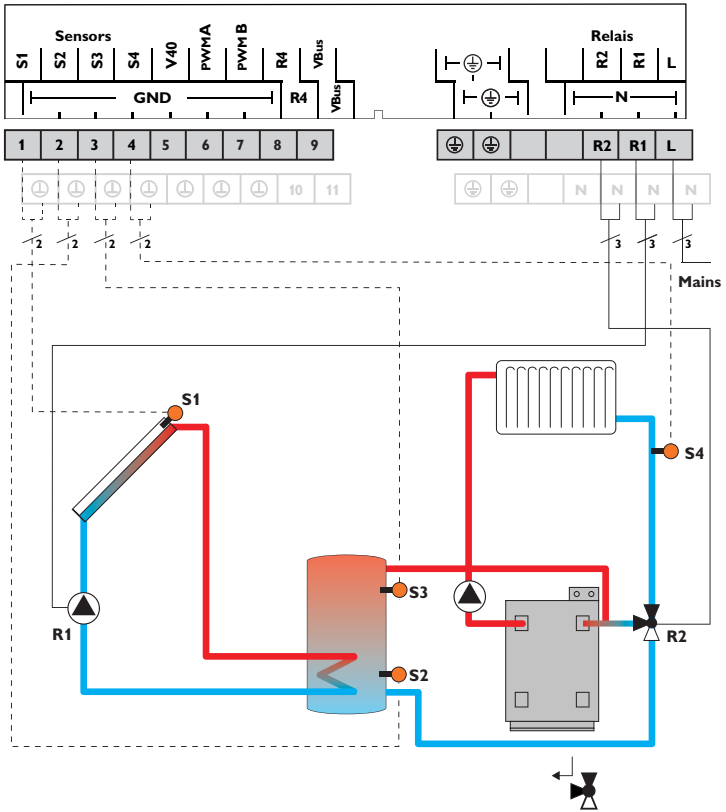
The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the store will be loaded until the switch-off temperature difference or the maximum store temperature is reached.

With another temperature differential function (S4 heat source/S3 heat sink), afterheating of the store with a solid fuel boiler can be carried out via another pump (R2).

System 8 system screen



System 9: Solar system with 1 store and return preheating



Flow direction when normally open

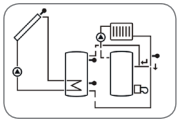
Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Temperature store return preheating	3/GND
S4	Temperature heating return	4/GND

Relay		
R1	Solar pump	R1/N/PE
R2	Valve return preheating	R2/N/PE
R4	Free	R4/R4

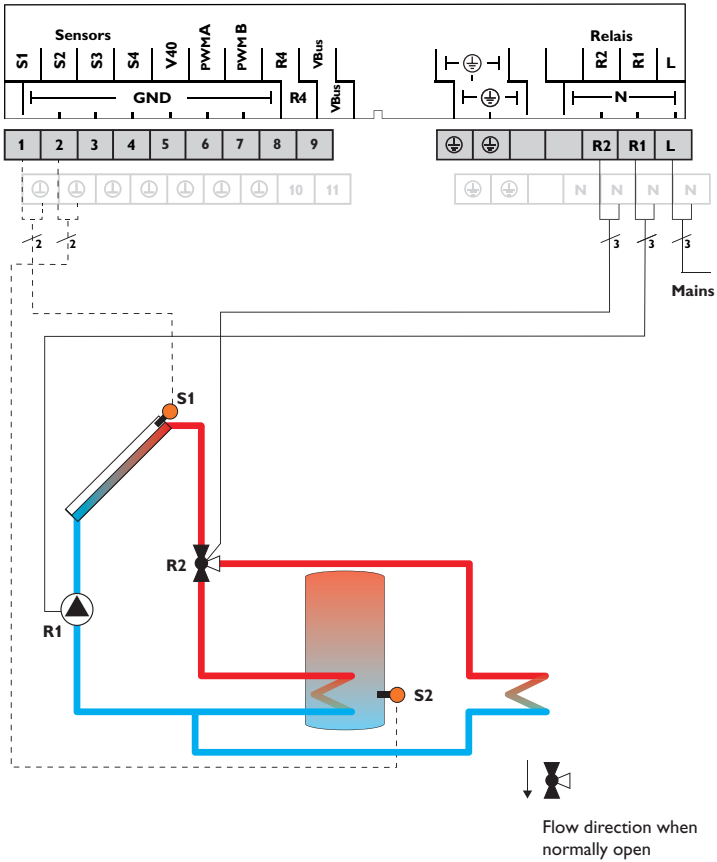
The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the store will be loaded until the switch-off temperature difference or the maximum store temperature is reached.

With another temperature differential function (S3 heat source/S4 heat sink) return preheating (heating circuit backup) is possible via another valve (R2).

System 9 system screen



System 10: Solar system with 1 store and heat dump



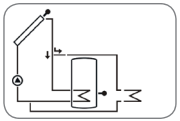
Temperature sensors		
S1	Temperature collector	1/GND
S2	Temperature store base	2/GND
S3	Free	3/GND
S4	Free	4/GND

Relay		
R1	Solar pump	R1/N/PE
R2	Heat dump valve	R2/N/PE
R4	Free	R4/R4

The controller calculates the temperature difference between collector sensor S1 and store sensor S2. If the difference is larger than or identical to the adjusted switch-on temperature difference, the pump (R1) will be switched on and the store will be loaded until the switch-off temperature difference or the maximum store temperature is reached.

If the collector maximum temperature (CMAX) is reached, the solar pump will be energised by R1 and the 3-port valve by R2 in order to divert excess heat to a heat sink. For safety reasons, excess heat dump will only take place as long as the store temperature is below the non-adjustable shutdown temperature of 95 °C [200 °F].

System 10 system screen

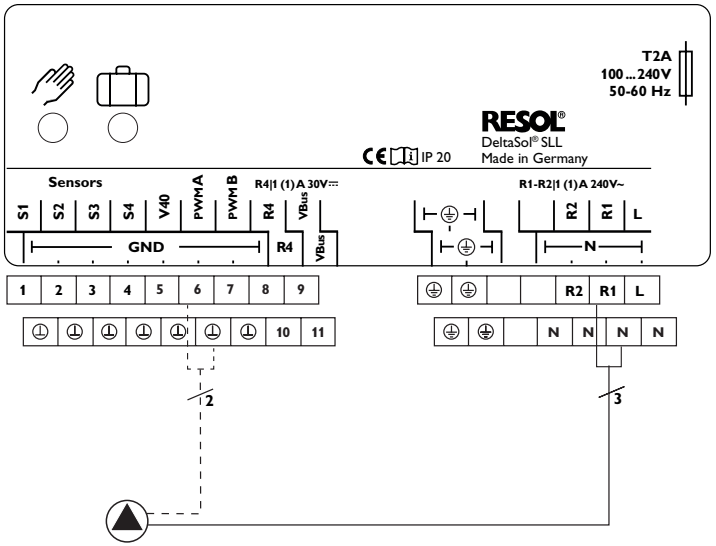


Electrical connection of a high-efficiency pump (HE pump)

Speed control of a HE pump is possible via a PWM signal. The pump has to be connected to the relay (power supply) as well as to one of the PWM A/B outputs of the controller.

Relay allocation for PWM outputs:

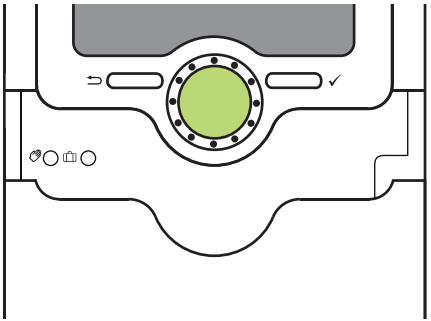
PWM A - Relay 1
PWM B - Relay 2



Note
For more information about relay control, see page 42.

3 Operation and function

3.1 Buttons and adjustment dial



The controller is operated via 2 buttons and 1 adjustment dial (Lightwheel®) below the display:

Left button (⮌) - escape button for changing into the previous menu
Right button (✓) - confirming / selecting
Lightwheel® - scrolling upwards / scrolling downwards, increasing adjustment values / reducing adjustment values

3.2 Microbuttons for manual mode and holiday mode

The controller is equipped with two microbuttons for quick access to the manual mode and the holiday function. The microbuttons are located underneath the slidable housing cover, the slider.

Mircobutton: If the microbutton is briefly pressed, the controller changes to the manual mode menu (see page 44).

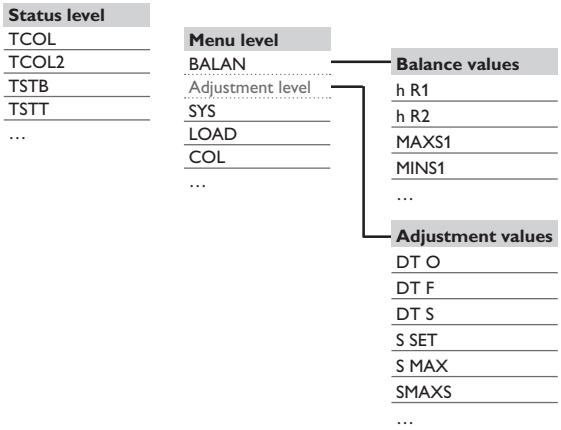
Microbutton: The microbutton is used for activating the holiday function (see page 43). If the microbutton is pressed and held down for approx. 3 s, the adjustment channel **DAYS** appears, allowing to enter the number of days for an absence. If the parameter is set to a value higher than 0, the function becomes active using the adjustments that have previously been made in the **H-DAY** menu. The days will be counted backwards at 00:00. If the value is set to 0, the function is deactivated.

3.3 Control lamp

The controller is equipped with a multicolour LED in the centre of the Lightwheel®, indicating the following states:

Colour	Permanently shown	Flashing
	Everything OK	Manual mode: at least one relay HAND ON / minimum speed / maximum speed
		Sensor line break, sensor short circuit, flow rate monitoring, overpressure, low pressure
	Holiday function active	ΔT too high, night circulation, FL/RE interchanged, store maximum temperature exceeded
		Manual mode: at least one relay HAND OFF

3.4 Menu structure



The menu structure of the controller consists of 2 levels: the status level and the menu level.

The status level consists of different display channels which indicate display values and messages.

The menu level consists of the balance values menu and several menu items each of which consists of sub-menus and adjustment channels. In order to activate or deactivate a function, it must be selected in the menu level. The display changes to the adjustment menu in which all adjustments required can be carried out.

Note
Some of the menu items depend on the selected system and the adjusted options. Therefore, they are only displayed if they are available.

Note
The abstract from the menu structure is for information on the structure of the controller menu and is therefore not complete.

3.5 Selecting menu points and adjusting values

During normal operation of the controller, the display shows the status level with the adjustment channels. If no button is pressed for 1 min, the display illumination goes out. If no button is pressed for further 3 min, the display indicates the status level.

Press any key to reactivate the display illumination.

In order to scroll through the display channels, turn the Lightwheel®.

Accessing the adjustment level:

➔ Press the right button (✓) for approx. 3 s.

The display changes to the adjustment level. All menus contain adjustment channels and are marked with **PUSH** below the menu item.

➔ In order to access the desired menu, press the right button (✓)

Note
Only if the installer code is entered (see page 51), will the adjustment level be accessible.

Selecting and adjusting options / functions

An option or function containing adjustment values are marked with **PUSH**.

➔ In order to access the sub-menu of the option, select the option by turning the Lightwheel® and press the right button (✓) .

➔ In order to activate an option, select ON. In order to deactivate it, select OFF.

The adjustment channels are characterised by the indication **SET**.

➔ Select the desired adjustment channel by turning the Lightwheel®.

➔ Confirm your selection with the right button (✓). **SET** starts flashing (adjustment mode).

➔ Adjust the value by turning the Lightwheel®.

➔ Confirm your selection with the right button (✓). **SET** permanently appears, the adjustment has been saved.

BACK PUSH appears as the last display.

➔ In order to get back to the menu selection, press the right button (✓).

If no button has been pressed within a couple of minutes, the adjustment is cancelled and the previous value is retained.

3.6 Resetting balance values

Heat quantity, operating hours of the relays as well as minimum and maximum temperatures can be set back to zero. In order to reset a value, proceed as follows:

➔ Select the desired value and press the right button(✓). **SET** starts flashing.

➔ Turn the Lightwheel® anticlockwise.

The value is set back to 0.

➔ Press the right button(✓).

The message DEL will be displayed.

➔ Turn the Lightwheel® clockwise.

YES instead of NO will be displayed.

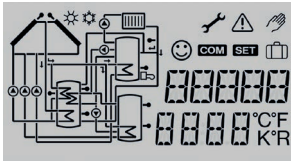
➔ Confirm your selection with the right button (✓).

The value will be set back to zero and the symbol will be permanently displayed.

In order to interrupt this process, press the left button (⮌).

4 System-Monitoring-Display

System-Monitoring-Display



The System-Monitoring-Display consists of 3 blocks: channel display, tool bar and system screen.

Channel display

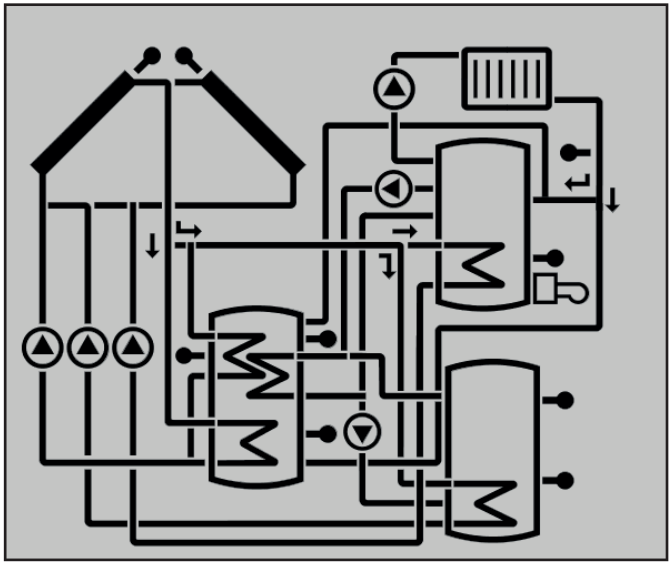
The channel display consists of 2 lines. The upper display line is an alphanumeric 16-segment display. In this line, mainly channel names and menu items are displayed. In the lower 16-segment display, values are displayed.

Tool bar

The additional symbols in the tool bar indicate the current system state.

4.1 System screen

The system selected is indicated in the System-Monitoring-Display. It consists of several system component symbols which are – depending on the current status of the system – either flashing, permanently shown or hidden.



Collectors with collector sensor

Store 1 and 2 with heat exchanger

3-port valves
Only the flow direction or current switching position is indicated.

Temperature sensor

Heating circuit return preheating

Pump

Afterheating with burner symbol

4.2 Further indications

Smiley

If the controller operates faultlessly (normal operation), a smiley ☺ is displayed.

Fault indication

If the controller detects a malfunction, the control LED flashes red and the symbols of the warning triangle ⚠ and the wrench are additionally displayed.

Short text and ticker

Functions, options, measurement and balance values as well as messages are indicated as both short text and ticker. After the short text has been displayed, the corresponding long text will be indicated as a ticker from right to left.

Symbol	Permanently shown	Flashing
Status indications:		
☼	Store maximum limitation active (store maximum temperature has been exceeded)	Collector cooling function active, system cooling or store cooling active
❄	Antifreeze option activated	Collector temp. below minimum temp., antifreeze function active
⚠		Collector emergency shutdown active
⚠ + ✋		Manual mode active
⚠ + ☼		Store emergency shutdown active
SET		Adjustment mode
🧳	Holiday function active	
☺	Normal operation	
Fault indication:		
⚠ + 🔧		Sensor fault

5 Status level / Measurement values

During normal operation of the controller, the display is in the status level, indicating the measurement values (depending on the system) shown in the table.

In addition to the display values, possible error messages are indicated in the status menu (see page 51).

Display	Description (long text)
TCOL	Temperature collector
TCOL2	Temperature collector 2
TSTB	Temperature store base
TSTT	Temperature store top
TST2B	Temperature store 2 base
TSTTS	Temperature heat exchange source
TST2S	Temperature heat exchange sink
TAH	Temperature afterheating
TSFB	Temperature solid fuel boiler
TSTSF	Temperature store - solid fuel boiler
TSTRP	Temperature store return preheating
TRET	Temperature heating circuit return
S3	Temperature sensor 3
S4	Temperature sensor 4
n1 %	Speed relay 1
n2 %	Speed relay 2
L/h	Flow rate sensor V40
TFHQM	Heat quantity measurement flow temperature
TRHQM	Heat quantity measurement return temperature
kWh	Heat quantity in kWh
MWh	Heat quantity in MWh
BLPR	Blocking protection relay 1
BLPR2	Blocking protection relay 2
INIT	Initialisation drainback
FLLT	Filling time drainback
STAB	Stabilisation drainback
TDIS	Disinfection temperature
CDIS	Countdown thermal disinfection
DDIS	Disinfection period
SDIS	Starting time delay
TIME	
DATE	

6 Balance values

The balance value menu indicates the balance values.

Display	Description
h R1	Operating hours relay 1
h R2	Operating hours relay 2
h R4	Operating hours relay 4
DAYS	Operating days of the controller (cannot be set back to zero)
MAXS1	Maximum temperature sensor 1
MINS1	Minimum temperature sensor 1
MAXS2	Maximum temperature sensor 2
MINS2	Minimum temperature sensor 2
MAXS3	Maximum temperature sensor 3
MINS3	Minimum temperature sensor 3
MAXS4	Maximum temperature sensor 4
MINS4	Minimum temperature sensor 4

7 Commissioning

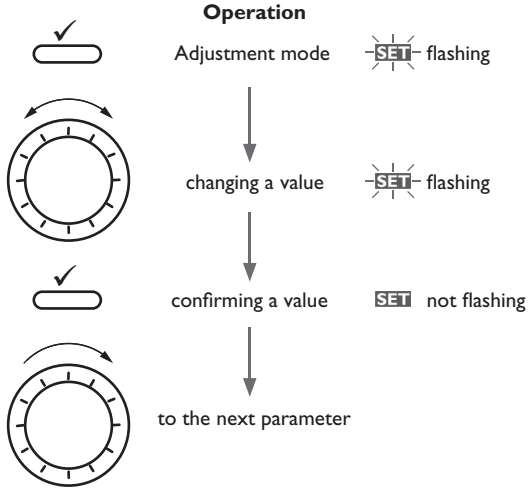
When the hydraulic system is filled and ready for operation, connect the controller to the mains.

The controller runs an initialisation phase in which all symbols are indicated in the display. The Lightwheel® flashes red.

When the controller is commissioned or when it is reset, it will run a commissioning menu after the initialisation phase. The commissioning menu leads the user through the most important adjustment channels needed for operating the system.

Commissioning menu

The commissioning menu consists of the channels described in the following. In order to make an adjustment, press the right button (✓). **SET** starts flashing and the adjustment can be made. Confirm the adjustment with the right button (✓). Turn the Lightwheel®, the next channel will appear on the screen.



Commissioning

1. Language:

➔ Adjust the desired menu language.

2. Time:

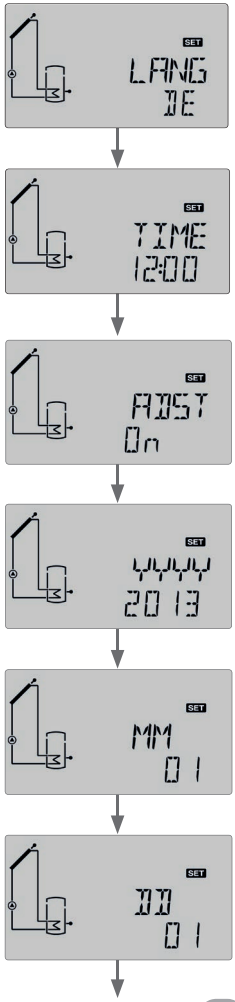
➔ Adjust the clock time. First of all adjust the hours, then the minutes.

3. Daylight savings time adjustment:

➔ Activate or deactivate the automatic daylight savings time adjustment.

4. Date:

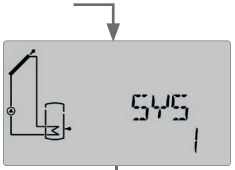
➔ Adjust the date. First of all adjust the year, then the month and then the day.



Commissioning

5. System:

➔ Adjust the desired system (see page 49).

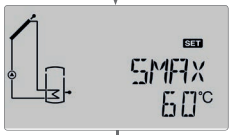


6. Store set temperature:

➔ Adjust the desired store set temperature. In 2-store systems, the adjustment has to be carried for **S2SET** aswell (see page 32).

7. Maximum store temperature:

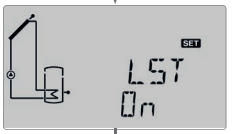
➔ Adjust the maximum store temperature. In 2-store systems, the adjustment has to be carried out for **S2MAX** aswell (see page 33).



8. Loading store 1:

➔ Switch on or off the "loading store 1" option (see page 33).

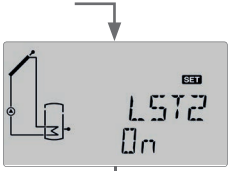
Note
"Loading store 1" is only available if a 2-store system or store loading in layers has been previously selected in the sub-channel **SYS**.



9. Loading store 2:

➔ Switch on or off the "loading store 2" option (see page 33).

Note
"Loading store 2" is only available if a 2-store system or store loading in layers has been previously selected in the sub-channel **SYS**.



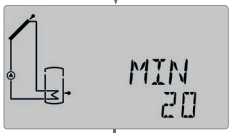
10. Relay control type:

➔ Select the relay control type for **REL**. Carry out this adjustment for **REL2** as well, if necessary (see page 42).

11. Minimum speed:

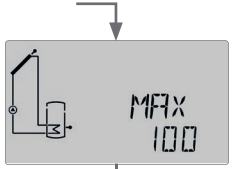
➔ Adjust the minimum speed **MIN** of the relay. Carry out this adjustment for relay 2 as well, if necessary (see page 42).

Note
The minimum speed value will not be available if **ONOF** has been selected in the sub-channel **REL (REL2)**



12. Maximum speed:

➔ Adjust the maximum speed **MAX** of the relay. Carry out this adjustment for relay 2 as well, if necessary (see page 42).



Note
The maximum speed value will not be available if **ONOF** has been selected in the sub-channel **REL (REL2)**.

➔ **Complete the commissioning menu by pressing the right button (✓):**

The controller is then ready for operation and normally the factory settings will give close to optimum operation.

Note
The adjustments carried out during commissioning can be changed anytime in the corresponding adjustment channel. Additional functions and options can also be activated or deactivated (see page 26).

Set the code to the customer code before handing over the controller to the customer (see page 51).

8 Indications, functions and options

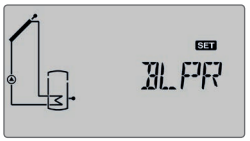
Note

The values and adjustment channels as well as the adjustment ranges depend on the system selected, the functions and options as well as the user code entered and the system components connected to the controller.

An additional document including a list with all options and parameters can be downloaded at www.resol.com.

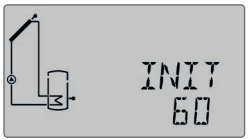
8.1 Status level

Display of blocking protection time



BLPR(2)
Blocking protection active

Display of drainback time periods



INIT
Initialisation active
Indicates the time adjusted in **tDTO**, running backwards.

FLLT
Filling time active
Indicates the time adjusted in **tFLL**, running backwards.

STAB
Stabilisation
Indicates the time adjusted in **tSTB**, running backwards.

Display of collector temperatures

TCOL(2)
Collector temperature
Display range: -40 … +260 °C
Displays the current collector temperature.

- TCOL : Collector temperature
- TCOL2: Collector temperature 2 (2-collector system)

Display of store temperatures

TSTB, etc.
Store temperatures
Display range: -40 … +260 °C
Displays the current store temperature.

- TSTB : Store temperature base
- TSTT : Store temperature top

in 2-store systems (only if available):

- TST2T : Temperature store 2 top
- TST2B : Temperature store 2 base
- TSTTS : Temperature heat exchange source
- TST2S : Temperature heat exchange sink
- TSTSF : Temperature store - solid fuel boiler

Display of temperatures at S3 and S4

S3, S4
Temperature sensors
Display range: -40 … +260 °C
Indicates the current temperature at the corresponding additional sensor (without control function).

- S3 : Temperature sensor 3
- S4 : Temperature sensor 4

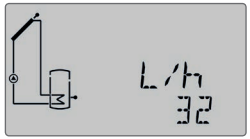
Note
In systems with return preheating, S3 is used as the heat source sensor TSTR.

Display of further temperatures

TSFB, etc.
Further measured temperatures
Indication range: -40 … +260 °C
Indicates the current temperature at the corresponding sensor. The display of these temperatures depends on the system selected.

- TSFB : Temperature solid fuel boiler
- TRET : Temperature heating return
- TSTR : Temperature store return preheating
- TFHQM : Temperature flow (HQM)
- TRHQM : Temperature return (HQM)
- TAH : Temperature afterheating

Display of flow rate



L/h
Flow rate
Indication range: 0 … 9999 l/h
Indicates the currently measured flow rate. This value is used for calculating the heat quantity supplied (V40).

Display of speed

n1%, n2%

Current pump speed

Indication range: 20 … 100 % (standard pump / HE pump)

Indicates the current speed of the corresponding pump.

Display of heat quantity

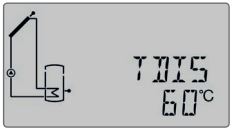
kWh/MWh

Heat quantity in kWh / MWh

Indicates the heat quantity produced in the system. For this purpose, the heat quantity measurement option has to be enabled. The flow rate as well as the values of the reference sensors fl ow and return are used for calculating the heat quantity supplied. It is shown in kWh in the **kWh** channel and in MWh in the **MWh** channel. The overall heat quantity results from the sum of both values.

The accumulated heat quantity can be set back to zero (see page 20).

Indication of thermal disinfection



TDIS

Disinfection temperature

Indication range: -40 … +260 °C

If the thermal disinfection option (**OTDIS**) is activated and the disinfection period is in progress, the disinfection temperature measured at the reference sensor is displayed in this channel.

CDIS

Countdown monitoring period

Display range: 0 … 30:0 … 24 (dd:hh)

If the thermal disinfection option (**OTDIS**) is activated and the monitoring period is in progress, the remaining time of the monitoring period is displayed as **CDIS** (in hours and minutes), counting backwards.

SDIS

Starting time

Display range: 0:00 … 24:00 (time)

If the thermal disinfection option (**OTDIS**) is activated and a starting delay time has been adjusted, the delay time is displayed (flashing) in this channel.

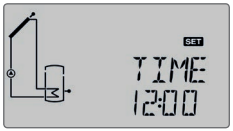
DDIS

Disinfection period

Display range: 0:00 … 23:59 (hh:mm)

If the thermal disinfection option (**OTDIS**) is activated and the disinfection period is in progress, the remaining time of the heating period is displayed (in hours and minutes) in this channel, counting backwards.

Display of time



TIME

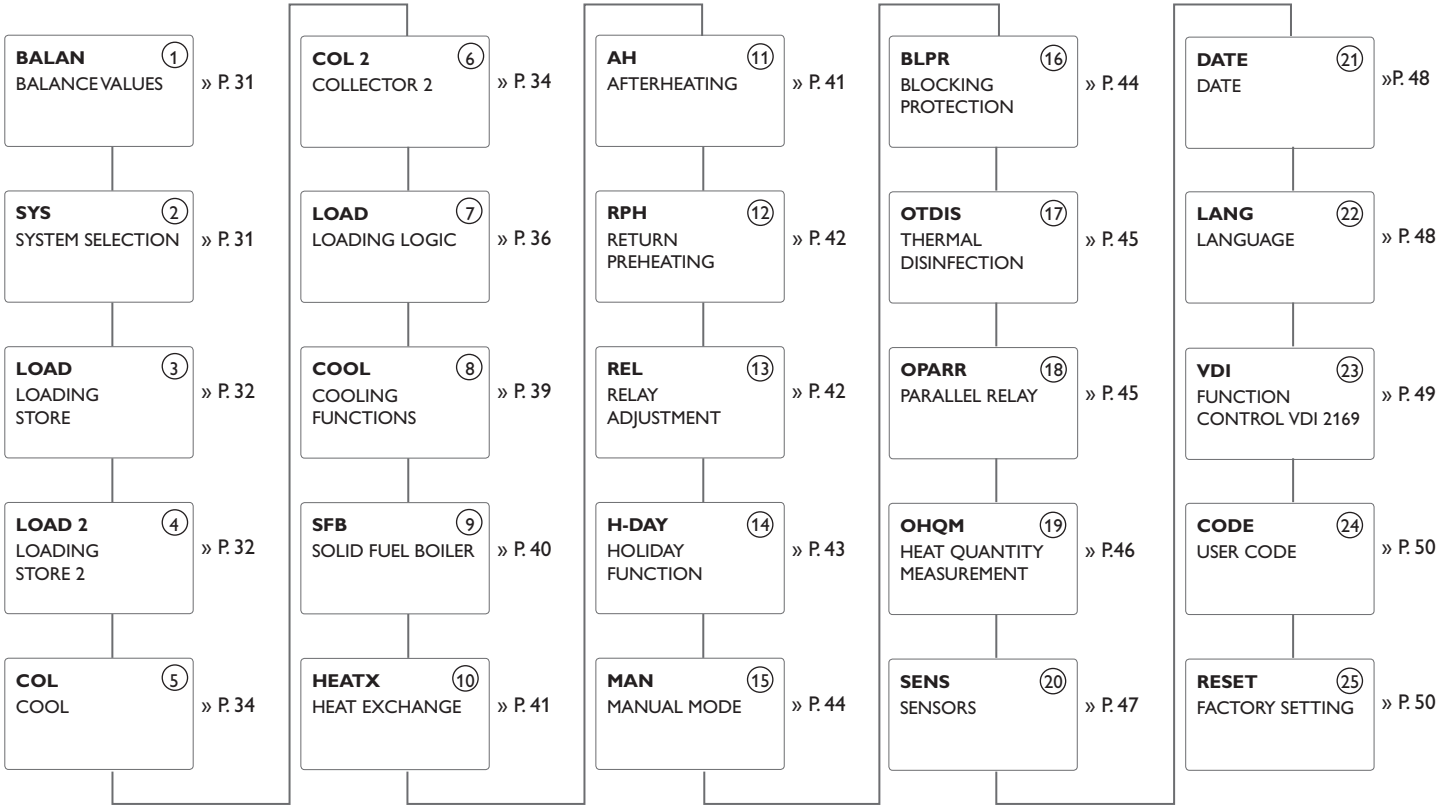
Indicates the current clock time.

Display of date

DATE

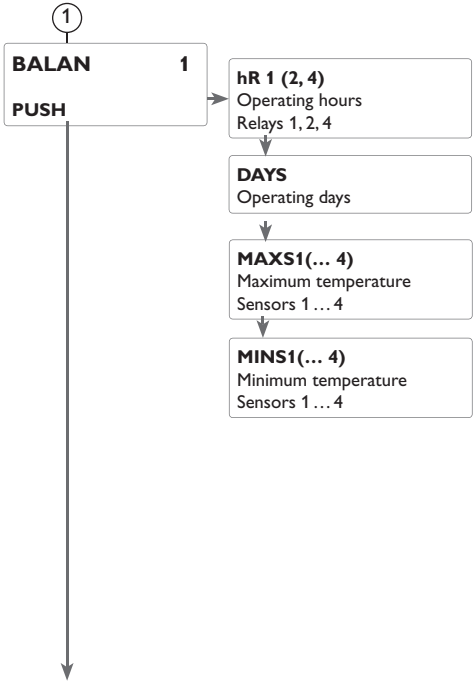
Indicates the current date.

8.2 Menu overview

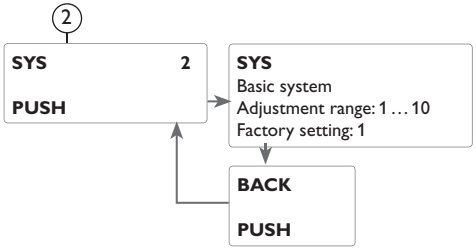


Parameters shown in the following with a dashed line depend on options and are only indicated if they are available in the system selected.

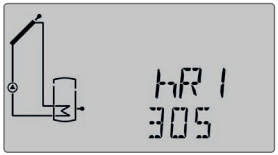
Balance values



Adjustment level



① Operating hours counter



h R (1, 2, 4)
Operating hours counter

The operating hours counter accumulates the solar operating hours of the relay (**h R1** / **h R2** / **h R4**). Full hours are displayed.

The accumulated operating hours can be set back to zero (see page 20).

Operating days
Display of operating days since commissioning or last reset. The operating days cannot be set back to zero.

Minimum and maximum temperatures

MAXS1(2, 3, 4)
Maximum temperatures at S1 … S4

MINS1(2, 3, 4)
Minimum temperatures at S1 … S4

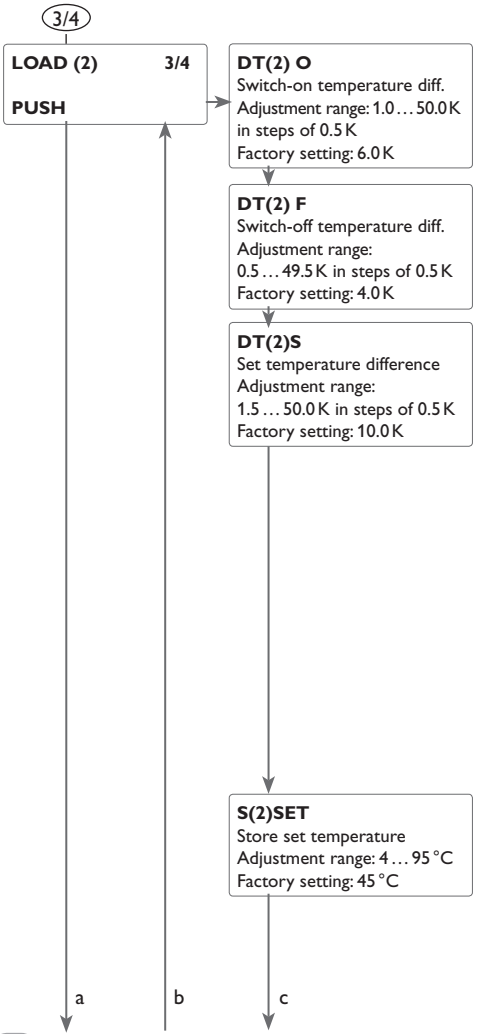
Indication of the minimum and maximum temperatures at S1…S4.

The temperature indication can be set back to zero (see page 20).

② System

Selecting the system

Each system has pre-programmed options and adjustments which can be activated or changed respectively if necessary. Select the system first (see page 7).



(3/4) ΔT control

The controller works as a standard differential controller. If the temperature reaches or exceeds the switch-on temperature difference, the pump switches on. When the temperature difference reaches or falls below the adjusted switch-off temperature difference, the respective relay switches off.

Note
The switch-on temperature difference must be 0.5 K higher than the switch-off temperature difference. The set temperature difference must be at least 0.5 K higher than the switch-on temperature difference.

Note
In systems with 2 stores or store loading in layers, 2 separate menus (**LOAD** and **LOAD 2**) will be displayed.

Speed control

If the temperature difference reaches or exceeds the switch-on temperature difference, the pump switches on at 100 % speed for 10 s. Then, the speed is reduced to the minimum pump speed value.

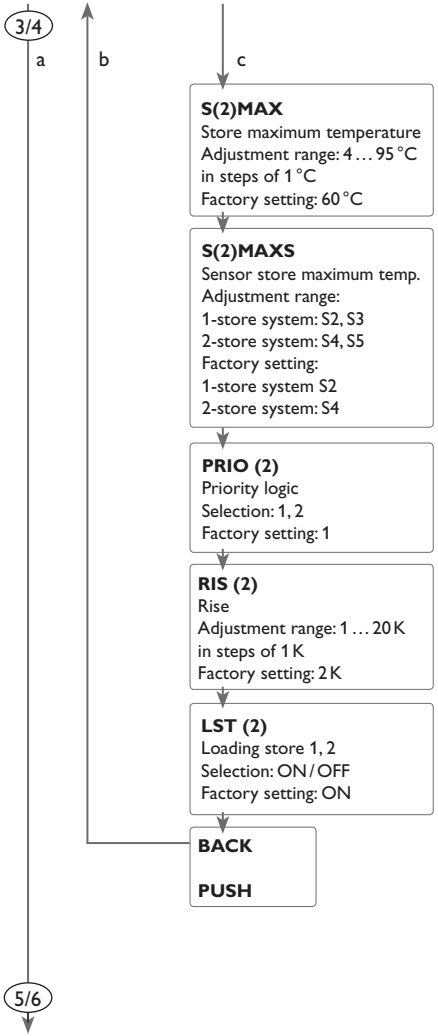
If the temperature difference reaches the adjusted nominal value, the pump speed increases by one step (10 %). The response of the controller can be adapted via the parameter Rise. Each time the difference increases by the adjustable rise value, the pump speed increases by 10 % until the maximum pump speed of 100% is reached. If the temperature difference decreases by the adjustable rise value, pump speed will be decreased by one step.

Note
To enable speed control, the corresponding relay has to be set to **AUTO**, **MIN**, **MAX** or **ADAP** (**MAN** channel) and relay control to **PULS, PSOL** or **PHEA** (adjustment channel **REL**).

Store set temperature

The store set temperature can be adjusted in the **S(2)SET** channel.

Note
For more information about relay control, see page 42.



(3/4) Priority logic

Priority logic can be used in 2-store systems or systems with store loading in layers only and determines how the heat is divided between the stores.

PRIO: Store 1 / store base

PRIO2: Store 2 / store top

The store which has been adjusted to 1 is considered as the priority store.

If both stores have been adjusted to an identical value, they will be loaded in parallel.

Store maximum temperature and Sensor store maximum temperature

If the store temperature reaches the adjusted maximum temperature, the store will no longer be loaded in order to avoid damage caused by overheating. If the maximum store temperature is exceeded, ☼ is displayed.

The sensor for store maximum limitation can be selected. The maximum limitation always refers to the sensor selected.

The switch-on hysteresis is selectable.

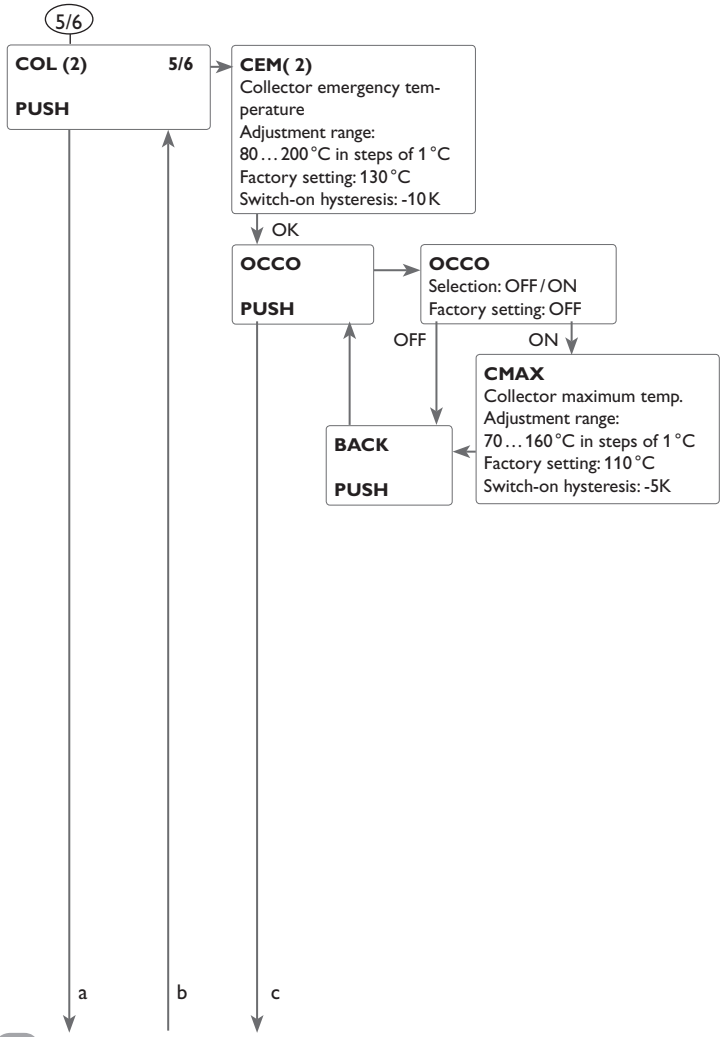
Note

In systems with 2 stores or store loading in layers, 2 separate menus (**LOAD** and **LOAD 2**) will be displayed.

Loading store

In systems with 2 stores or store loading in layers, one of the two stores or the store zone respectively can be switched off with the parameter **LST(2)**.

If **LST or LST2** is adjusted to **OFF**, the system runs like a 1-store system. The representation in the display remains the same.



(5/6) Collector emergency shutdown

When the collector temperature exceeds the adjusted collector emergency temperature, the solar pump (R1 / R2) switches off in order to protect the system components against overheating (collector emergency shutdown). If the maximum collector temperature is exceeded, ⚠ is displayed (flashing).

Note
If the drainback option is activated, the adjustment range of the collector emergency temperature is 80 … 95 °C. The factory setting then is 95 °C.

Note
In systems with east-/west collectors, 2 separate menus (**COL** and **COL 2**) will be displayed.

WARNING! **Risk of injury! Risk of system damage by pressure surge!**

If water is used as the heat transfer fluid in pressureless systems, water will boil at 100 °C.

➔ **In pressureless systems with water as the heat transfer fluid, do not set the collector limit temperature higher than 95 °C.**

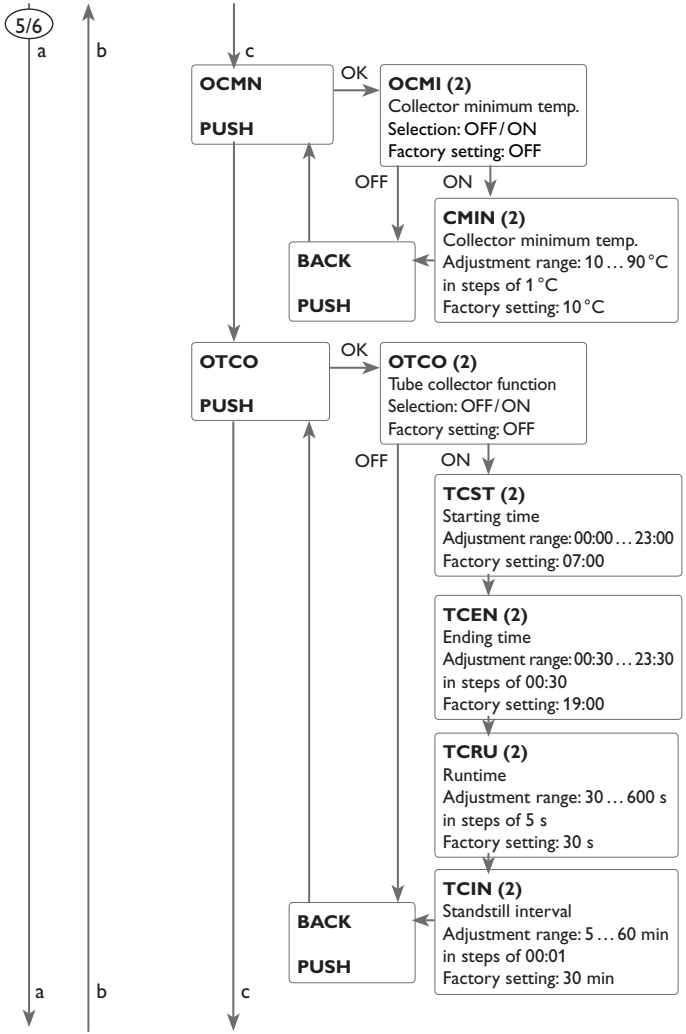
Collector cooling

The collector cooling function keeps the collector rise temperature within the operating range by heating the store. If the store temperature reaches 95 °C the function will switch off for safety reasons.
When the store temperature exceeds the adjusted maximum store temperature, the solar system switches off. If the collector temperature increases to the adjusted maximum collector temperature, the solar pump is activated until the collector temperature falls below the maximum collector temperature. The store temperature may then exceed the maximum temperature, but only up to 95 °C (emergency shutdown of the store).

If the collector cooling is active, ☼ is displayed (flashing).

Note
This function is only available if the system cooling function and the heat dump function are not activated.

Note
In systems with east-/west collectors, 2 separate menus (**COL** and **COL 2**) will be displayed.



(5/6) Collector minimum temperature

The minimum collector temperature is the minimum switch-on temperature which must be exceeded for the solar pump (R1 / R2) to switch on. If the collector temperature falls below the adjusted minimum temperature, ❄ is displayed (flashing).

Note
In systems with east- / west collectors, 2 separate menus (**COL** and **COL 2**) will be displayed.

Tube collector function

This function is used for improving the switch-on behaviour in systems with non-ideal sensor positions (e. g. with some tube collectors).

This function operates within an adjusted time frame. It activates the collector circuit pump for an adjustable runtime between adjustable pauses in order to compensate for the delayed temperature measurement.

If the runtime is set to more than 10 s, the pump will be run at 100 % for the first 10 s of the runtime. For the remaining runtime, the pump will be run at the adjusted minimum speed.

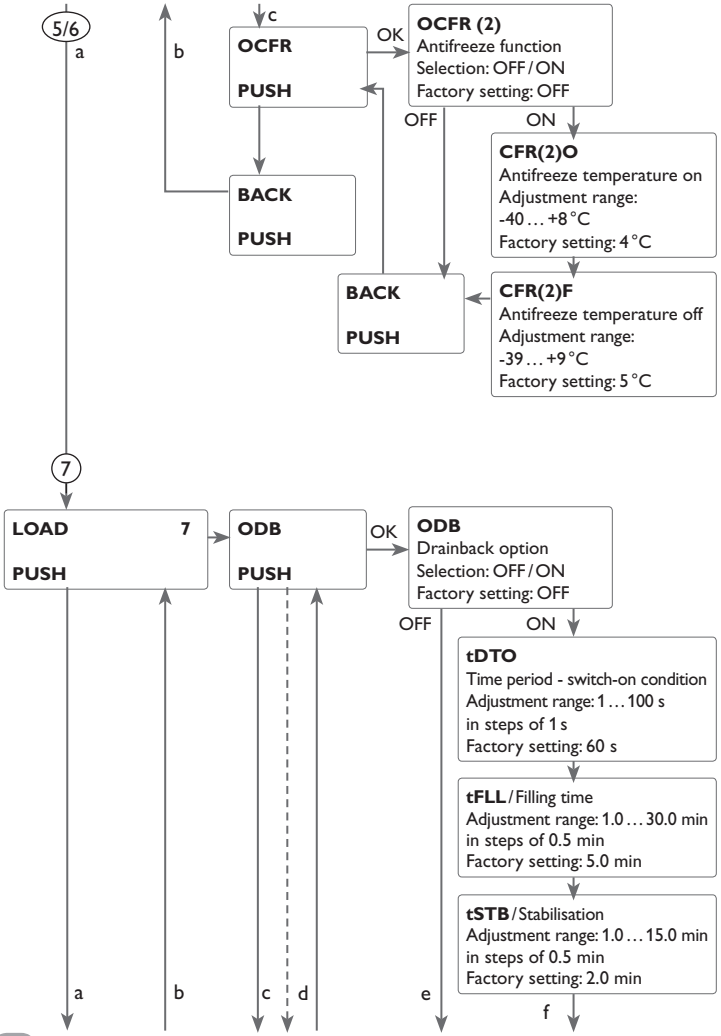
If the collector sensor is defective or the collector is blocked, this function is suppressed or switched off.

2-collector systems

In 2-collector systems, the tube collector function is available for each individual collector field.

In 2-collector systems, the tube collector function will affect the inactive collector field only. The solar pump of the active collector field will remain switched on until the switch-off conditions are fulfilled.

Note
If the drainback option is activated, the tube collector function will not be available.



(5/6) Antifreeze function

The antifreeze function activates the loading circuit between the collector and the store when the temperature falls below the adjusted temperature **CFR O**. This will protect the fluid against freezing or coagulating. If **CFR F** is exceeded, the solar pump will be switched off again.

The antifreeze function will be suppressed if the store temperature of the selected store falls below 5 °C. In 2-store systems, the function then switches to the second store or, in the case of store loading in layers, to the upper store zone. If the temperature of the second store (or of the upper store zone respectively) also falls below 5 °C, the system will be switched off.

Note
In systems with east-/west collectors, 2 separate menus (**COL** and **COL 2**) will be displayed.

Note
Since this function uses the limited heat quantity of the store, the antifreeze function should be used in regions with few days of temperatures around the freezing point.

(7) Drainback option

In a drainback system the heat transfer fluid will flow into a holding tank if solar loading does not take place. The drainback option initiates the filling process if solar loading is about to start. If the drainback option is activated, the following adjustment can be made:

Note
A drainback system requires additional components such as a holding tank. The drainback option should only be activated if all components required are properly installed.

Time period – switch-on condition

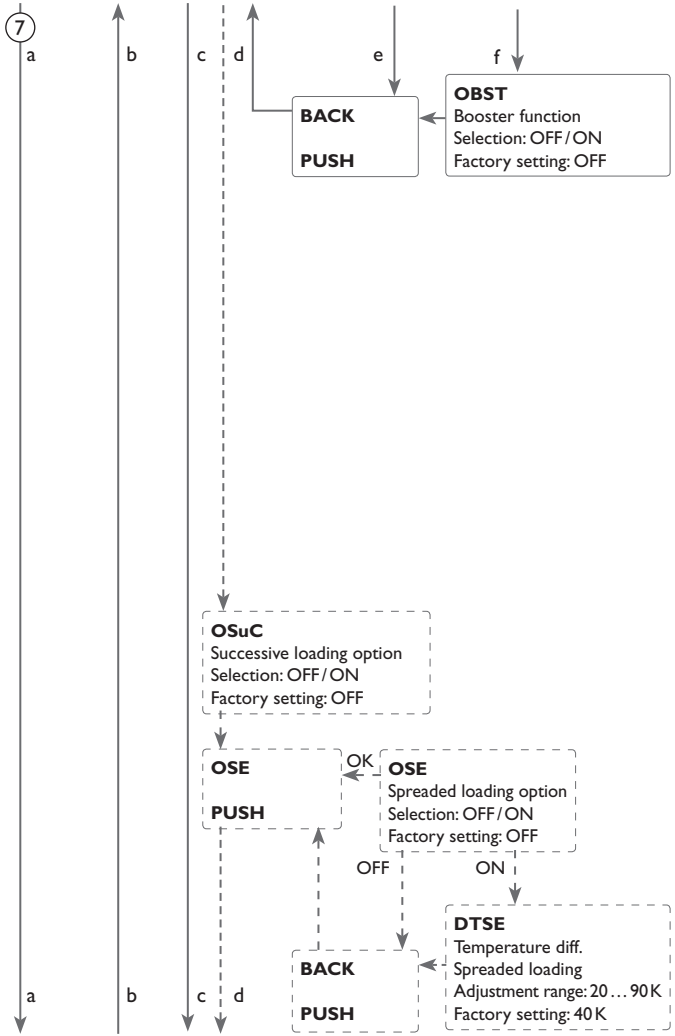
The parameter **tDTO** is used for adjusting the time period during which the switch-on condition DT O must be permanently fulfilled.

Filling time

The filling time can be adjusted using the parameter **tFLL**. During this period, the pump runs at 100 % speed.

Stabilisation

The parameter **tSTB** is used for adjusting the time period during which the switch-off condition will be ignored after the filling time has ended.



Note
If the drainback option is activated, the cooling functions and the antifreeze function will not be available.
The **H-DAY** (holiday function) menu will also not be available and cannot be selected by means of the microbutton.

Note
The drainback option is only available in systems with 1 store and 1 collector field and if no cooling function is activated.

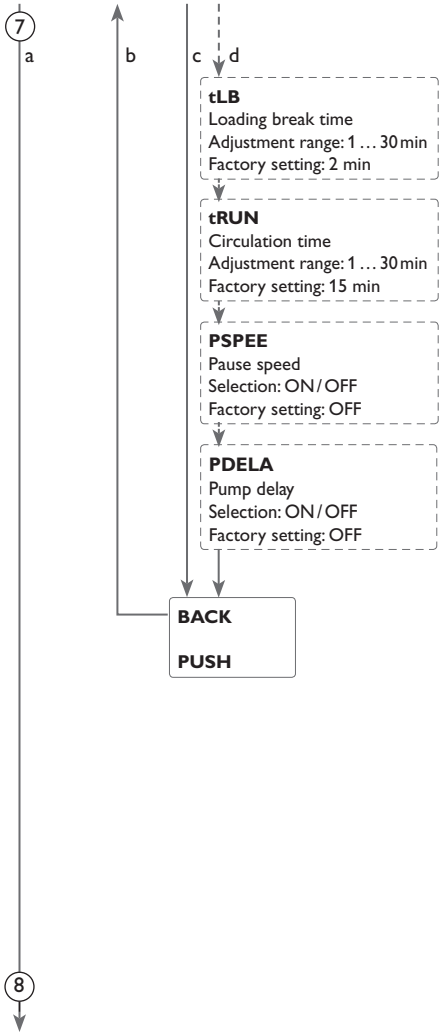
Note
If the drainback function **ODB** is activated, the factory settings of the parameters **DT O**, **DT F** und **DT S** will be adapted to values suiting drainback systems:
DT O = 10 K
DT F = 4 K
DT S = 15 K
Additionally, the adjustment range and the factory setting of the collector emergency shutdown **CEM** will change:
Adjustment range: 80 … 120 °C; Factory setting: 95 °C
Adjustments previously made in these channels will be overridden and have to be entered again if the drainback option is deactivated later on.

Note
If the holiday function is activated, the drainback option will not be available.

Booster function
This function is used for additionally switching on a second pump when filling the system. When solar loading starts, R2 is energised in parallel to R1. After the filling time has elapsed, R2 switches off.

Note
The booster function is available in system 1 only.

Successive loading option
Successive loading means that the priority store will be loaded up to its maximum temperature. If it is reached, the second store will be loaded. If the temperature of the first store falls below the store set temperature, the second store will no longer be loaded, regardless of whether the switch-on conditions of the priority store or of the subordinate store are fulfilled or not.
If both store have been loaded to their set temperature, the same process described above will take place until the stores heave reached their maximum temperature.



Spreaded loading option

In 2-store systems with 2 pumps, a spreaded loading function can be activated:

As soon as the adjustable temperature difference **DTSE** between the collector and the priority store is reached, the second store will be loaded in parallel unless it is blocked. If the temperature difference falls by 2 K below **DTSE**, the pump is switched off.

The collector temperature has to be higher than the store temperature.

Loading logic

In systems with 2 stores or store loading in layers, store sequence control can be adjusted.

In 1-store systems, only the menu item **PDELA** will be available.

Store sequence control

If the priority store cannot be loaded, the subordinate store will be checked. If useful heat can be added, it will be loaded for the circulation time.

After this, the loading process stops and the controller monitors the increase in collector temperature during the loading break time. If it increases by 2 K, the break time timer starts again to allow the collector to gain more heat. If the collector temperature does not increase sufficiently, the subordinate store will be loaded again for the circulation time.

As soon as the switch-on condition of the priority store is fulfilled, it will be loaded. If the switch-on condition of the priority store is not fulfilled, loading of the second store will be continued. If the priority store reaches its set temperature, store sequence control will not be carried out.

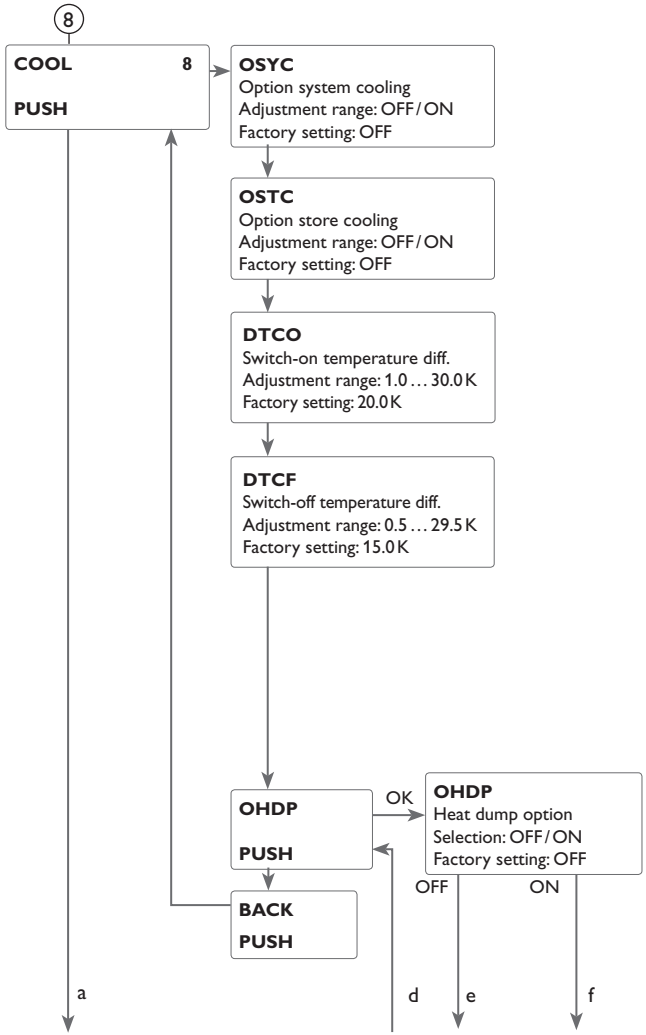
The minimum runtime of each loading process is 3 min.

In systems with 2 stores or store loading in layers, all stores / store zones will be loaded to their set temperature (according to their priority and store sequence control). Only when all stores / store zones have exceeded their set temperature will they be loaded up to their maximum temperatures, again according to their priority and store sequence control.

If store sequence control is active and the system switches to load the priority store, the parameter Loading break also acts as a stabilisation time, during which the switch off temperature difference will be ignored.

Overrun

By means of this function, store loading continues after the temperature difference between the collector and the store has fallen below the switch-off difference. It switches off if the temperature difference between the allocated flow and return sensors falls below the switch-off difference DT(2)F.



(8) Cooling functions

Different cooling functions can be activated: system cooling, store cooling and heat dump.

Note
If the temperature at the store sensor reaches 95 °C, all cooling functions will be blocked. The switch-on hysteresis is -5 K.

Note
If one of the cooling functions or the antifreeze function is activated, the drainback option will not be available.

System cooling

The system cooling function aims to keep the solar system operational for a longer time. The function overrides the maximum store temperature to provide thermal relief of the collector field and the heat transfer fluid on hot days.

If the store temperature is higher than the adjusted maximum store temperature and the switch-on temperature difference **DTO** is reached, the solar pump remains switched on or will be switched on. Solar loading is continued until either the temperature difference falls below the adjusted value **DTF** or the collector emergency shutdown temperature is reached.

In 2-store systems the sequence of the stores can be adjusted.

If the system cooling is active, ☼ is displayed (flashing).

Note
This function will only be available if the collector cooling function, the heat dump function, and the drainback option are not activated.

Store cooling

When the store cooling function is activated, the controller aims to cool down the store during the night in order to prepare it for solar loading on the following day.

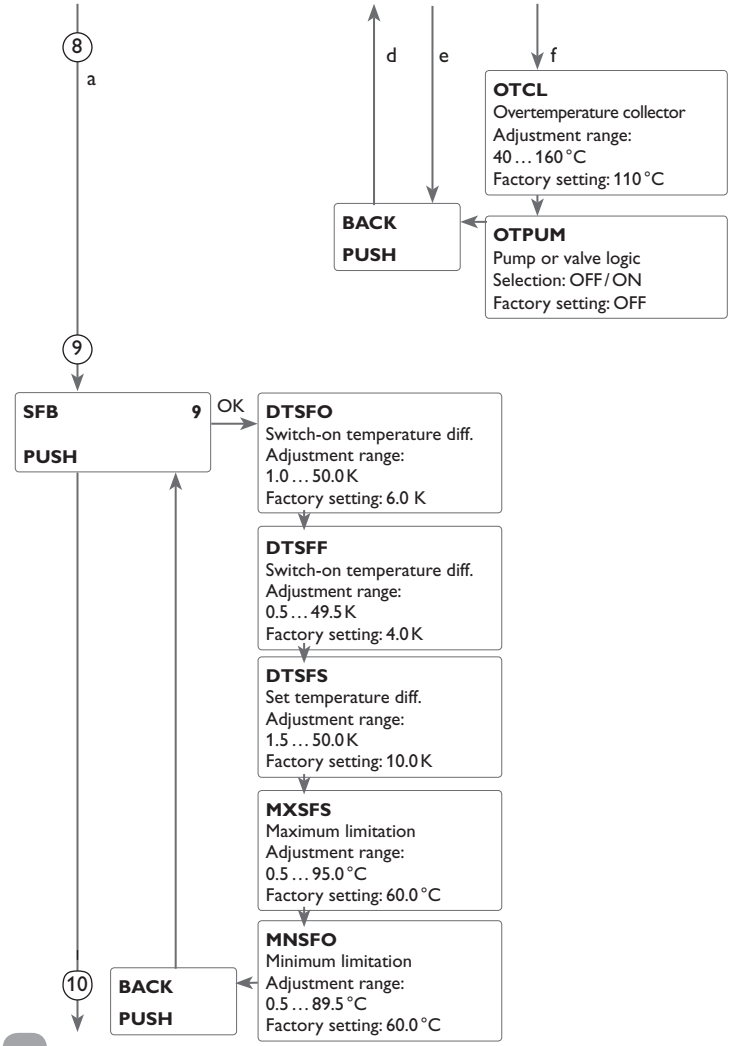
If the adjusted maximum store temperature is exceeded and the collector temperature falls below the store temperature, the system will be reactivated in order to cool down the store.

DTCO and **DTCF** are used as the reference temperature differences.

Heat dump

The heat dump function can be used to direct excess heat generated by strong solar irradiation to an external heat exchanger (e. g. fan coil) in order to keep the collector temperature within the operating range.

The heat dump function can either use an additional pump or valve (**OTPUM ON** = pump logic, **OTPUM OFF** = valve logic).



Variant pump:
The allocated relay is energised with 100 %, if the collector temperature reaches the adjusted switch-on temperature.

If the collector temperature falls by 5 K below the adjusted collector overtemperature, the relay will be switched off. In the variant pump, the heat dump function works independent from solar loading.

Variant valve:
The allocated relay will be energised in parallel to the solar pump, if the collector temperature reaches the adjusted collector overtemperature. If the collector temperature falls by 5 K below the adjusted collector overtemperature, the relay will be switched off.

If the store temperature exceeds its maximum temperature by more than 5 K while the heat dump function is being active, the function will be deactivated. If the temperature falls below this value by the **hysteresis maximum store temperature** (**HYSP(2)** in **BEL(2)**), the heat dump function is will be available again.

Note
In system 1, the adjustable value **OTCL** is blocked against the collector emergency temperature by 10 K. This function will only be available if the collector cooling function, the heat dump function, and the drainback option are deactivated.

(9) Solid fuel boiler

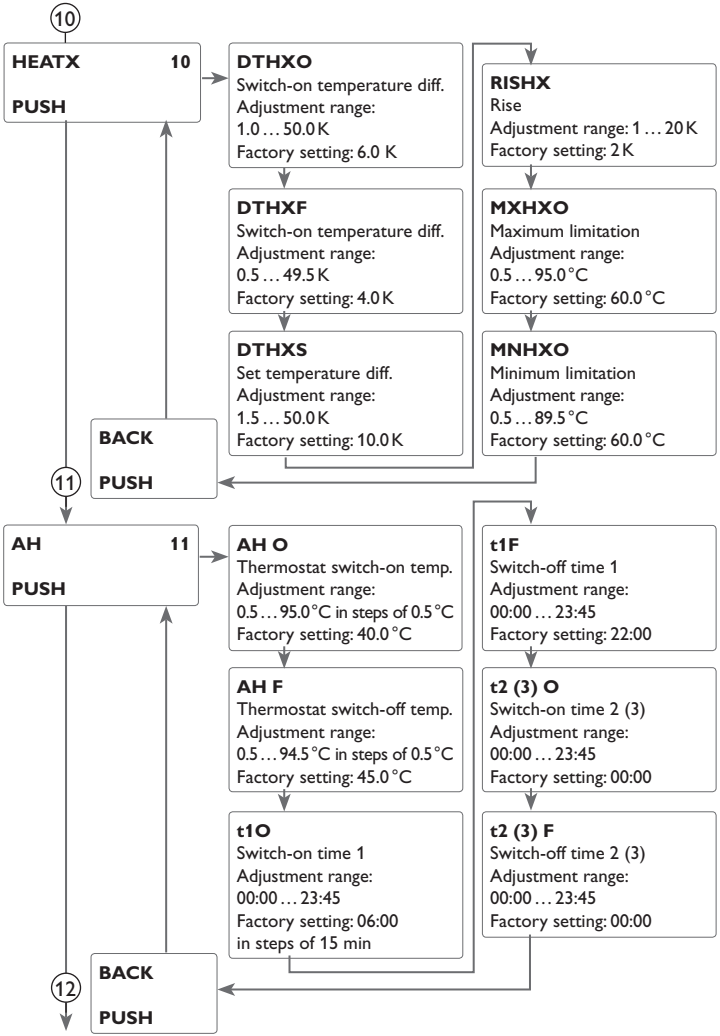
The solid fuel boiler function can be used for transferring heat from a solid fuel boiler to a store.

The relay (system-dependent) is energised when all switch-on conditions are fulfilled:

- the temperature difference between the sensors heat source and heat sink has exceeded the switch-on temperature difference.
- the temperature at the solid fuel boiler sensor has exceeded the minimum temperature
- the temperature at the store sensor has fallen below the maximum temperature

When the Set temperature difference is exceeded, pump speed control starts. For every increase or decrease by the rise value, the pump speed will be adjusted by 10 %.

The switch-on hysteresis is -5 K.



(10) Heat exchange function

The heat exchange function can be used for transferring heat from a heat source to a heat sink.

The relay (system-dependent) is energised when all switch-on conditions are fulfilled:

- the temperature difference between the sensors heat source and heat sink has exceeded the switch-on temperature difference.
- the temperature at the heat source sensor has exceeded the minimum temperature
- the temperature at the heat sink sensor has fallen below the maximum temperature

When the Set temperature difference is exceeded, pump speed control starts. For every increase or decrease by the rise value, the pump speed will be adjusted by 10 %.

(11) Afterheating / Thermostat function

The thermostat function works independently from the solar operation and can e. g. be used for using surplus energy or for afterheating.

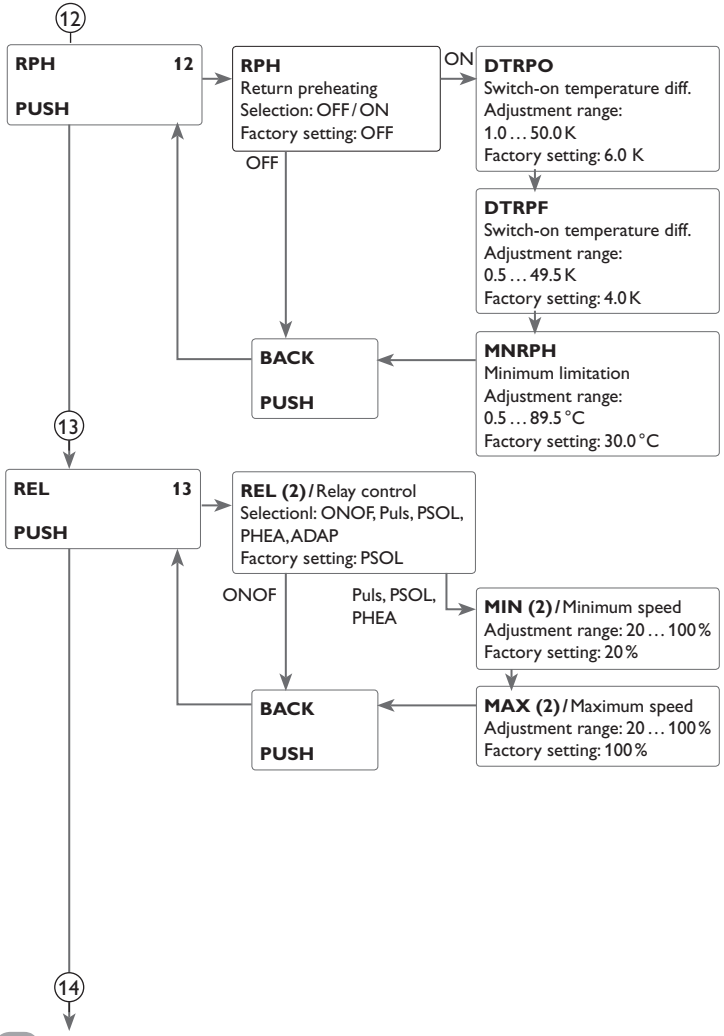
- **AH O** < **AH F** thermostat function for afterheating
- **AH O** > **AH F** thermostat function for using surplus energy

In order to block the thermostat function for a certain period, there are 3 time frames t1 … t3. The switch-on and switch-off times can be adjusted in steps of 15 min. If the switch-on and the switch-off times are identical, the time frame is inactive.

If the thermostat function is supposed to run from 06:00 a.m. and 09:00 a.m. only, adjust t1 O to 06:00 a.m. and t1 F to 09:00 a.m.

The first time frame is factory set from 06:00 to 22:00.

If all time frames are set to 00:00, the thermostat function is solely temperature dependent.



(12) Return preheating

The return preheating function can be used for transferring heat from a heat source to the heating circuit return.

The relay (system-dependent) is energised when both switch-on conditions are fulfilled:

- the temperature difference between the sensors store return and heating circuit return has exceeded the switch-on temperature difference.
- the temperature at the heating circuit return has exceeded the minimum temperature.

The switch-on hysteresis is -5 K.

(13) Relay control

With this parameter, the relay control type can be adjusted. The following types can be selected:

Adjustment for standard pump without speed control

- ONOF : Pump on / pump off

Adjustment for standard pump with speed control

- PULS : Burst control via semiconductor relay

Adjustment for high-efficiency pump (HE pump)

- PSOL : PWM profile solar pump
- PHEA : PWM profile heating pump

Note
For more information about connecting HE pumps, see page 18.

Minimum speed

In the adjustment channel **MIN (2)** a relative minimum speed for connected pumps can be allocated to the outputs R1 and R2.

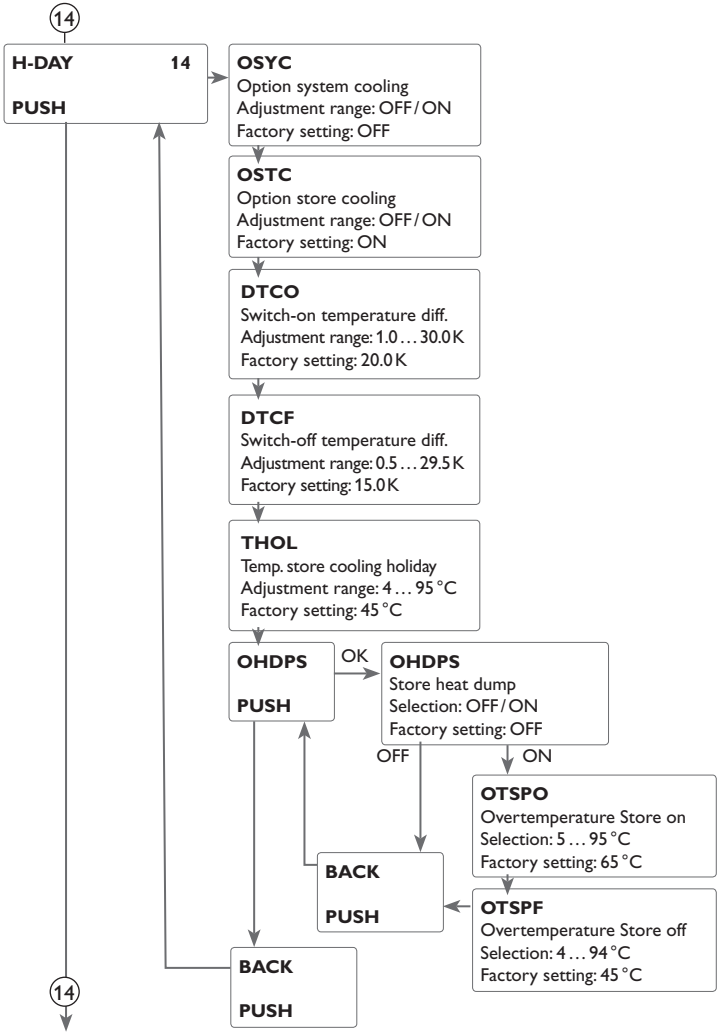
Note
When loads which are not speed-controlled (e. g. valves) are used, the pump speed value of the corresponding relay must be set to 100 % or the control type must be set to ONOF in order to deactivate pump speed control.

Maximum speed

In the adjustment channel **MAX (2)** a relative maximum speed for connected pumps can be allocated to the outputs R1 and R2.

Note
When loads which are not speed-controlled (e. g. valves) are used, the pump speed value of the corresponding relay must be set to 100 % or the control type must be set to ONOF in order to deactivate pump speed control.

Relay allocation for PWM outputs:
PWM A - Relay 1
PWM B - Relay 2



(14) Holiday function

The holiday function is used for operating the system when no water consumption is expected, e. g. during a holiday absence. This function cools down the system in order to reduce the thermal load.

Only if the holiday function has been activated with the parameter **DAYS** will the adjustments described in the following become active.

3 cooling functions are available: system cooling, store cooling and store heat dump.

The system cooling function aims to keep the solar system operational for a longer time. The function overrides the maximum store temperature to provide thermal relief of the collector field and the heat transfer fluid on hot days.

The system cooling option can be activated with the parameter **OSYC**. The function uses the adjustable switch-on and switch-off temperature differences **DTO** and **DTF** from the **LOAD1(2)** menu.

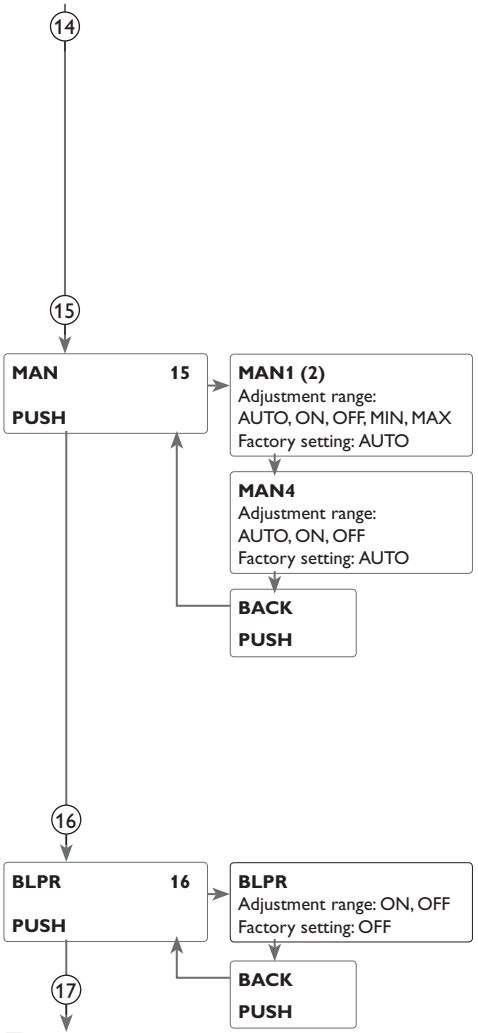
The store cooling option is activated by default and can be deactivated with the parameter **OSTC**. Store cooling starts when the store temperature exceeds the collector temperature by the adjustable value **DTCO**. It switches off if the store temperature reaches **THOL** or if the temperature difference falls below **DTCF**. The parameter **THOL** is used for adjusting the temperature for store cooling.

The store heat dump function can be used to direct excess heat generated by strong solar irradiation from the store to an external heat exchanger (e. g. fan coil) or radiator in order to prevent the collectors from overheating. The store heat dump function is independent of the solar system and can be activated with the parameter **OHDPS**. The function uses the adjustable switch-on and switch-off temperature differences **DTO** and **DTF**. If temperature measured at sensor 3 reaches the switch-on temperature, relay 2 will be energised until the temperature falls below the switch-off value.

The parameter **DAYS** can be used for entering the number of days for a holiday absence. If the parameter is set to a value higher than 0, the function becomes active using the adjustments that have previously been made in the **H-DAY** menu. The days will be counted backwards at 00:00. If the value is set to 0, the function is deactivated.

Note
The **OHDPS** option is available in system 1 only.

Note
The parameter **DAYS** can be accessed via the microbutton only (see page 18).



Note
The adjustments described in this chapter are independent of those in the **COOL** menu, which are inactive during a holiday.

Note
When the drainback option is activated, the holiday function will not be available and cannot be selected by means of the microbutton.

Note
If the holiday function is activated, the drainback option will not be available.

(15) Manual mode

For control and service work, the operating mode of the relays can be manually adjusted. For this purpose, select the adjustment channel MAN1(2, 4) (for R1, 2, 4) in which the following adjustments can be made:

Operating mode

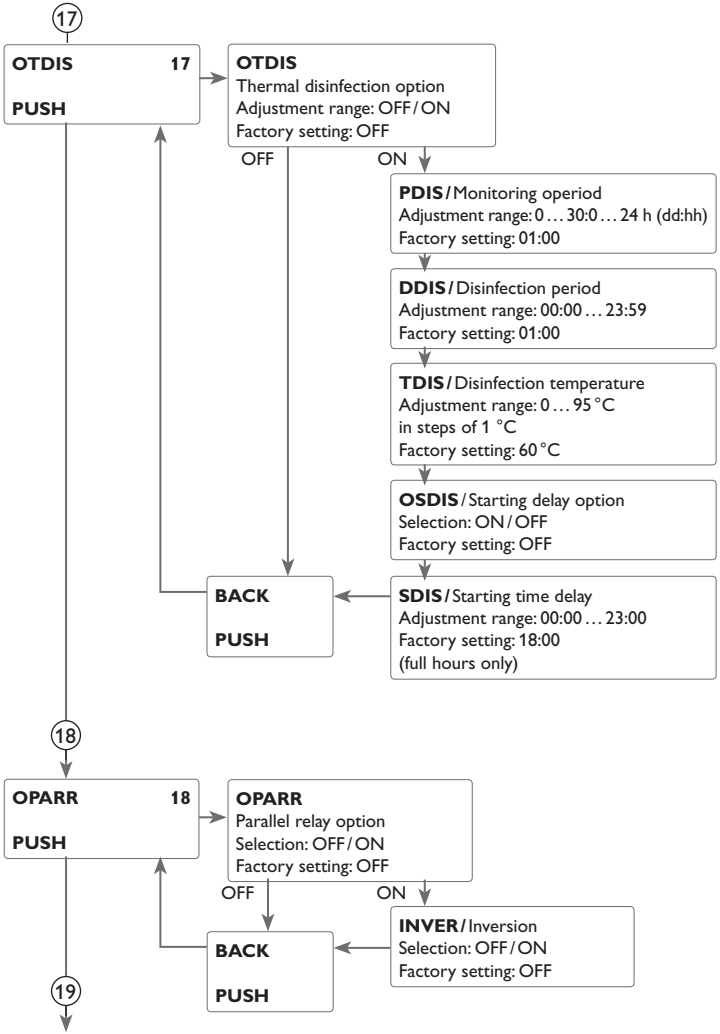
AUTO : relay in automatic mode
OFF : relay is switched off
MIN : relay is switched with adjusted minimum speed (not if REL = ONOF)
MAX : relay is switched with adjusted maximum speed (not if REL = ONOF)

Note
After service and maintenance work, set the relay mode back to AUTO. Normal operation is not possible in manual mode.

Note
For information about the control LED in the Lightwheel® see page 19.

(16) Blocking protection

In order to protect the pumps against blocking after standstill, the controller is equipped with a blocking protection function. This function switches on the relays one after another every day at 12:00 a.m. for 10 s at 100 %.



(17) Thermal disinfection

This function helps to contain the spread of Legionella in DHW stores by systematically activating the afterheating.

R2 is the reference relay, S3 is the reference sensor.

For thermal disinfection, the temperature at the reference sensor has to be monitored. This protection is ensured when, during the monitoring period, the disinfection temperature is continuously exceeded for the entire disinfection period.

The monitoring period starts as soon as the temperature at the reference sensor falls below the disinfection temperature. When the monitoring period ends, R2 and R4 activate the circulating pump and the afterheating. The disinfection period starts, if the temperature at the reference sensor exceeds the disinfection temperature.

Thermal disinfection can only be completed when the disinfection temperature is exceeded for the duration of the disinfection period without any interruption.

Starting time delay

If the starting delay option is activated, a starting time for the thermal disinfection with starting delay can be adjusted. The activation of the afterheating is then delayed until that starting time after the monitoring period has ended.

If the monitoring period ends, for example, at 12:00 o'clock, and the starting time has been set to 18:00, the reference relay will be energised with a delay of 6 hours at 18:00 instead of 12:00 o'clock.

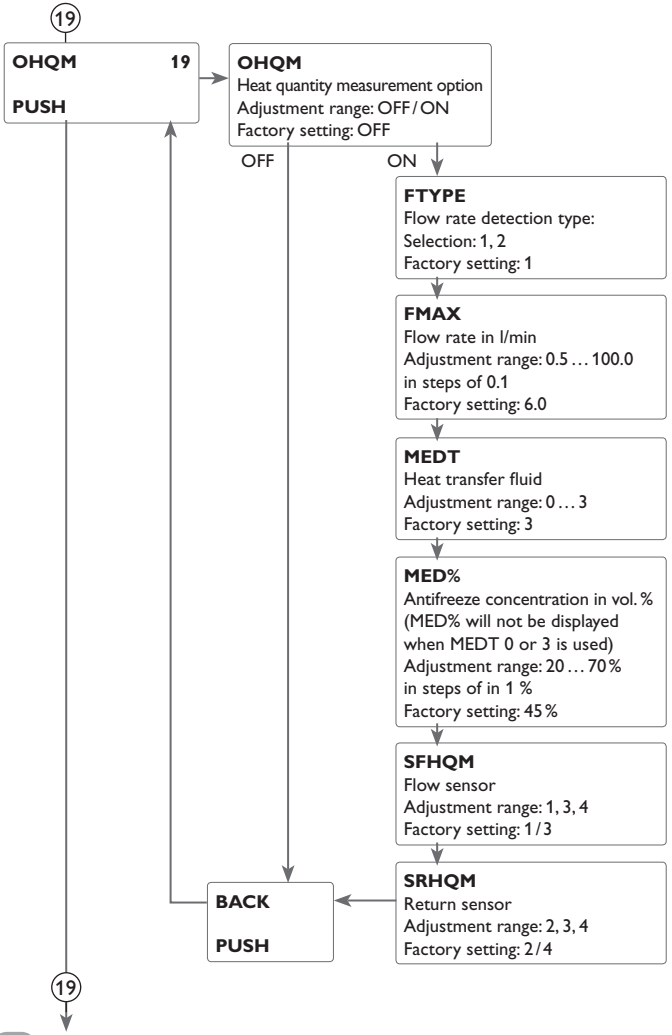
Note
If the thermal disinfection option is activated, the display channels **TDIS**, **CDIS**, **SDIS** and **DDIS** will be displayed.

(18) Parallel relay

With this function, e. g. a valve can be controlled in parallel to the pump via a separate relay.

If solar loading takes place or if a solar function is active, the relay selected will be energised. The parallel relay can also be energised inversely.

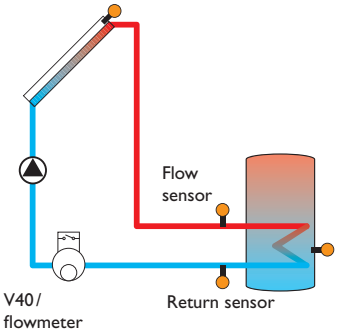
Note
If R1 is in the manual mode, the selected parallel relay will not be energised.



(19) Heat quantity measurement

The heat quantity measurement can be carried out in 2 different ways: without V40 flowmeter or with V40 flowmeter

Note
The most precise heat quantity measurement is achieved by using sensors in the flow and return pipes as well as a flowmeter.
In 2-collector systems, heat quantity measurement can only be carried out with sensors installed in the common flow and return pipes.



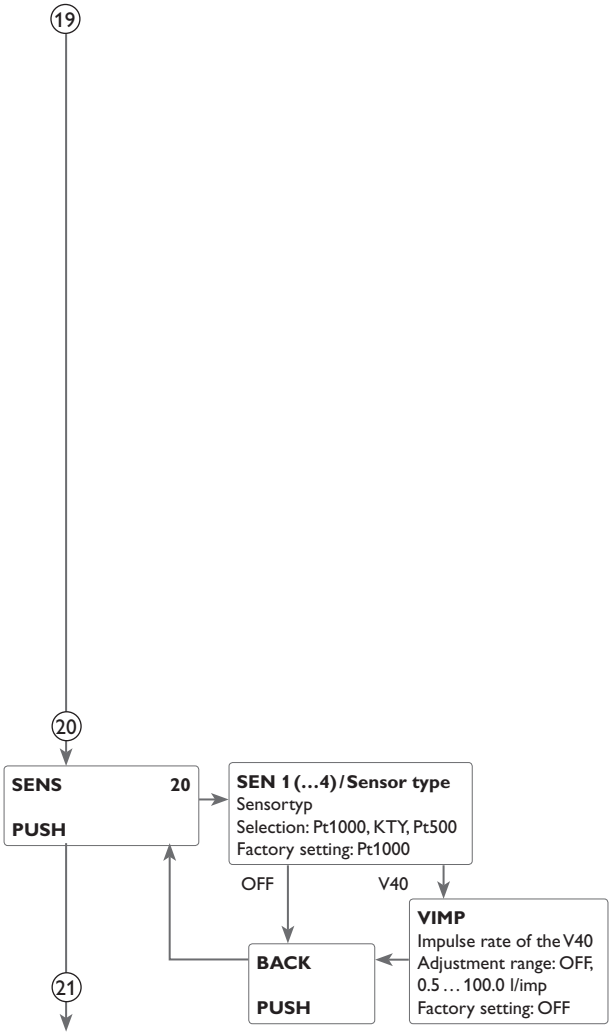
Example of flow and return sensor positions for heat quantity measurement.

➔ Enable the heat quantity measurement option in the channel **OHQM**.
➔ Select the type of flow rate detection in the channel **FTYPE**.

Flow rate detection type:
1 : Fixed flow rate value (flowmeter)
2 : V40

Note
If the flow rate detection type V40 has been adjusted,the impulse rate of the sensor must be adjusted in the **SENS** menu (see page 47).

Note
If a V40 is used as the flow rate sensor (flow rate detection type 2) and is then deactivated in the **SENS** menu, the flow rate detection type will be set to 1 (flowmeter) and heat quantity measurement will be deactivated.



(19) Heat quantity measurement with fixed flow rate value

The heat quantity measurement calculation (estimation) uses the difference between the flow and return temperatures and the entered flow rate (at 100 % pump speed).

➔ **Adjust 1** in the channel **FTYPE**.

➔ Read the flow rate (l/min) and adjust it in the **FMAX** channel.

➔ Adjust the antifreeze type and concentration of the heat transfer fluid in the channels **MEDT** and **MED%**.

Note
Heat quantity measurement is not possible in systems with 2 solar pumps.

Antifreeze type:
0 : Water
1 : Propylene glycol
2 : Ethylene glycol
3 : Tyfocor® LS / G-LS

Heat quantity measurement with V40 flowmeter:

The heat quantity measurement uses the difference between the flow and return temperatures and the flow rate transmitted by the flowmeter.

➔ **Adjust 2** in the channel **FTYPE**.

➔ Adjust the antifreeze type and concentration of the heat transfer fluid in the channels **MEDT** and **MED%**.

HQM sensors

The flow sensor as well as the return sensor can be selected for heat quatity measurement.

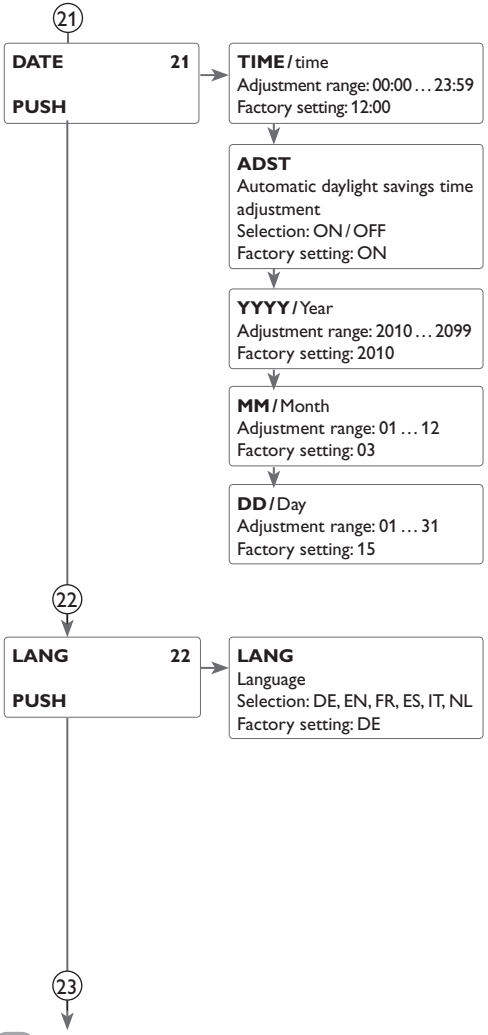
➔ In the channel **SFHQM** select the flow sensor.

➔ In the channel **SRHQM** select the return sensor.

(20) Temperature sensors

The sensor type can be selected for the sensor inputs S1 to S4.

The impulse rate can be adjusted for the sensor input V40.



(21) Time and date

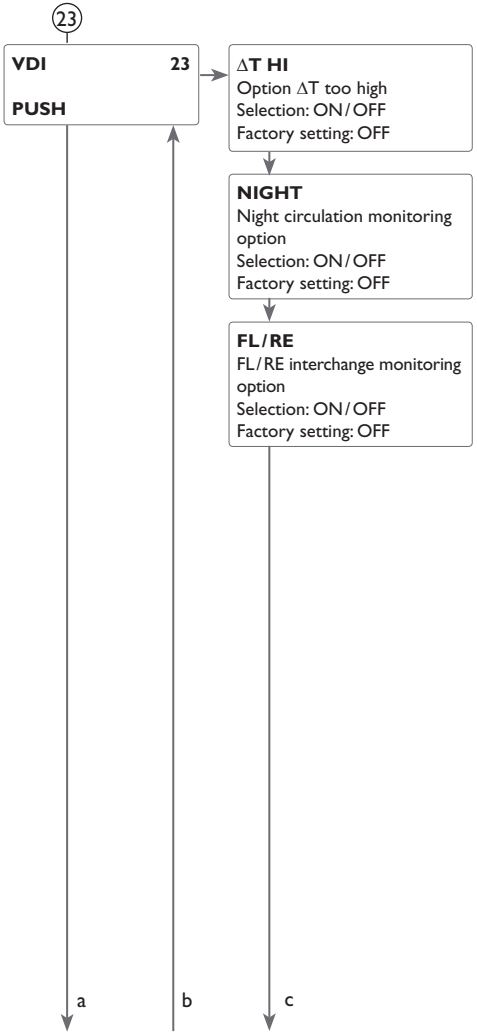
The controller is equipped with a real time clock required e.g. for the thermostat function.

In the display, the lower line indicates the day followed by the month.

(22) Language

In this adjustment channel the menu language can be chosen.

- DE : German
- EN : English
- FR : French
- ES : Spanish
- IT : Italian
- NL : Dutch



(23) Function control

ΔT monitoring

This function is used for monitoring the temperature difference. The message ΔT too high is shown, if solar loading has been carried out for a period of 20 min with a differential higher than 50 K. Normal operation is not aborted or inhibited, but the system should be checked for the cause of the warning.

Possible causes are:

- pump power too weak
- blocked system components
- circulation problems in the collector
- air inside the pipework
- defective valve/ defective pump

Night circulation

This function can be used for detecting thermal circulation inside the solar circuit that leads to an unwanted cooling of the store. A warning message will appear when the following condition has been detected for at least 1 min during the period between 11 p.m. and 5 a.m.:

- collector temperature exceeds 40 °C

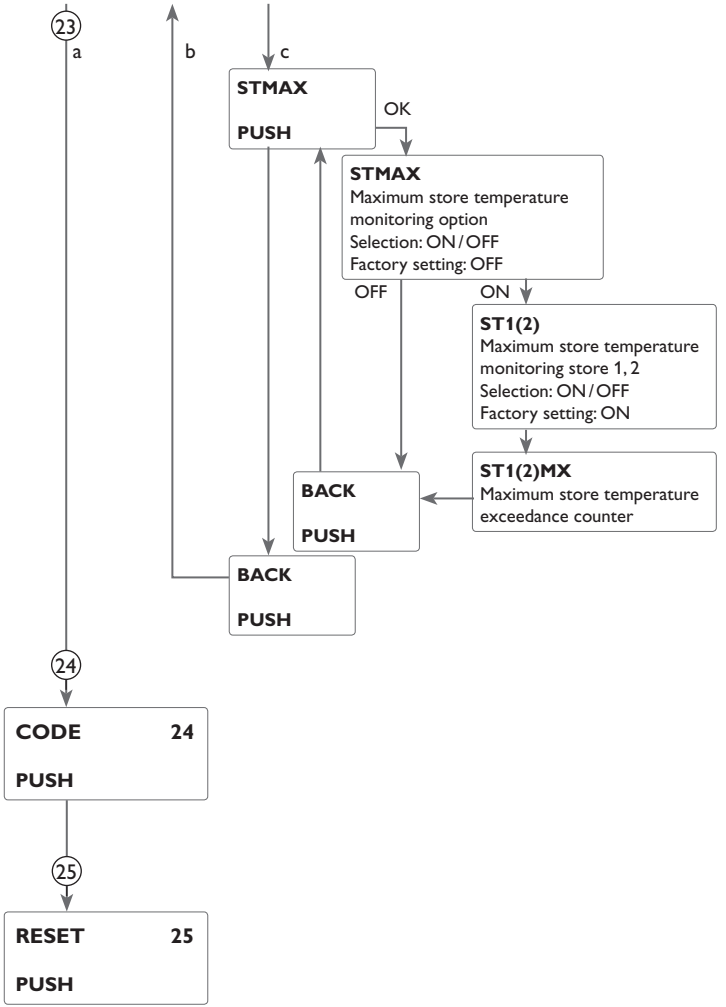
The delay time of 1 min ensures that the message is not triggered by short-term fault conditions.

Possible causes are:

- defective non-return valves
- defective valve
- wrongly adjusted time

Flow and return interchanged

This function is used for detecting an interchange of the flow and return pipe or a badly placed collector sensor. For this purpose, the collector temperature is monitored for plausibility during the switch-on phases of the solar pump. An error message will appear, if the plausibility criteria have not been met 5 times in a row.



Maximum store temperature

This function is used for detecting and indicating if the adjusted maximum store temperature has been exceeded. The controller compares the current store temperature to the adjusted maximum store temperature, thus monitoring the store loading circuits.

The maximum store temperature is considered exceeded when the temperature measured at the store sensor exceeds the adjusted maximum store temperature by at least 5 K. The monitoring becomes active again as soon as the store temperature falls below the adjusted maximum store temperature.

The channels **ST1**, **ST2** can be used for selecting the stores to be monitored. The number of exceedances is displayed in the **ST(2)MX** channels. A possible cause for an unwanted exceedance of the maximum store temperature is a defective valve.

Note
Only if the installer code is entered (see page 51), will the option be availabe.

(24) CODE

The user code can be entered in the **CODE** menu (see page 51).

(25) Reset

By means of the reset function, all adjustments can be set back to the factory settings. To do so, the installer code must be entered (see page 51).

9 User code and short menu – Adjustment values

CODE

The access to some adjustment values can be restricted via a user code (customer).

1. Installer **0262** (Factory setting)

All menus and adjustment values are shown and all values can be altered.

2. Customer **0000**

The installer level is not shown, adjustment values can be changed partly.

For safety reasons, the user code should generally be set to the customer code before the controller is handed to the customer!

➔ In order to restrict the access, enter 0000 in the menu item **CODE**.

The display changes to the status level. The short menu shown will then be available in the adjustment level. The short menu suits the selected system.

➔ In order to authorise access to the installer level, enter 0262 in the menu item **CODE**.

Short menu

Channel	Factory setting	Adjustment range	Designation
TIME	12:00	00:00 … 23:59	Time
DT O	6.0 K	1.0 … 50.0 K	Switch-on temperature difference store
DT F	4.0 K	0.5 … 49.5 K	Switch-off temperature difference store
S SET	45 °C	5.0 … 95.0 °C	Store set temperature
S MAX	60 °C	4 … 95 °C	Store maximum limitation
LST	ON	ON / OFF	Loading store on
DT2O	6.0 K	1.0 … 50.0 K	Switch-on temperature difference store 2
DT2F	4.0 K	0.5 … 49.5 K	Switch-off temperature difference store 2
S2SET	45 °C	5.0 … 95.0 °C	Set store temperature store 2
S2MAX	60 °C	4 … 95 K	Store maximum limitation store 2
LST2	ON	ON / OFF	Loading store 2 on
CODE	0000	0000 / 0262	User code

10 Messages

In the case of an error, the control LED starts flashing red and a message is indicated in the status display. A warning triangle is additionally indicated. If more than one error or fault condition has occurred, only the one with the highest priority will be displayed as a message in the status display.

In the case of a sensor error, the system switches off, and a message appears on the display. Additionally, a corresponding value for the error type assumed is indicated.

Error code display	Plain text display	Monitoring function	Cause
0001	!LINE BREAK SENSOR X!	Sensor line break	Sensor line broken
0002	!SHORT CIRCUIT SENSOR X!	Sensor short circuit	Sensor line short-circuited
0011	!ΔT TOO HIGH!	ΔT too high	Collector 50 K > than store to be loaded
0021	!NIGHT CIRCULATION!	Night circulation	Betw. 11 p.m. and 5 a.m. col. temp. > 40 °C
0031	!FL/RE INTERCHANGED!	FL/RL interchanged	Col. temp. does not rise after switching on
0061	!DATA MEMORY DEFECTIVE!	Storing and changing adjustments not possible	
0081	STORE MAX EXCEEDED	Maximum store temperature	St. max has been exceeded

After the error has been removed and acknowledged, the error message disappears.

➔ In order to acknowledge an error message, select the message and press the left button (⮌) for 2 s.

Note

The function control „flow and return interchanged“ according to the VDI guidelines 2169 can only correctly detect and indicate the error „0031 !FL/RE INTERCHANGED!“ if the collector sensor measures the temperature directly in the fluid at the collector outlet. If the collector sensor is not correctly placed, a false message may occur.

➔ Place the collector sensor directly in the fluid at the collector outlet or deactivate the “flow and return interchanged” function control.

11 Troubleshooting

Control LED in the Lightwheel® is flashing red. The symbol is indicated on the display and the symbol ⚠ is flashing.

Sensor fault. An error code instead of a temperature is shown on the corresponding sensor display channel.

- *888.8* → Cable is broken. Check the cable.
- *- 88.8* → Short circuit. Check the cable.

Disconnected temperature sensors can be checked with an ohmmeter. Please check if the resistance values correspond with the table.

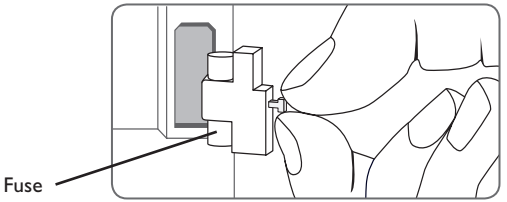
°C	°F	Ω Pt500	Ω Pt1000	Ω KTY	°C	°F	Ω Pt500	Ω Pt1000	Ω KTY
-10	14	481	961	1499	55	131	607	1213	2502
-5	23	490	980	1565	60	140	616	1232	2592
0	32	500	1000	1633	65	149	626	1252	2684
5	41	510	1019	1702	70	158	636	1271	2778
10	50	520	1039	1774	75	167	645	1290	2874
15	59	529	1058	1847	80	176	655	1309	2971
20	68	539	1078	1922	85	185	664	1328	3071
25	77	549	1097	2000	90	194	634	1347	3172
30	86	559	1117	2079	95	203	683	1366	3275
35	95	568	1136	2159	100	212	693	1385	3380
40	104	578	1155	2242	105	221	702	1404	3484
45	113	588	1175	2327	110	230	712	1423	3590
50	122	597	1194	2413	115	239	721	1442	3695

If a malfunction occurs, a message will appear on the display of the controller.

Lightwheel® or display are permanently off

Press the right button ✓. Display illuminated?

- yes → Controller has been in standby, everything o.k.
- no → Check the power supply of the controller. Is it disconnected?
  - yes → Check the supply line and reconnect it.
  - no → The fuse of the controller could be blown. The fuse holder (which holds the spare fuse) becomes accessible when the cover is removed. The fuse can then be replaced.



Pump is overheated, but no heat transfer from the collector to the store, flow and return have the same temperature; perhaps also bubbling in the lines.

- Air or gas bubbles in the system?
  - no → Is the collector circuit blocked at the dirt trap?
    - yes → Clean dirt trap
    - no
  - yes → Vent the system; increase the system pressure to a static primary pressure of at least plus 0.5 bar; if necessary continue to increase pressure; switch the pump on and off for a short time.

Pump starts up very late.

- Switch-on temperature difference ΔTon too large?
  - yes → Change ΔTon and ΔToff correspondingly.
  - no → Non-ideal position of the collector sensor (e. g. flatscrew sensor instead of sensor in immersion sleeves).
    - yes → Activate tube collector function if necessary.
      - o.k.

Pump starts for a short moment, switches off, switches on again, etc.

- Temperature difference at the controller too small?
  - yes → Change ΔTon and ΔToff correspondingly.
    - no → o.k.
  - no → Wrong position of collector sensors?
    - yes → Mount the collector sensor at solar flow (warmest collector output); use immersion sleeve of the respective collector.
    - no → Plausibility control of the option tube collector function

The temperature difference between store and collector increases enormously during operation; the collector circuit cannot dissipate the heat.

- Collector circuit pump defective?
  - yes → Check / replace it
  - no → Heat exchanger calcified?
    - yes → Decalcify it
    - no → Heat exchanger blocked?
      - yes → Clean it
      - no → Heat exchanger too small?
        - yes → Replace with correctly sized one.

Note
For answers to frequently asked questions (FAQ) see www.resol.com.

The solar circuit pump does not work, although the collector is considerably warmer than the store.

LED in Lightwheel® illuminated? If not, press the right button. Display illuminated again?
- yes
- no → There is no current; check fuses / replace them and check power supply.

Does the pump start up in manual operation?
- no
- yes → The adjusted temperature difference for starting the pump is too high; choose a value which makes more sense.

Is the pump current enabled by the controller?
- no → Controller might be defective - replace it.
- yes → Is the pump stuck?
  - yes → Turn the pump shaft using a screwdriver; now passable?
    - no → Pump is defective - replace it.

Stores cool down at night.

Collector circuit pump runs during the night?
- no
- yes → Check controller

Collector temperature at night is higher than the outdoor temperature.
- no
- yes → Check the non-return valves in the flow and the return pipe for functional efficiency.

Sufficient store insulation?
- yes → a
- no → Increase insulation.

a

Insulation close enough to the store?
- yes
- no → Replace insulation or increase it.

Are the store connections insulated?
- yes
- no → Insulate the connections.

Warm water outflow upwards?
- no
- yes → Change connection and let the water flow sidewards or through a siphon (downwards); less store losses now?
  - no
  - yes → o.k.

Does the DHW circulation run for a very long time?
- no
- yes → Use the circulation pump with timer and switch-off thermostat energy-efficient circulation).

Circulation pump and blocking valve should be switched off for 1 night; less store losses?
- yes
- no → Check whether the pumps of the after-heating circuit run at night; check whether the non-return valve is defective; problem solved?
  - no → Further pumps which are connected to the solar store must also be checked.

Check the non-return valve in warm water circulation - o.k.
- yes
- no → Clean or replace it.

The gravitation circulation in the circulation line is too strong; insert a stronger valve in the non-return valve or an electrical 2-port valve behind the circulation pump; the 2-port valve is open when the pump is activated, otherwise it is closed; connect pump and 2-port valve electrically in parallel; activate the circulation again. Deactivate pump speed control!

Temperature sensors

Overvoltage protection device

V40 flowmeter

VBus® / USB & VBus® / LAN interface adapters

SD3 Smart Display / GA3 Large Display

AM1 Alarm Module

DL2 Datalogger

DL3 Datalogger

12.1 Sensors and measuring instruments

Temperature sensors

The product range includes high-precision platinum temperature sensors, flatscrew sensors, outdoor temperature sensors, indoor temperature sensors, cylindrical clip-on sensors, also as complete sensors with immersion sleeve.

Overvoltage protection device

In order to avoid overvoltage damage at collector sensors (e. g. caused by local lightning storms), we recommend installing the overvoltage protection RESOL SP10.

V40 flowmeter

The RESOL V40 is a measuring instrument for detecting the flow of water or water/glycol mixtures. After a specific volume has passed, the V40 reed switch sends an impulse to the calorimeter. The heat quantity used is calculated by the calorimeter using these impulses and the measured temperature difference with the help of pre-defined parameters (glycol type, concentration, heat capacity, etc.).

12.2 VBus® accessories

SD3 Smart Display / GA3 Large Display

The RESOL Smart Display is designed for simple connection to RESOL controllers with RESOL VBus®. It is used for visualising data issued by the controller: collector temperature, store temperature and energy yield of the solar thermal system. The use of high-efficiency LEDs and filter glass assures a high optical brilliance and good readability even in poor visibility conditions and from a larger distance. An additional power supply is not required. One module is required per controller.

The RESOL GA3 is a completely mounted large display module for visualisation of collector- and store temperatures as well as the heat quantity yield of the solar system via one 6-digit and two 4-digit 7-segment displays. An easy connection to all controllers with RESOL VBus® is possible. The front plate is made of antireflective filterglass and is printed with a light-resistant UV-lacquering. The universal RESOL VBus® allows the parallel connection of 8 large displays as well as additional VBus® modules.

AM1 Alarm Module

The AM1 Alarm Module is designed to signal system failures. It is to be connected to the VBus® of the controller and issues an optical signal via the red LED if a failure has occurred. The AM1 also has a relay output, which can e. g. be connected to a building management system (BMS). Thus, a collective error message can be issued in the case of a system failure.

DL3 Datalogger

Be it solar thermal, heating or DHW heat exchange controllers – with the DL3 you can easily and conveniently log system data of up to 6 RESOL controllers. Get a comprehensive overview of all controllers connected with the large full graphic display. Transfer data with an SD memory card, or use the LAN interface to view and process data on your PC.

DL2 Datalogger

This additional module enables the acquisition and storage of large amounts of data (such as measuring and balance values of the solar system) over a long period of time. The DL2 can be configured and read-out with a standard Internet browser via its integrated web interface. For transmission of the data stored in the internal memory of the DL2 to a PC, an SD card can be used. The DL2 is appropriate for all controllers with RESOL VBus®. It can be connected directly to a PC or router for remote access and thus enables comfortable system monitoring for yield monitoring or for diagnostics of faults.

VBus.net

The Internet portal for easy and secure access to your system data.
VBus.net is all about the data of your RESOL controller. Live data of your system, customized filter settings and much more await you.

12.3 Interface adapters

VBus® / USB & VBus® / LAN interface adapters

The VBus® / USB interface adapter is the interface between the controller and a personal computer. With its standard mini-USB port it enables a fast transmission of system data for processing, visualising and archiving data via the VBus®. The RESOL ServiceCenter software is included.

The VBus® / LAN interface adapter is designed for the direct connection of the controller to a PC or router. It enables easy access to the controller via the local network of the owner. Thus, controller access and data charting can be effected from every workstation of the network. The VBus® / LAN interface adapter is suitable for all controllers equipped with a RESOL VBus®. The RESOL ServiceCenter software is included.

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Important note

The texts and drawings in this manual are correct to the best of our knowledge. As faults can never be excluded, please note:

Your own calculations and plans, under consideration of the current standards and directions should only be basis for your projects. We do not offer a guarantee for the completeness of the drawings and texts of this manual - they only represent some examples. They can only be used at your own risk. No liability is assumed for incorrect, incomplete or false information and / or the resulting damages.

Note

The design and the specifications can be changed without notice.

The illustrations may differ from the original product.

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