

# Solar Pump Station 0.5-15 or 4-22 l/min

Installation, Commissioning,  
User & Maintenance Instructions

LV311637 | December 2015





## IMPORTANT INFORMATION

These instructions must be read and understood before installing, commissioning, operating or maintaining the equipment.



**Read this manual  
carefully****Warning**

Read this manual carefully before starting the water heater and solar pump. Failure to read the manual and to follow the printed instructions may lead to personal injury and damage to the water heater and/or solar pump station.

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Refer further to the General Conditions. These are available on request, free of charge.

Although considerable care has been taken to ensure a correct and suitably comprehensive description of all relevant components, the manual may nonetheless contain errors and inaccuracies. Should you detect any errors or inaccuracies in the manual, we would be grateful if you would inform us. This helps us to further improve our documentation.

**More information**

If you have any comments or queries concerning specific aspects related to the water heater and/or solar pump station, then please do not hesitate to contact:

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In the event of problems with your electricity or other connections, please contact the supplier/installation engineer of your installation.



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# 1 General

## 1.1 About these instructions

These instructions describe the installation, commissioning and operation of the solar pump station.

Part number	Flow meter	Pump	Integrated controller	Non Return Valve
LV311631	0,5-15 l/min	Grundfos UPM 3 15-145	No (SHM <sup>1</sup> )	Yes
LV311632	4-22 l/min	Grundfos UPM 3 15-145	No (SHM <sup>1</sup> )	Yes
LV311633	0,5-15 l/min	Grundfos UPM 3 15-145	Yes (SLT <sup>2</sup> )	Yes
LV311634	4-22 l/min	Grundfos UPM 3 15-145	Yes (SLT <sup>2</sup> )	Yes

1. The SHM-control is delivered with the EcoCharger Hybrid water heater.
2. The Resol SLT-control is a universal controller that is integrated in the pump station.

This instruction will only describe the pump station. For other components of the solar system, such as collectors, tanks, expansion vessels and controllers, please observe the instructions of the corresponding manufacturer.



**Note:**

Pump stations for non drain back systems have to have a non return valve in the piping.



**Note:**

These pump stations may **not** be used in a drain back systems.



**Attention:**

Please contact your supplier for further information on installation requirements and accessories.

Description	Part number	
Solar fluid	LV308803	40% glycol mixture
Expansion vessel	LV308875	25 litres
	LV308876	35 litres
	LV308877	50 litres
	LV308878	80 litres

## 1.2 About this product

The solar pump station is, a pre-mounted piping group, used to circulate the solar fluid in the solar circuit. It contains important fittings and safety devices for the operation of the solar thermal system:

- A Pump
- B Flow meter to display the flow rate
- C Ball valves to isolate the pump group
- D Non return valve
- E Solar security group
- F Expansion vessel



**Note:**

The solar expansion vessel required for operation is not a part of this station and must be ordered separately.



**Note:**

It is advised to install a valve to isolate the solar expansion vessel. This is not part of the delivery of this pump station.

G Control, there are two types off controls:

1. Solar Control (SHM-Control):

This control is part of the EcoCharger Hybrid water heater (labelled as SHM x.x) and is only used on the pump stations without integrated control - *This is not visible on the drawing.*

2. Resol SLT-Control:

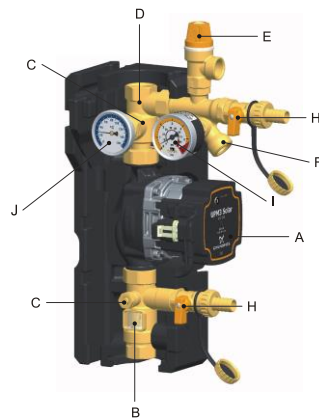
This control is part of the pump station.

H Fill and drain valves to flush and fill the solar thermal system

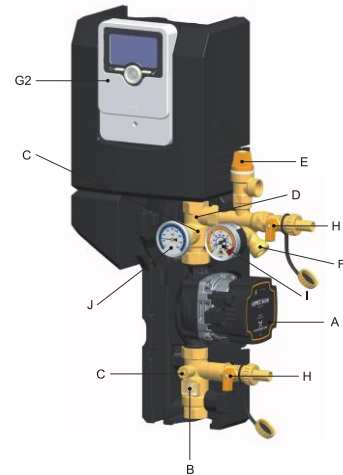
I Manometer to display the installation pressure

J Thermometer to display the installation temperature

*Pump station without integrated control*



*Pump station with integrated control*



**1.3 Designated use**

The pump stations, mentioned in par 1.1, may only be used as solar pump station in the solar circuit of a solar thermal system, taking into consideration the technical limit values indicated in these instructions. Improper usage excludes any liability claims.



## 2 Safety

The installation and commissioning of the pump station as well as the connection of electrical components requires technical knowledge commensurate with a recognized vocational qualification as a fitter for plumbing, heating and air conditioning technology, or a profession requiring a comparable level of knowledge.

The following must be observed during installation and commissioning:

- Relevant local and national prescriptions
- Accident prevention regulations of the professional association
- Instructions and safety instructions mentioned in these instructions



**Attention: Risk of burns and scalding!**

The valves and fittings can heat to temperatures of more than 130 °C due to the solar fluid. Therefore, do not clean or fill the installation with the collector's heated (intense sunshine).

Observe that hot solar fluid can leak from the safety valves in case of too high system pressure!

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**Attention: Material damage due to high temperatures!**

Install the valves and fitting group at a sufficient distance to the collector field, since the solar fluid may be very hot near the collector.

It may be necessary to install an intermediate tank in order to protect the expansion vessel.

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**Attention: Material damage due to mineral oils!**

It is imperative to avoid that the EPDM sealing elements of the station get in contact with substances containing mineral oils. Mineral oil products cause lasting damage to the material, whereby its sealant properties are lost.

If necessary, ask the manufacturer whether the solar fluid, fats or installation aids contain mineral oils.

We do not assume liability nor provide warranty for damage to property resulting from sealants damaged in this way.

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# 3 Installation

## 3.1 Piping

To connect the pump station to the piping, the following steps must take place:

1. Remove the insulation from the pump station and mount the pump station onto solid ground. Use the mounting materials that are in the box.
2. Take note of the direction of the flow. The flow needs to run from the lower connection of the coil inside the unit through the solar pump station towards the entrance of the solar collectors.
3. Connect the piping from the solar loop to the inlet and outlet connection of the pump station.
4. When all the piping has been connected, check the complete system for leakage. For instance by pressurizing the system with air for an extended period of time. The maximum allowed pressure on the system during this test is 5 bar.
5. If the system is free of leaks, connect piping to the pressure relief valve to a drain location. This needs to be an open connection to prevent blockage when the pressure relief valve opens for safety reasons.

## 3.2 Expansion vessel

The expansion vessel must be installed (only on systems with drain valve) on the pressure side of the pump. Install the vessel so that the fluid it contains cannot circulate.



**Note:**

The expansion vessel comes pre-charged: damage may result in serious injuries.



**Note:**

Prevent overpressure in the installation. A 6 bar safety valve is part of the high capacity pump station to prevent this. The opening pressure of the safety valve should be equal to or lower than the maximum working pressure shown on the label. The connection between the expansion vessel and the solar collector field must always be open.



**Note:**

The bracket must be able to carry the weight of a full expansion vessel.

1. If the piping is connected and the system is free of leaks, connect the supplied solar expansion vessel to the predetermined connection on the solar pump station.

**Note:**

Due to the high temperatures and the used fluid (glycol mixture) the expansion vessel must be a special solar expansion vessel with a high temperature resistant membrane.

The package includes an expansion vessel with label, a manual and an installation kit.

2. It is advised to place a valve between the security group and the solar expansion vessel to ease the filling procedure or possible exchanging in case of a faulty vessel.
3. Install the expansion vessel:
  - a. Expansion vessel of 25 litre  
Mount the expansion vessel with the water nipple pointing upwards.
  - b. Expansion vessel of 35, 50 and 80 litre  
Mount the expansion vessel with the water nipple pointing side ways or downwards. It is not allowed to mount these expansion vessels with the water nipple upwards.

4. Apply Teflon tape (F) (do not use hemp!) to the connection of the expansion vessel.
5. Screw the expansion vessel to the security group of the installation with additional piping.
6. To fill the system, read the instructions in chapter 4.

### 3.3 Electrical connection



**Note:**

Choose a seal that is suitable for the maximum temperature and the fluid used!

Read these steps to make the required electrical connections correctly. The electrical connections are different for the Resol control and the SHM Control.



**Note:**

In order to receive electrical power connect the mains power by means of a permanent electrical connection. A double-pole isolator with a contact gap of at least 3 mm must be fitted between this permanent connection and the water heater. The power cable must have cores of at least 3 x 1,0 mm<sup>2</sup>.



**Warning:**

Leave the solar pump station electrically isolated until you are ready to commission it.

#### 3.3.1 Resol SLT-control (for indirect systems)

For this instruction, the Resol control already has to be connected as instructed in the manual supplied with the control. See also appendix 9.1.

1. Mount the pump station with integrated Resol control to the wall. Place it as close as possible to the water heater.
2. Supply power to the Resol control by using the connections 12 -  $\frac{L}{N}$ , 19 - N and 20 - L on the Resol control.
3. The pump is already factory fitted to the Resol control. When this is not the case, connect the pump to the Resol control in the following steps:
  - the connections output - L to R1, N to N and  $\frac{L}{N}$  to  $\frac{L}{N}$ .
  - the PWM-signal - PWM A (connection 6 voor PWM+ and  $\frac{L}{N}$  for PWM-)
4. Connect de other components according to the instructions in the supplied manual of the Resol control.

#### 3.3.2 SHM Control (for HWHC- and HWH-systems)

For this instruction, the SHM control already has to be connected as instructed in the manual supplied with the water heater. See also appendix 9.2.

1. Mount the SHM control, supplied with the water heater, to the wall. Place the control close between the pump station and the water heater.
2. Supply power to the SHM control by using the connections 1 -  $\frac{L}{N}$ , 2 - L and 3 - N of the SHM-controls connection strip.
3. Connect the pump output to the SHM-control by using the supplied pump cable. Use connection 10 for  $\frac{L}{N}$  (yellow/green), 11 for L3 (brown) and 12 for N (green). For the PWM-cable use terminal 1, of J18, for PWM- and use terminal 2, of J18, for PWM+.
4. Connect de other components according to the instructions in the supplied manual of the water heater.

# 4 Commissioning

Observe the following safety instructions regarding the commissioning of the station:



**Attention: Risk of burns and scalding!**

The valves and fittings can heat to temperatures of more than 100°C due to the solar fluid. Therefore, do not clean or fill the installation with the collector's heated (intense sunshine).

Observe that hot solar fluid can leak from the safety valves in case of too high system pressure!



**Attention: Risk of frost!**

It often happens that the solar system cannot be completely drained after flushing. Thus, there is a risk of frost damage when flushing with water. Therefore, do only use the solar fluid used later to flush and fill the solar system.

Use a water and propylene glycol mixture with max. 50% propylene glycol as solar fluid.



**Note regarding the commissioning sequence**

When putting the system into operation, first fill the heating circuit and then the solar circuit. This guarantees that eventually absorbed heat can also be dissipated.

## 4.1 Filling the solar system

The fill and drain valves required to flush and fill are integrated in the station. Make sure not to wash dirt particles that may be present in the solar system into the expansion vessel. Isolate the solar expansion vessel from the solar circuit during flushing and filling with the valve between the solar expansion vessel and the security group and only use flush and fill stations with fine filters.



**Note:**

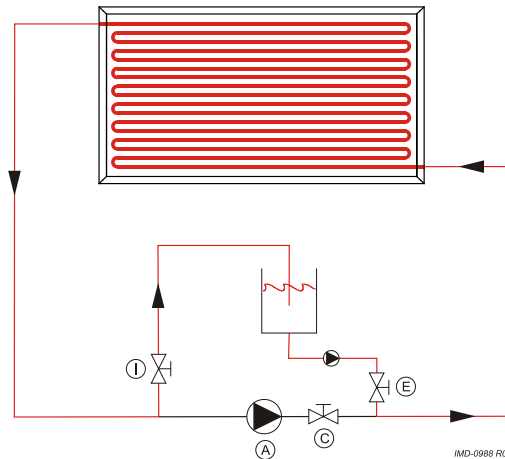
The system must be clean and free of air and contaminants to ensure the perfect functioning of the system.

1. Disconnect the power supply. The pump may not run during filling.
2. All the connections on the roof (collectors) must stay closed.
3. Isolate the expansion vessel (F) by closing the valve.
4. Close the valve (C) on the bottom side of the pump.
5. Open the lower filling point (H) and connect this opening to an open and clean container, suited for high temperatures and glycol mixture.
6. Connect the filling pump to the filling point (H) present on the security group (E).
7. Open the valve on the security group (E) and add glycol from the container through this point. Add glycol to the container when the fluid level becomes too low to continue the filling procedure.



**Note:**

Prevent air from entering the system through the filling point.



8. Keep adding glycol through this opening until there are no more air bulbs visible coming out of the lower filling point (H) for over 5 minutes.
9. The system is now filled with glycol. Stop adding glycol and shut down the filling pump. Open the valve (C) on the bottom side of the solar pump and close the lower filling point(H).
10. Check on the roof if the fluid level inside the collectors is okay. Do this by opening the air elimination valve on the highest point of the collector field. The system is filled correct when the fluid is just running out, over the edge of this connection.
11. If there is no fluid coming out of this connection, fill the remaining portion of the system with the filling pump through the filling point (H) as described in steps 7 to 9.
12. When the fluid is running out of the air elimination valve of the collector, the system is completely filled and the air elimination valve can be closed.
13. Bleeding of the solar pump will happen automatically once the solar fluid is pumped through the system.
14. Open the valve at the pre-charged expansion vessel. For instructions about pre-charging the expansion vessel, see 4.2.4.
15. Finally, add some more fluid through the filling point (H) to reach the predetermined pressure which is measured at the pressure gauge (I). For non drain back systems, this pressure depends on the static height of the system. See appendix 9.4.
16. Close the filling point (H).
17. Provide power to the pump by powering up the Resol control or the SHM control.
18. Let the system run for several minutes (override this with the control) and check if air bulbs can be heard in the piping. If so, redo steps 10 to 17. If not, the filling of the system is finished.
19. Disconnect the filling pump and check the fittings and seals on leaks. The system is now ready to use.

## 4.2 Setting the solar system

### 4.2.1 Flow setting

After putting the solar system in operation, the flow rate needs to be adjusted to the desired speed. The flow rate can be adjusted at the flow meter (B), with the pump running. Make sure the pump runs at 100% when adjusting the flow.

1. Determine the reference flow rate at which the flow meter should be set. The flow must be based on the number of collectors, the flow must be reduced to the predetermined rate, as stated in the table in appendix 9.3

**Note**

On the Grundfos UPM3 15-145 pump, it is possible to adjust the PWM Solar Curve (c1 till c4 (max)), see Grundfos instruction manual, how this must be adjusted. Contact Lochinvar for more information about when this should be done.

2. Place, with all valves in the open position, a screwdriver on the notch of the ball valve (C) to adjust the flow. The flow is indicated by a metal float within a transparent conductor, marked by a l/min scale.
3. The top of the float indicates the rate of the flow

**Scale:** 0,5-15 l/min

**Example:** app. 4 l/min



#### 4.2.2 Settings Resol Control

To make the pump station function in combination with the Resol control some settings need to be made. Based on the wishes of the end user, several settings can be made. These settings and the available ranges can be found in the instruction manual of the Resol control, supplied with the part.

#### 4.2.3 Settings SHM Control

To make the pump station function in combination with the SHM control and the water heater some settings need to be made. Based on the wishes of the end user, several settings can be made. These settings and the available ranges can be found in the instruction manual of the water heater, supplied with the unit.

#### 4.2.4 Expansion vessel

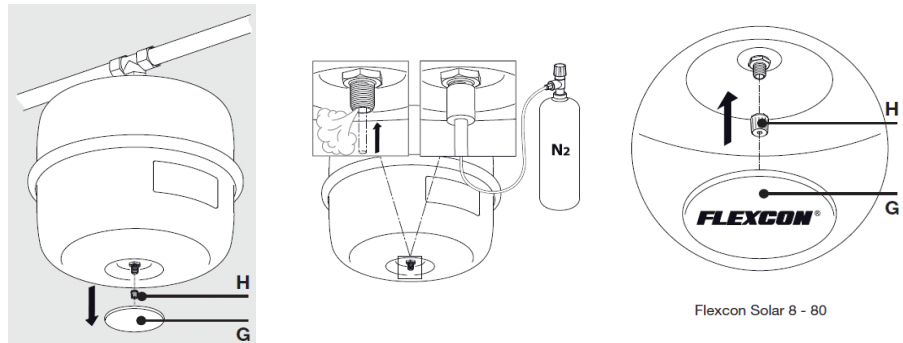
**Note:**

The expansion vessel comes pre-charged: damage may result in serious injuries.

**Note:**

Prevent overpressure in the installation. A 6 bar safety valve is part of the high capacity pump station to prevent this. The opening pressure of the safety valve should be equal to or lower than the maximum working pressure shown on the label. The connection between the expansion vessel and the solar collector field must always be open.

1. Determine the pre-charge value of the expansion vessel. This value depends on the type of system and is stated in appendix 9.4.
2. Set the pressure of expansion vessel to the predetermined value with the following procedure:
  - a. Remove the protective cap (G) and valve cap (H).
  - b. Measure the pressure.
  - c. If the pressure is too high, allow gas to discharge through the gas valve; if the pressure is too low, fill with expansion gas. Nitrogen must be used as filling gas.
  - d. Replace valve cap (H) and protective cap (G).



3. The expansion vessel is now ready for use.

### 4.3 Draining the solar system

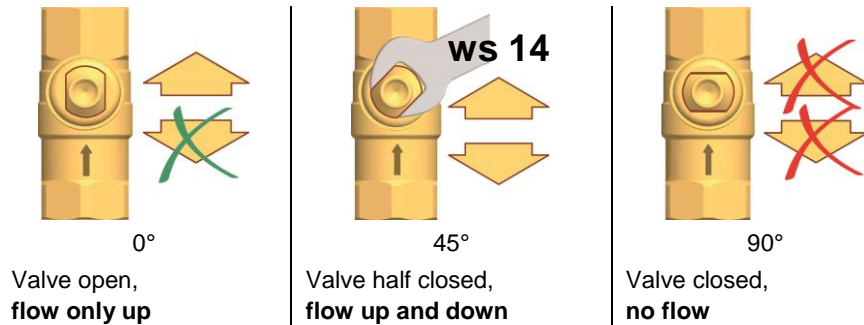
1. Disconnect the power supply. The pump may not run during draining.
2. Connect a heat resistant hose to the drain valve connection.



**Note:**

Make sure that the solar fluid is collected in a heat resistant container.

3. Open the bottom drain valve (H) to remove solar fluid and reduce the pressure of the solar system.
4. Open (in case of a system without drain valve) the top ball valve (C), behind the thermometer, in an 45° angle, in order to lock the non return valve.



5. Open the air eliminator on the highest point of the collector system.



**Note:**

Be prepared that the solar fluid still can be hot.

6. The fluid can now be drained from the system. Dispose the solar fluid observing the local prescriptions.



**Danger: Danger of scalding due to hot solar fluid!**

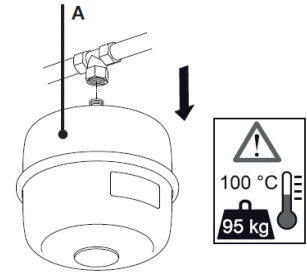
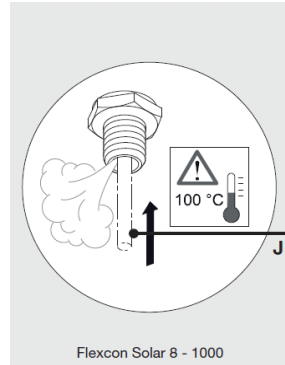
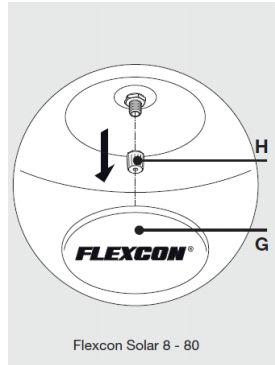
The escaping medium may be very hot. Place the collecting container so that people standing nearby are not endangered when the solar thermal system is being emptied.



### 4.3.1 Dismantling the expansion vessel

The following procedure must be followed to dismantle the expansion vessel.

1. Depressurize the installation
2. Remove the protective cap (G) and valve cap (H)
3. Push the inner valve (J) in to drain the pressure from the expansion vessel
4. Unscrew the expansion vessel
5. When disposing the expansion vessel observe local regulations



**Note:**

A full expansion vessel is heavy.



**Danger: Danger of scalding due to hot solar fluid!**

The escaping medium (both from the inner valve (J) as from the water nipple) may be very hot. Execute the work safely so that people standing nearby are not endangered when the expansion vessel is dismantled.



# 5 Technical data

## Dimensions

Height:	Pump station with int. control	560 mm
	Pump station without int. control	383 mm
Width:	Pump station with int. control	334 mm
	Pump station without int. control	256 mm
Depth:	Pump station with int. control	151 mm
	Pump station without int. control	151 mm
Inlet connection:	G ¾" (int. thread)	
Outlet connection:	G ¾" (int. thread)	
Safety valve outlet:	¾" (int. thread)	
Connection expansion vessel:	¾" (ext. thread)	

## Operating data

Max. admissible pressure:	6 bar
Max. operating temperature:	120 °C
Max. propylene glycol content:	50 %

**Equipment**

Safety valve:	6 bar
Manometer:	0 - 106 bar
Thermometer:	0 - 160 °C
Non return valve (if applicable):	Opening pressure close to 0 bar
Flow meter:	0,5 - 15 l/min 4 - 22 l/min
Pump:	Grundfos UPM3 15-145  <b>Note</b> These pump stations are delivered with the Grundfos UPM3 15-145 pump, but these pump stations can also be equipped with the Wilo Yonos PARA ST15/13 PWM 2 pump.
Controller:	Solar Heating Control → HWH or HWHC systems Resol SLT → systems with integrated controls

**Material**

Valves and fittings:	Brass
Seals:	Klingersil/EPDM
Non return valve:	Modified PPS
Insulation:	EPP, $\lambda = 0,041 \text{ W/(m K)}$

# 6 Maintenance

## 6.1 General maintenance

A solar installation has to be maintained every year. During this annual maintenance all components have to be checked and tested.



### Caution:

Maintenance may only be carried out by an approved service and maintenance engineer.



### Note:

Before ordering spare parts, it is important to write down the installation type, solar pump model, and the full serial number of the solar pump station. These details can be found on the rating plate. Only by ordering with this information can you be sure to receive the correct spare parts. Because glycol is used in the system, special seals are required.

## 6.2 Preparation for maintenance

Before carrying out any maintenance work, switch off the unit (control and pump) and ensure that it cannot be switched on again by unauthorized people. Never carry out work on a running pump.

## 6.3 Water heater or tank maintenance

For maintenance, please see the manual included with the water heater or tank. If this topic is not covered in the manual, then contact the supplier of the water heater or tank.

## 6.4 Solar collector maintenance

For maintenance, please see the manual included with the solar collectors. If this topic is not covered in the manual, then contact the supplier of the solar collectors.

## 6.5 Maintenance items

The following items need to be maintained during annual check up:

### 6.5.1 Visual check system

Check the pump and solar pump station piping for leaks, also check the ground beneath the pump and piping (if possible) for any residue or wet spots.

### 6.5.2 Check pump

Check the functionality of the pump. When the pump is running, the meter from the pressure gauge should change and the shaft should be rotating. To check this, remove the screw on the front side of the pump.

During the running-in period (after replacing the seal), there may be some dripping from the axial face seal.

If placed in a frost-free location (as required with this pump station), the pump does not have to be emptied, even if it is out of service for a long period.

**6.5.3 pH-value glycol**

Check the pH of the glycol by taking a small amount from the system. If the measured pH value of the glycol is below the 7,0 replacing the glycol is necessary to maintain a good heat transfer in the system. The original value of the glycol mixture supplied by your supplier is approximately 8,0.

Fill the system as described in chapter 4.1.

**Note:**

Always replace the complete volume of the system when the pH is too low. Do not mix old and new glycol.

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**6.5.4 Flow**

Check if the flow through the system is still in accordance with the value stated in chapter 9.3, based on the number of collectors. If not, correct this using the instruction from chapter 4.2.1.

**6.5.5 Fluid level**

The fluid level has to be checked to make sure no air is being transferred through the pump. If additional filling of the installation is needed; always use identical solar fluid as used originally. Mixing different fluids can result in improper functioning and damaging of the installation. Fill the system as described in chapter 4.1.

**6.5.6 Pressure gauge**

Test the operation of the pressure gauge (I) located at the security group (E). The values on the display should be equal and in accordance to the value stated in chapter 9.4. When the pump is being activated, the value should change.

**6.5.7 Overflow valve**

Test the operation of the overflow valve of the solar security group (E). The glycol mixture should spurt out when opening the lever.

**6.5.8 Check expansion vessel**

The expansion vessel must be checked yearly for leaks and proper pre-charge value. See chapter 9.4 for the required pre-charge values.

# 7 Warranty

## 7.1 General Warranty

If within one year of the original installation date of a solar pump station supplied by Lochinvar, our warranty is to provide a replacement pump station in exchange for the return of the defective component and is subject to an audit upon receipt of the faulty pump station. If the pump station becomes unserviceable due to a material or workmanship defect it will be replaced. The replacement pump station must be paid for in full prior to dispatch unless we agree otherwise. The warranty does not include any labour costs or carriage of the returned component. Damage to the pump station due to the following, is not a defect in the material or workmanship of the item and is therefore not covered by the warranty.

- Not installed as per manufacturers and MCS guidelines, along with the relevant British standards
- Lack of maintenance to the solar thermal system.
- Damage to the pump station from an external factor.
- Misuse, neglect (including frost damage), modification, incorrect and/or unauthorised use of the pump station;
- any attempts at repair to a defective solar pump station other than by an approved service engineer;
- Damage due to prolonged high stagnation temperatures.

## 7.2 Warranty Procedures

If a claim is to be made under the terms of our warranty, the original purchaser of the appliance should place a purchase order for the required component and obtain a Sales Return Order (SRO) number for the return of the defective component.

**To process any warranty claim, we require the following information:**

- **Item model number**
- **Date and proof of purchase**
- **Brief description of fault**

Upon receipt of the defective component, it will be tested and if the component is found to be faulty, a credit will be raised against the relevant invoice.

The warranty period starts from the date of delivery of the original appliance unless the equipment is commissioned by Lochinvar, in which case the warranty period will begin from the completion date of the initial commissioning. Warranties are subject to the equipment being installed and maintained in accordance with the relevant Installation Commissioning and Maintenance Instructions and do not cover failures due to deliberate misuse, malicious damage, neglect, unauthorised alterations or repairs, accidental damage or third party damage. The warranty is held by the company/organisation that has placed the purchase order with us and is only valid if the appliance supplied has been paid for in full.

Lochinvar's total liability is limited to the value of the warranted appliance or component and it shall not be responsible for any loss of income, profits (actual or anticipated), contracts or for any other business related loss, indirect or consequential losses arising in connection with the warranted appliance or component.

We retain the exclusive right to replace the product or offer a refund at our sole discretion. Such remedy shall be your sole and exclusive remedy for any breach of warranty.

Lochinvar's standard terms and conditions apply to this warranty and in the event of any inconsistency between the two, the wording in this warranty shall prevail.



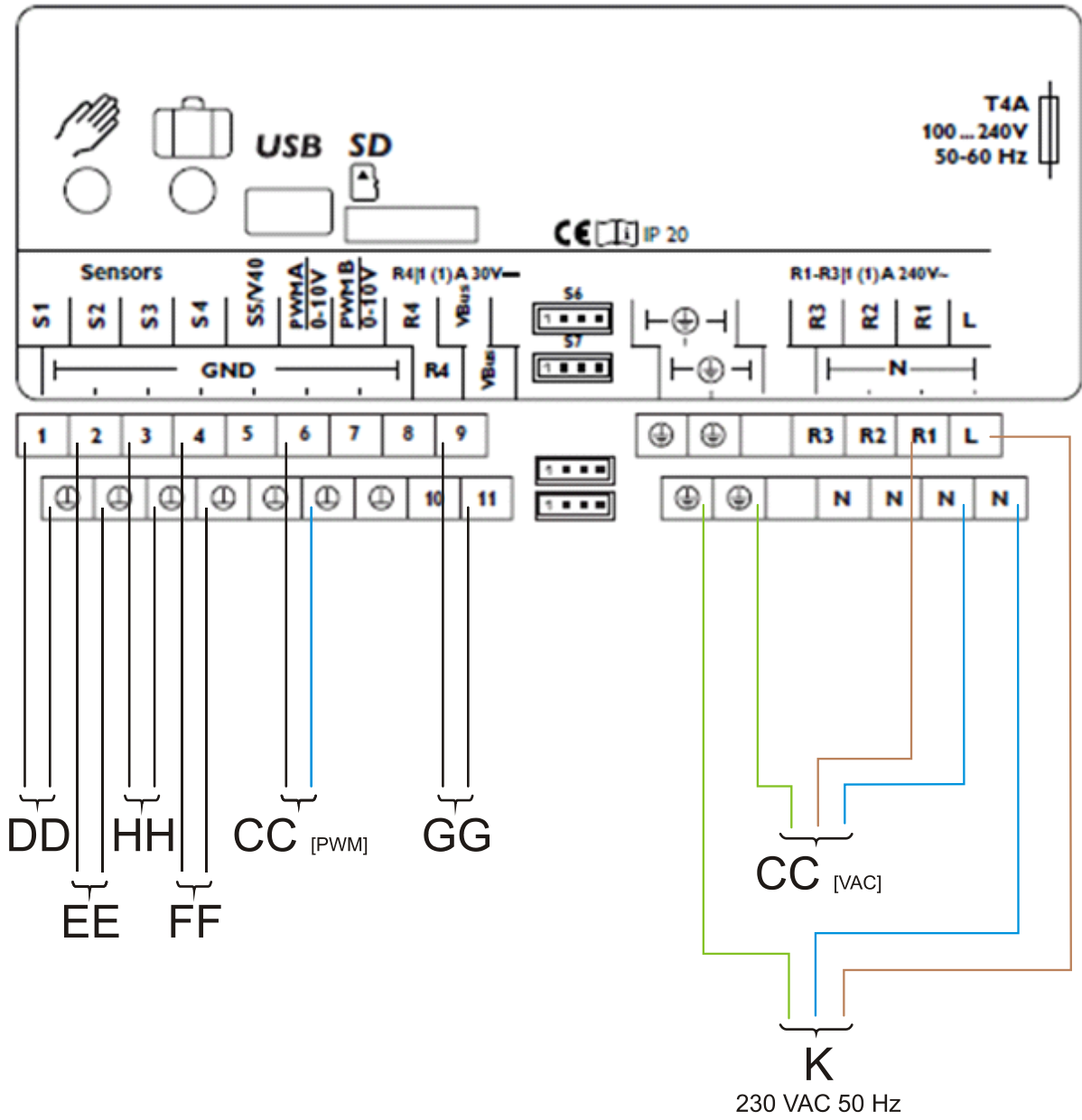


# 8 Appendices

This appendix contains:

- Electrical diagram of a pump station with Resol-control ([8.1 "Electrical diagram - Resol control"](#))
- Electrical diagram of a pump station with SHM-control ([8.2 "Electrical diagram - SHM-control"](#))
- Flow rate for solar system ([8.3 "Flow rate"](#))
- Pre-charge values of expansion vessel and filling pressure of the system ([8.4 "Pre-charge values of expansion vessel and system pressure"](#))

8.1 Electrical diagram - Resol control



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**COMPONENTS:**

CC <sub>[VAC]</sub>	Solar heating system pump (modulating) (230 VAC)
CC <sub>[PWM]</sub>	Solar heating system pump (modulating) (PWM-signal)
DD	Temperature sensor (S1 - collector)
EE	Temperature sensor (S2 - tank)
FF	Temperature sensor (S4 - return collector) *
GG	VBus-communication between solar control and external modules
HH	Temperature sensor (S3 - top storage tank)
K	Mains solar control

**SOLAR CONTROL CONNECTIONS:**

S1	Temperature sensor S1 connection (1-2)
S2	Temperature sensor S2 connection (3-4)
S3	Temperature sensor S3 connection (5-6)
S4	Temperature sensor S4 connection (7-8)
VBus	Resol VBus-communication port (9-10)
$\perp$	Earth (12-13-14)
N	Neutral output relay 2 - used for pump (15)
R2	Live output relay 2 - used for pump (16)
N	Neutral output relay 1 - used for pump (17)
R1	Live output relay 1 - used for pump (18)
N	Neutral (19)
L	Live input solar control (20)
PWM A	PWM connection pump solar heating system (6- $\perp$ ) - CC <sub>[PWM]</sub>

\* Temperature sensor S4 is part of the contribution sensor of the Resol system.



**TERMINAL BLOCK CONNECTIONS**

$\perp$	Earth
N	Neutral
L	Live input of the controller
L <sub>3</sub>	Live input for the solar heating system pump
PWM +	PWM+ signal of solar heating system pump (modulating)
PWM -	PWM- signal of solar heating system pump (modulating)

**COMPONENTS**

AA	Controller
BB <sub>[VAC]</sub>	Solar heating system pump (modulating) (230 VAC)
BB <sub>[PWM]</sub>	Solar heating system pump (modulating) (PWM-signal)
CC	Temperature sensor (S <sub>1</sub> - solar collector)
DD	Temperature sensor (S <sub>2</sub> - tank)
EE	Combined Q/T sensor (incl. temperature sensor S <sub>4</sub> - solar collector return)
FF	Communication between the water heater controller and the solar Heating system controller (BUS-link)
GG	Temperature sensor (S <sub>3</sub> - top of storage tank) - only HWH-system
K	Double-pole isolator

**CONTROLLER CONNECTIONS**

J12	Connection of combined Q/T sensor (1-2-3-4)
J13	Connection of temperature sensor S <sub>1</sub> (2-4)
J14	Connection of temperature sensor S <sub>2</sub> (2-4) and S <sub>3</sub> (1-3)
J16	Connection of BUS-link communication
J18	Connection of PWM-signal solar heating system pump
F2	Fuse (T 3.15A - 250 V)

### 8.3 Flow rate

Number of collectors	Desired flow rate	
	[m <sup>3</sup> /h]	[l/min]
1	0.06	1
2	0.12	2
3	0.18	3
4	0.24	4
5	0.30	5
6	0.36	6
7	0.42	7
8	0.48	8
9	0.54	9
10	0.60	10
11	0.66	11
12	0.72	12
13	0.78	13
14	0.84	14
15	0.90	15

#### Note

In case, that the desired flow can't be achieved is it possible to deviate from this. Please contact Lochinvar for further information about the minimum required flow.

### 9.4 Pre-charge values of expansion vessel and system pressure

The pre-charge value differs for each system and has been calculated at the supplier. The tables underneath will give a general direction and can be different than the advice received from your supplier. In case of doubt, contact your supplier for help.

Pressure components			System pressure	
Static height installation <sup>1)</sup>	Pre-charge expansion vessel <sup>2)</sup>	Value safety valve	Filling pressure	Maximum pressure
0 - 10 m	1,0 bar	6,0 bar	1,5 bar	5,5 bar
10 - 15 m	1,5 bar	6,0 bar	2,0 bar	5,5 bar
15 - 20 m	2,0 bar	6,0 bar	2,5 bar	5,5 bar
20 - 25 m	2,5 bar	6,0 bar	3,0 bar	5,5 bar

- 1) The static height of the installation is measured from the highest point, which is always the top of the solar collector, to the centre of the expansion vessel.
- 2) The factory set pre-charge value of the supplier supplied expansion vessel is 2,5 bar. If more pressure is required, nitrogen must be used as filling gas. This procedure is described in 4.2.4.