PV Heater DCLV

Producing warm water with photovoltaics

Operation- and installation instructions

Version 02.2

REFUsol
ADVANCED ENERGY

Title	**PV Heater DCLV** Production of warm water
Type of Documentation	Operation- and installation instruction
Purpose of the Documentation	In this documentation the use of PV Heater DCLV has been described.
Released by	REFUsol GmbH Uracher Street 91 • D-72555 Metzingen Telephone: +49 7123969202 • Fax +49 7123302 02 www.refusol.com
Reservation of Rights	All the data in this documentation was generated with a lot of care and has been checked. Despite that there could be errors or deviations because of the technical progress, which could not be completely excluded. No responsibility or guarantee is taken for completeness. The present updated version can be obtained at www.refusol.com.
Copywright	The data obtained in this documentation is the property of REFU sol GmbH. The evaluation as well as the publication of this documentation, even in extracts, requires the written approval of REFU sol GmbH.
Trade Symbol	**REFU *sol*®** is a registered trademark.

Marking Version Number	**Version Number**
BA_PV_Heater_V02.2_EN	03/2014

Contents

1 Using this operation instruction

This operation instruction is a part of the product

⇒ Operation instruction should be read before installation of the equipment.

⇒ Operation instructions should be made available at the equipment during the complete life of the product.

⇒ Operation instruction should be made available to prospective users of the equipment.

1.1 Symbols and Text Markings

☑	Assumptions
⇒	Instructions one step
1.	Instructions multiple steps
•	Ennumeration
Highlighting	Highlighting within a text
↳	Results

1.2 Warning Instructions

1.2.1 Set up of a Warning Instruction

 **WARN WORD**	**Type and source of the danger are described here.** ⇒ Here one provides the measures for avoiding the danger.
Example	
 **DANGER**	**Death or severe physical damages to the body because of high leakage current while opening the equipment.** ⇒ Before connecting the power supply the earthing must be checked without fail.

1.2.2 Classes of Warnings

There are three classes of warnings.

 **DANGER**	“DANGER” designates a safety instruction, which if ignored immediately leads to death or severe physical damages!
 **WARNING**	“WARNING” designates a safety instruction, which if ignored can lead to death or severe physical damages to the person!

 **CAUTION**	“CAUTION” designates a safety instruction, which if ignored could lead to damaged goods or light physical damages!

1.3 Suggestions

Note: A **suggestion** describes information, which is important for the optimum and economic operation of the system.

2 Suggestions on Safety

2.1 Introduction

Before the installation and the commissioning of this equipment all the data that is delivered along with the equipment is to be carefully read.

The following suggestions are to be noted before the installation of the equipment for avoiding physical damages and/or damages to the equipment. The safety instructions are to be maintained at any point of time.

In case of sale, lease or any other kind of transfer of the equipment, the product documentation is to be likewise enclosed.

Before the installation and commissioning it should be ensured that, the PV and the heating system available, as well as the warm water storage correspond to the regulations and the actual technology levels. In case of doubt, before the installation the existing PV and the heating system, as well as the hot water storage is to be checked by a recognized professional.

2.2 Appropriate use

AE PV Heater should be used only with AE PV heating element that is delivered.

 **WARNING**	**Danger of infection through insufficient disinfected water.** ⇒ The thermal disinfection must be guaranteed by the heating system that is available. ⇒ Existing heating system must always remain in operation.

PV Heater DCLV serves for the generation of hot water in residential or commercial installations. The equipment shall be supplied with its own separate PV system and being fitted into an existing heating system. AE PV heater DCLV should be used only in connection with the AEREFUsol screwed in PV heating element that is delivered along with the equipment. Every usage that goes beyond that is considered as not in accordance with the regulations. The connection of additional electrical supplies is specifically not permitted.

2.3 Technical specification PV-module

PV-Modules of the class A as per IEC 61730 must be used.

2.4 Target group

The use of the equipment is suited for persons, who have a minimum technical knowledge and the skills and capabilities.

Out of this, persons, (including children) with limited physical, sensory or physical abilities or lacking the required electrical knowledge are excluded. In this case, the support is needed through the corresponding technical personnel.

2.5 Disclaimer

The general conditions for the supply and performance of REFU*sol* GmbH are applicable

- In case of damages because of ignoring the warning instructions given in this installation manual or a use outside the ambit of regulations, REFUsol GmbH does not take any liability or responsibility.
- The PV Heater have both water and electricity contact. Any changes other than the permitted exchange of the heating rod with an original REFUsol replacement heating rod (hereinafter

changes) thus to the PV Heatern jeopardize their safe operation and can cause considerable damage.

- Because of this it is not allowed to make changes or repair attempts to the PV Heaters. REFUsol assumes no responsibility, if damage due to a change or a repair attempt at a PV Heater arises. Changes to the PV Heater lead to the exclusion of warranty, if the changes are the cause for a warranty claim.
- Before the commissioning the operation, maintenance and security measures should be read through.
- The error free and safe operation of this equipment pre supposes an appropriate and professional transport, storage, assembly and installation as well careful operation and maintenance.
- Accessories and spare parts that are approved by the manufacturer are permitted.
- The safety specifications and guidelines of the country, in which the system is being used, are to be considered.
- The environment conditions specified in the product documentation must be maintained.
- The technical data, the measurement, connection and installation conditions are to be derived from the product documentation and maintained unconditionally.
- For damages in connection with higher power and catastrophe cases, we do not take any liability.

2.6 Warning instructions in or on the equipment

Image 1: Adhesive in the equipment

The sticker is found in the interior of the equipment right next to the connections for the PV-modules.

Below the meaning of individual symbols and texts from the top to the bottom:

- PV-Modules to be connected parallel.
- PV-Modules never to be connected in series.
- Before the installation the operation instructions to be read.
- The voltage per PV input should not exceed 50 V.
- After the installation and before the commissioning the water level in the heating system is to be checked.

Image 2: Adhesive

Pay attention that the product documentation must be read before the installation.

3 Scope of Supply

3.1 Packing List

PV Heater DCLV contains:

Stk.	Designation		Type No.
1	PV Heater		
1	The enclosed set contains:		0034468
	2	2-polar plug part	0017062
	1	3-polar plug part	0034410
	4	Combination screws M4x16	
	10	Cable binder	
1	Operation and. installation instructions		0034464

The additionally required AE PV heating element – set No. 0034480 is delivered in a separate packaging.

3.2 Unpacking and checking out the scope of supply

⇒ Completeness of the packing content to be checked as per 3.1.

In case of the incomplete scope of supply viz. Damages or defects, an installation and commissioning is not permissible. In this case, REFU*sol* service is to be contacted.

4 Structure and function

4.1 Equipment safety and personnel protection

The AE PV Heater device prodives the following safety functions:

- Recognizing of Earth connection and insulation error PV-modules and screw heater.
- Recognizing and protective circuit in case of wrong DC-polarity.
- Recognizing and regulation in case of surge on the screw heater.
- Redundant temperature monitoring and switching off in case of emergency.
- Recognizing of errors or failures in PV-modules and screw heater.
- Personal protection guaranteed by protective extra low voltage (PELV).
- Internal temperature monitoring and switch off.

 **CAUTION**	**Damages to equipment because of defects caused possibly high back current in parallel connection of modules.** ⇒ Possible back current of modules to be checked by experts.

4.2 Protection from surge and lightning strike

PV-supply inputs for PV Heater DCLV are protected by the use of surge conductors against surge from internally and externally. The electronic facilities and communication lines fulfill the requirements for protection against external surges.

In case of an existing lightning protection system a lightning protection specialist has to evaluate, as to how far the complete system must be connected with the PV Heater DCLV in the lightning protection.

4.3 Installation suggestions for the complete system

While planning, installation and after the following first commissioning of the complete PV- System the following must be considered:

- The local standards and laws concerning grounding, construction, cabeling and conncetion.
- Installation suggestions of the PV-module manufacturer
- Standards presently valid at the location, specially the standards:
    - IEC 60364 (Erection of low voltage systems)
    - IEC 61643 (Surge arrester for low voltage systems)
    - IEC 821749 / EN 62446 (Minimum requirements for PV-systems)
    - EN 61000-4 (EMC)

4.4 Configuration of the photovoltaic system

WARNING	**Disturbance or damage to the equipment and danger of damage because of high voltage.** ⇒ Never connect photovoltaic-modules in series connection. ⇒ Maximal voltage of 50 V and maximum current of 30 A per MPPT input to be noted unconditionally. ⇒ Ensure that, the socket of the PV-system is easily accessible, so that the system can always be connected quickly without voltage.

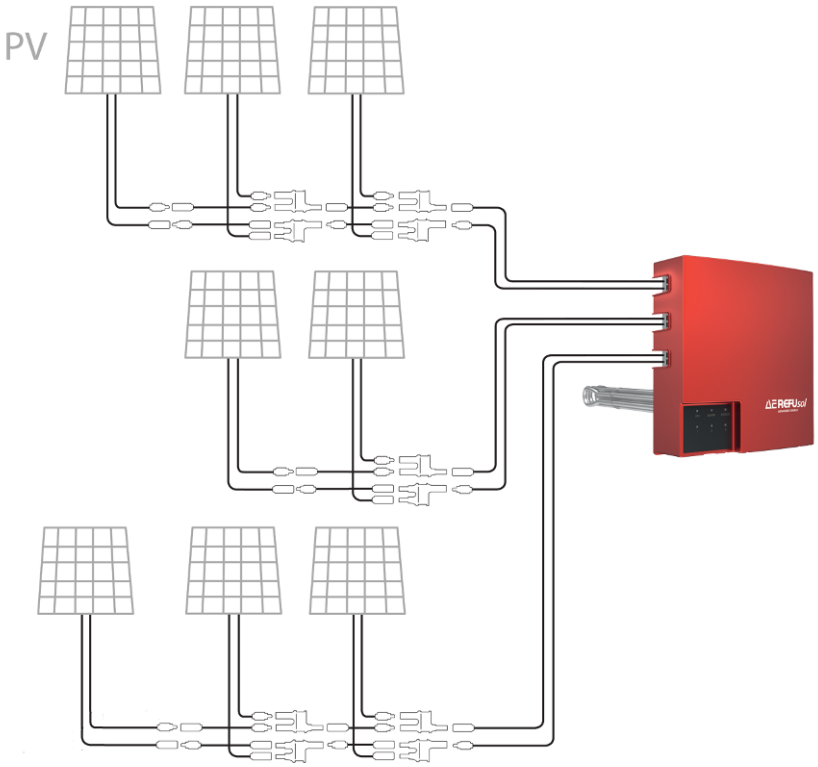


Image 3: Principle sketch of the complete system

Parallel connection, 1-3 module per MPPT, return current to be checked

- MPPT 18-40 V
- Max. 50 V
- Max. 20 A
- Overload possible up to 30 A

4.5 Equipment and functional description

PV Heater DCLV uses the power generated from the solar cells for generation of hot water with the help of a screw-in heating element integrated into the hot water tank.

A connection of up to 9 modules is possible on low voltage level. As hereby a voltage of 50 VDC is not exceeded, the PV Heater DCLV can be installed even by persons, who have no knowledge on electro technical systems.

Front Side

1: Connection for 3 Photovoltaic strings

2: Display Element

3: ON/OFF switch on the lower side or bottom side of the equipment

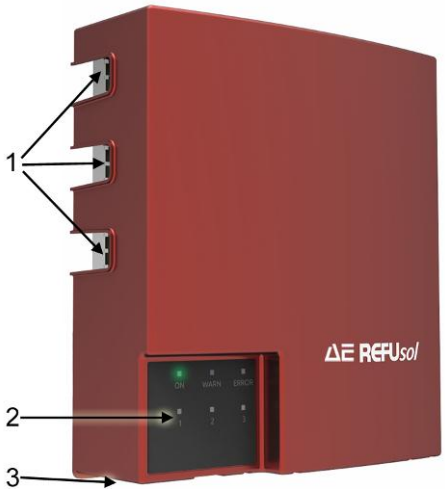


Image 4

Back Side

1: Ethernet Connection

2: Screw Heater

3: Air outlet opening

4: Air input opening

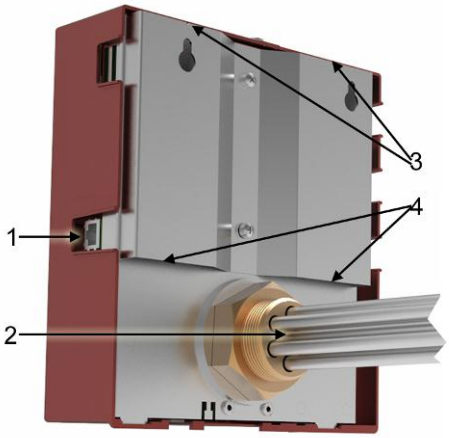


Image 5

Bottom / ON/OFF switch

Image 6

Display Element

ON (green blinking 90% on):
Equipment is active

WARN (yellow): Insulation error. The LEDs 1-3 display an error code.

ERROR (red): The LEDs 1-3 display an error code.

1. Error code to be determined (see para. 8, page. 30)
2. REFUsol Service to be contacted.

1-3 (yellow): In normal operation display of the actual active power for the lines 1 to 3. The duty cycle within a 2 second interval showes by the situation “LED on” and “LED off” the presently provided power as part of 100% power.

Examples:

LED 1 illuminates continuously: over line 1 the complete power is delivered.

LED 1 is likewise on and off for one second: Over line 1 half of the possible power is delivered.

LED 1 on for 0,5 seconds and off for 1,5 seconds: Over line 1, 25% of the possible power is delivered.

Image 7

4.5.1 Internal connections

Description of internal connections		
Connection	**Function**	**Pinning (Numbers from top to bottom)**
X2	Potiential free contact max. 24V/3A DC or AC	1-2: n.c. 2-3: n.o.
X3	Remote control input 10…24V DC or AC, 20mA	1-2
X4	Internal contact	
X14	Water temperature	Temperature sensor for heating element
X15	External Temperature sen-sors 1 and 2	1-2: External Sensor 1 (PT1000) 3-4: External Sensor 2 (PT1000)

5 Installation

 **WARNING**	**Danger to life because of possible lightning.** ⇒ Installation should not be carried out during a thunderstorm.
 **CAUTION**	**Material damages because of inappropriate installation.** ⇒ The screw-in heating element must be assembled before equipment installation by an expert in heating systems in the warm water storage tank. For details, see operation instructions AE PV heating element. ⇒ The hot water storage tank must correspondingly filled with water. ⇒ For the connection to the solar modules PV-lines or cables with a dia of 4 mm^2 or 6 mm^2 must be used. The use of adder sleeves is not permitted.. ⇒ Only vertical mounting is permissible (see step 19). Switch board must always be on the bottom side. ⇒ The air input and output vents of the equipment should never be covered, to avoid any overheat and damage. ⇒ The place of assembly must be freely accessible for service and maintenance. ⇒ For guaranteeing the operational safety of the equipment the LEDs must always be visible and the Power ON switch on the equipment's bottom side must always be accessible. ⇒ Equipment must be protected from the penetration of water.

5.1 Required tools

A countersunk screw driver, engineers pliers and side cutting pliers are needed.

5.2 PV Heater DCLV to be assembled to Water Storage

☑ The hot water storage tank must be correspondingly filled with water.

☑ ON/OFF switch must remain OFF (0).

1. Screw M5 on the upper side of the housing to be loosened with the screw driver.
2. Housing cover to be folded down from the top and removed.

Image 8

3. Position of the threaded bore on the screw-in heating element to be determined.

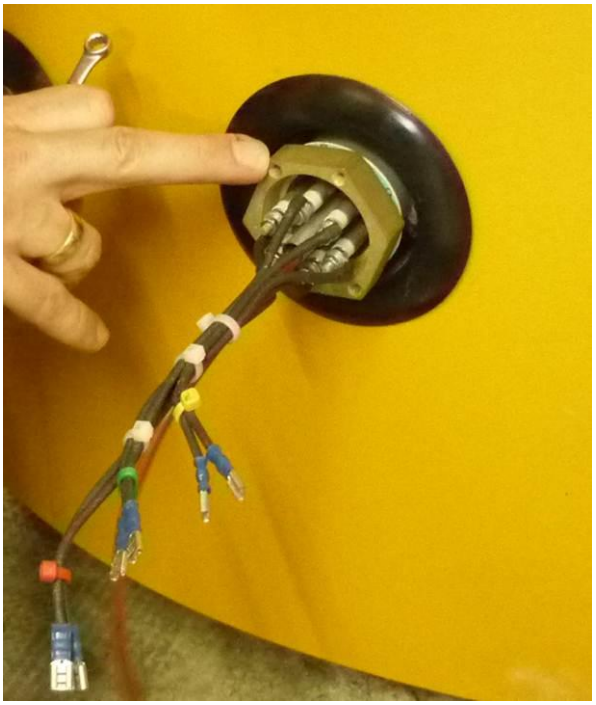


Image 9

4. Ring (Inner housing) to be turned in such a way, that the screw holes match with the thread bores of the screw-in heating element. Notch (arrow) must lie in the center between two threaded bores.

Image 10

5. Housing to be placed and possibly aligned with a mechanic's level.

Image 11

6. The four accompanying screws M4x16 are to be placed and tightened over a cross.

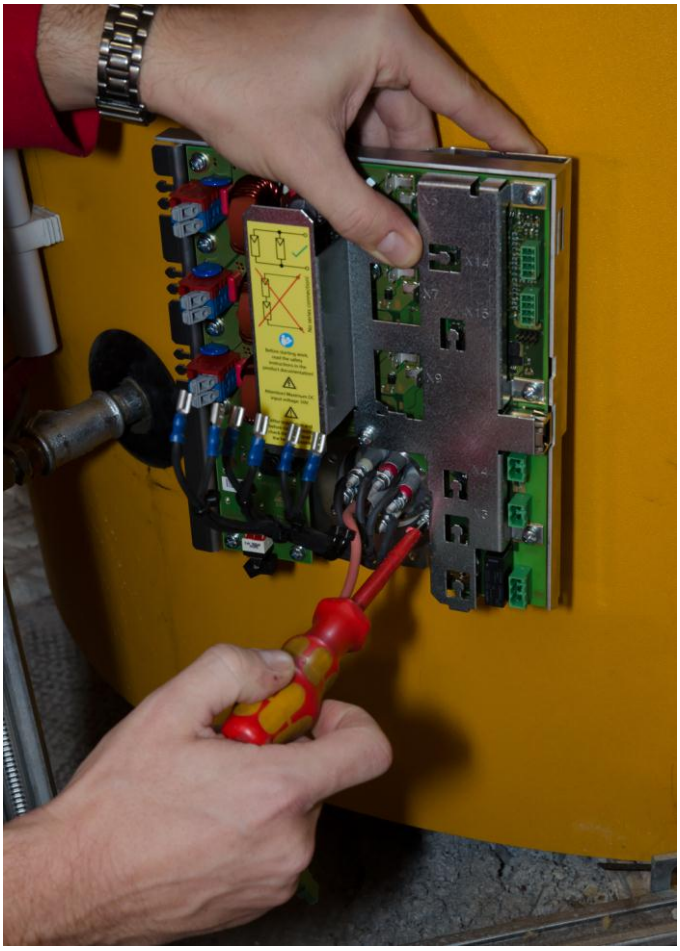


Image 12

7. The six pin plug of the cable of the screw in heating body is to be inserted pair wise in the connector X5, X7 and X9. Be sure there is no loose connection.

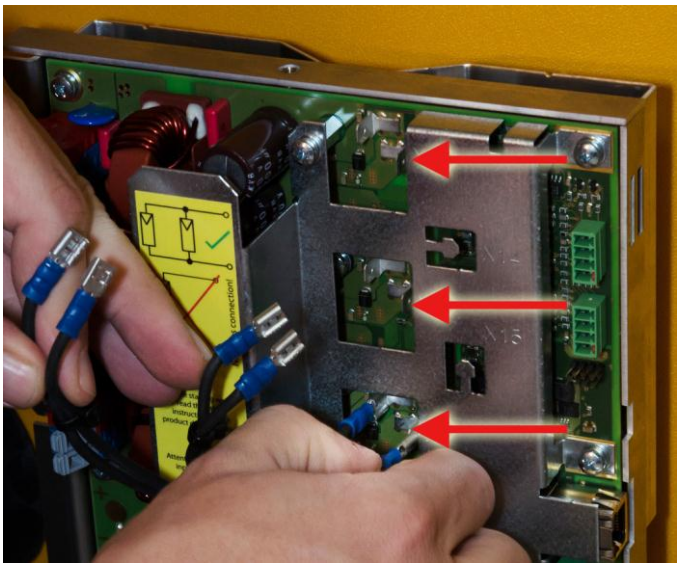


Image 13

8. The main sensor cable (Type PT1000) is to be plugged into connector X14 located in the upper right of the housing.

   The connector X15 below provides optionally a second (pin 1+2) and third (pin 3+4) external sensor to be connected. Pin 1 in the connector is the most upper pin in the adjacent figure.

Image 14

9. Sensor cable to be fastened with cable ties on the housing.
10. Long ends of the cable tie to be cut.

Image 15

11. Insulation to be removed 11 mm from the photovoltaic string cable.
12. Plus and Minus of the string cable with the help of the integrated polarity tester on the PCB to be checked.
    - ☞ Green LED (arrow) glows: Alignment plus and minus match.
    - ☞ Red LED glows:
    - ⇒ Plus and minus to be interchanged.

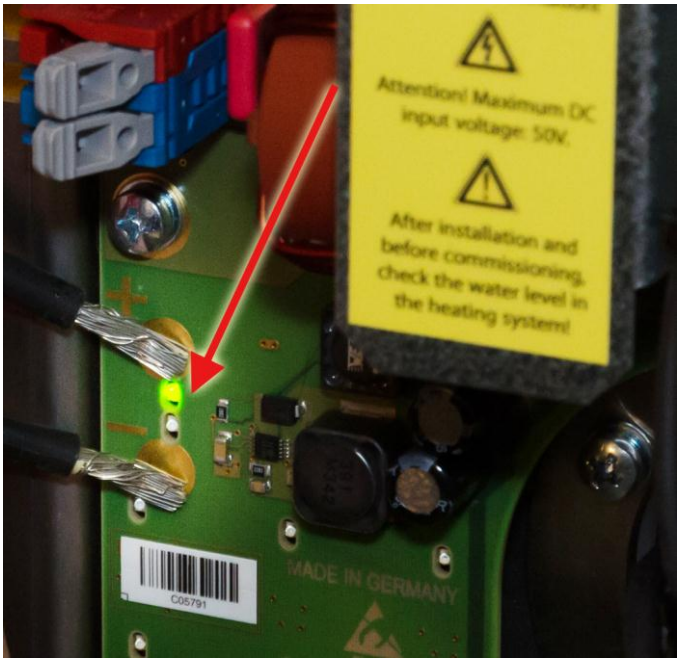


Image 16

13. Insert string cables in accordance with the polarity (red = plus, blue = minus) in the insertion funnels of the PCB terminals. Avoid touching the bare ends of the wires.

Image 17

14. Press lever down until it stops, to safely connect the conductor. The lever must be completely depressed (B). The conductor connection is not guaranteed when a lever is not closed.

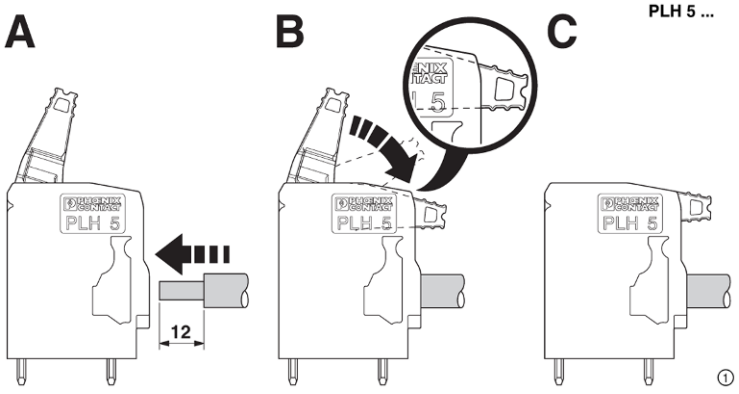


Image 18

15. Attach string cable with cable ties to the case. Cut off the long ends of the cable ties.
16. Check secure fixing of the string cables!

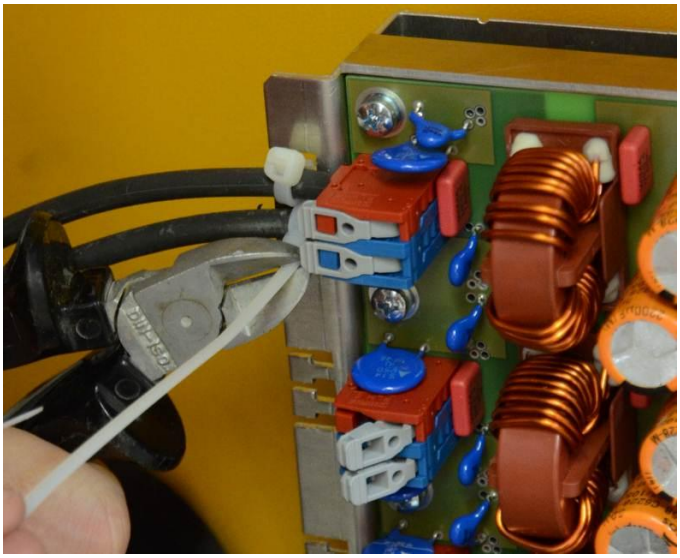


Image 19

17. If the integration is desired in a LAN, connect using a network cable.

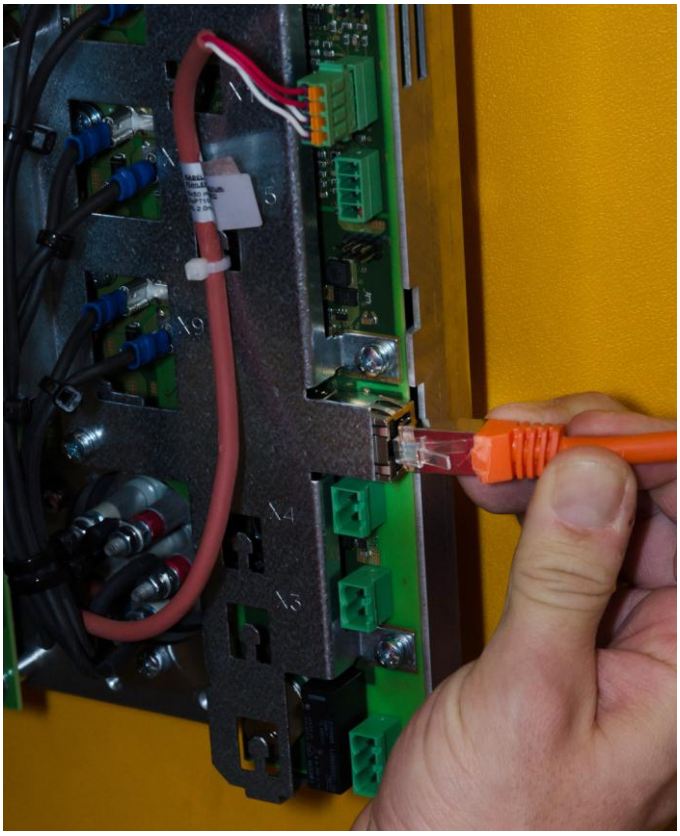


Image 20

18. Hook in housing cover to the pins of the device frame and fold up.

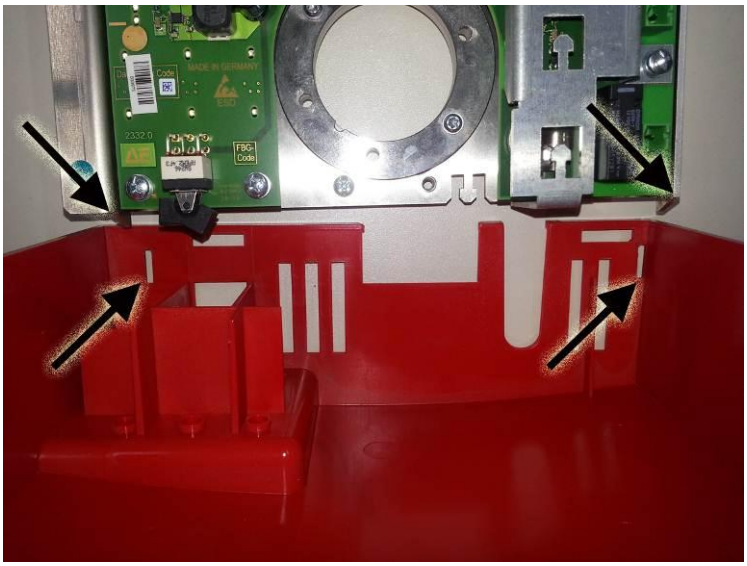


Image 21

19. Attach the housing cover above with the enclosed screw.

Image 22

20. Switch on the device on the switch at the bottom left. Under the assumption that solar power is available, the following happens:

    - (1) The two LEDs above left will light up for 5 seconds.
    - (2) All 6 LEDs will flash with decreasing frequency rotating in a clockwise direction (running lights) until they are almost constantly lit after 5 seconds.
    - (3) Then lights up the ON LED and the LEDs 1-3, if the corresponding solar modules generate electricity.
    - If insufficient power is available, the process (1) and (2) repeat themselves.

Image 23

5.3 Optional web connection

It is possible to connect the PV Heater via the Ethernet port to the local network. The connection with a Wi-Fi adapter (e.g. Netgear WNCE2001) over the local WLAN is also possible.

PV Heater is then found in the local network with its name. The integrated Web browser of the PV Heater can be addressed then under the corresponding IP address. The Green and yellow LED on the Ethernet port show the correct function of the interface.

A functioning connection can be expected only during the day due to the auxillary power supply of the device coming from the solar generator.

5.4 Optional control on ENABLE input (X4)

5.4.1 Location on board

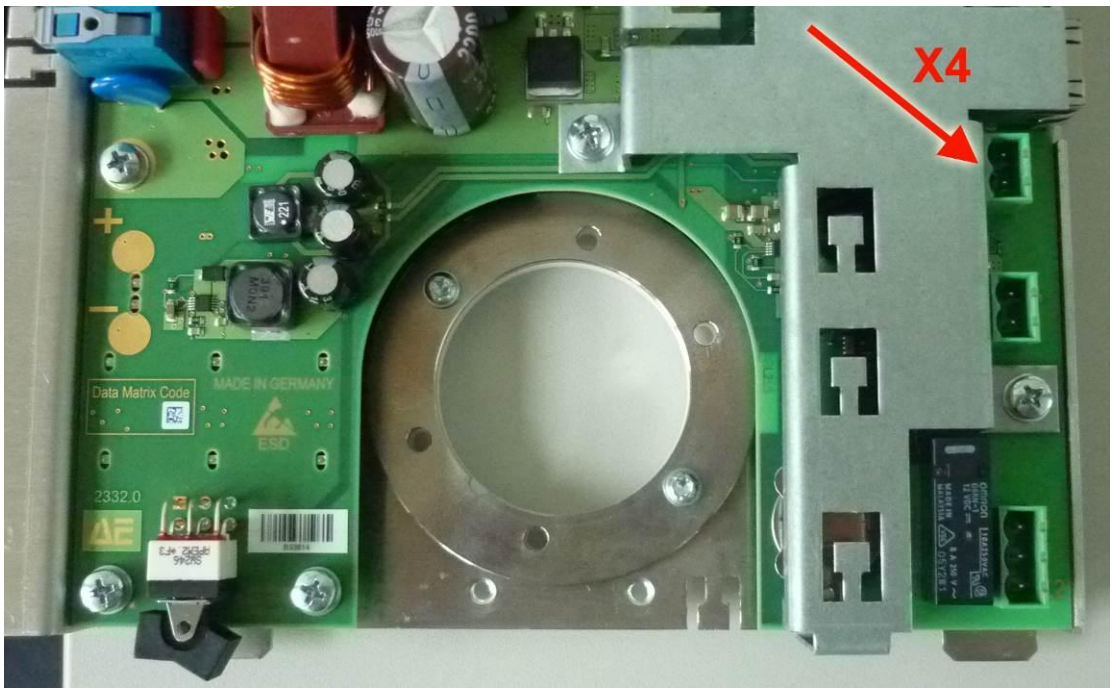


Image 24

5.4.2 Properties

- Needed voltage 10-24 volt
- Electricity requirement Max. 20 mA
- Polarity arbitrary

5.4.3 Operation

⇒ Enable use of the ENABLE input on connection tool (see Chapter 6.8, page 28).

☞ Unit starts, if there is a corresponding voltage.

If the voltage drops, the message "222" will be issued (see chapter 8, page 30).

6 Configuration with advanced energy connection tool

 **CAUTION**	**Damage caused by incorrect settings possible.** ⇒ Changes to the default values can be carried only by a heating specialist. Here, the relationship with the existing heating system must be observed.

Note: A shorter life span of the immersion heater is to be expected at higher set temperatures

The lowering of the boiling temperature must be observed in case of using the unit in mountain regions

The configuration is done through the advanced energy connection tool. This can be downloaded from the REFUsol Homepage.

The switch on and switch off temperatures of the device can be set with this tool. More auxillary functions affecting the power relay within the PV Heater can be configured.

6.1 Prerequisites

☑ PV heater must be integrated into the local network.

6.2 Automated Device Search

After execution of "ConnectionTool.exe", the following screen appears. The program then automatically searches for devices in the network.

In the box right above the found devices are listed. The device that is to be configured must be marked here. The associated network data is displayed under "Configurations Network".

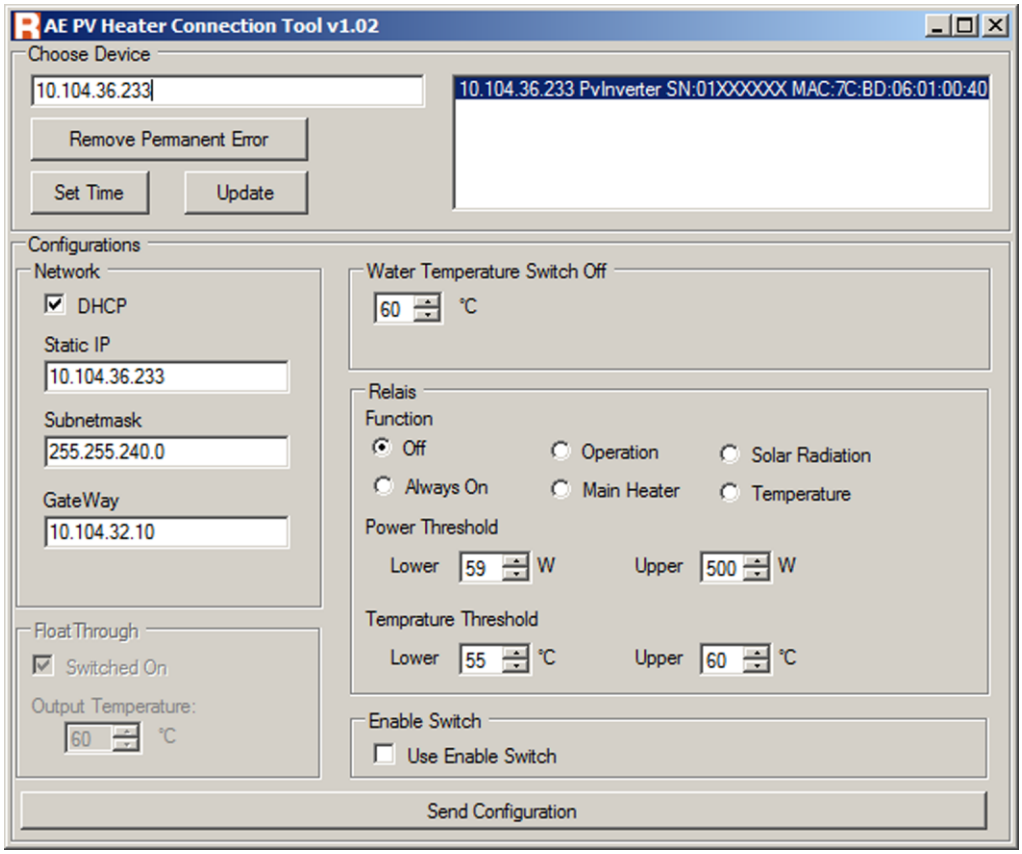


Image 25

6.3 Configure Network Connection PV Heater with DCHP

This method should be used preferably.

☑ Check mark DHCP is set.

⇗ Static IP, Subnet mask, and GateWay are set automatically, if not already done.

1. Enter the desired values.
2. Confirm the values by pressing the button "Send Configuration" (all values of the mask are transferred).

6.4 Manually Configure Network Connection PV Heater

☑ Only make manual network connection if you have relevant knowledge of the device and network building.

1. Remove check mark for DHCP.
2. Fill the input fields static IP (E.g. 192.168.0.100), subnet mask, and gateway.
3. Enter the desired values.
4. Press the button "Send Configuration" (all values of the mask are transferred).

⇗ PV heater is configured accordingly.

6.5 Direct Connection of PV Heater - Windows-PC

Note: Direct connection is not working with Windows XP or earlier!

The direct connection allows you to configure PV Heater over a PC without a network.

1. Switch off PV heater.
2. Pull out network cable (if applicable) from the Ethernet port on the PV heater.
3. Switch on PV heater.

☞ After 30 seconds the IP address 192.168.0.100 and the subnet 255.255.255.0 are configured in the PV Heater for this session..

4. Connect PV heater and Windows PC with network cable.
5. Set Up on the network adapter of the Windows based PCs, fixed IP address, for example 192.168.0.20 and the same subnet 255.255.255.0 as on the PV Heater.

☞ The configuration can be now carried out by the Windows PC with the Advanced Energy Connection tool.

Note: In order not to affect the functionality of the Windows PC, the fixed settings should be reversed on the network card after successful configuration of the PV Heaters.

6.6 Set up the Maximum Water Temperature

1. Enter the desired shutdown temperature in the box under "Water Temperature Switch Off" (maximum value 80 °C).
2. Transfer new value by pressing the button "Send configuration" at PV heater.

6.7 The Functions of the Relay

The relay can be used to control the primary heating or other devices. A different control behavior arises depending on the selected radio button.

Note: New values are only active if they have been confirmed with "Send Configuration".

The temperature is reported from the external temperature sensor 1 (the two upper pins of X15).

Mark	Function description
Off	The relay is off permanently. This is the delivery setting.
Always on	The relay is on continuously when the power ON switch is on. If PV Heater switched off via the power ON switch, or no PV electricity available, so also turns off the relay.

Operation	Where PV heater is in operation, the relay is on. This function could be used for example, to turn off the primary heating during the operation of PV heater
Main Heater	If in case of "Temperature threshold" specified "lower" temperature is gone below, the relay switches on. This function could be used to turn a signal lamp that indicates that PV heater provides not enough hot water or to activate the primary heating system to deliver hot water.
Solar Radiation	The relay switches on, when the "Upper" output indicated in "Power threshold" is exceeded. The relay turns off again, when the "Lower" output indicated in "Power threshold" went below.
Temperature	The relay switches on, when the "Upper" output indicated in "Temperature threshold" is exceeded. The relay turns off again, when the "Lower" output indicated in "Temperature threshold" went below. This function could be used by a consumer, such as a washing machine that needs the hot water, then turn on when enough hot water is available.

6.8 Enable Switch

"Use Enable Switch" is not set by default. This means that PV Heater starts immediately if there is enough solar energy.

If PV Heater shall be controlled remotely, then a corresponding signal via the input X4 should be provided (see Chapter. 5.4, page 24) and check mark should be set for "Use Enable Switch".

6.9 Remove Permanent Error

 **CAUTION**	**Error 888 indicates security-related problems.** ⇒ Press button only when causes of the problem has been eliminated.

Button is used to reset error 888.

6.10 Set Time

By pressing this button takes over the internal clock of the PV Heater's current time from the network.

6.11 Update

By pressing this button, the "Advanced Energy Connection Tool" is updated to the latest version.

6.12 Float Through

The check mark in this field must be set when the unit is used in a water heater. The "output temperature" indicates up to which temperature AE PV heater remains switched on.

7 Monitoring Portal REFU*log*

7.1 General Information

REFUlog is an internet-based monitoring portal. With your login information, you can monitor your PV Heater from any freely accessible Internet access worldwide.

With the two external temperature sensors 1 and 2 for example, the course of charging the storage tank are described in detail.

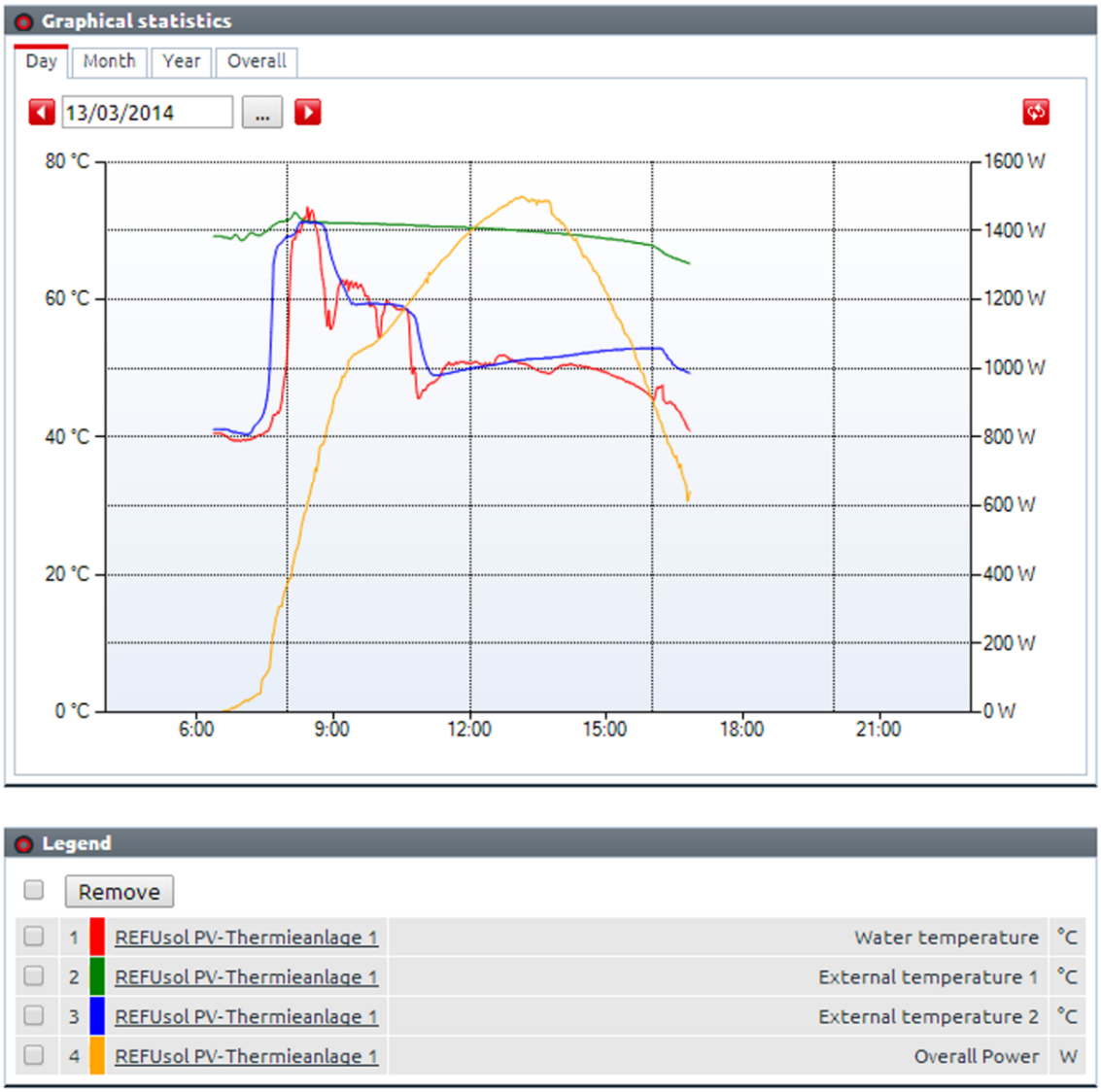


Image 26: graphic REFUlog

7.2 Integration of PV Heater in REFU*log*

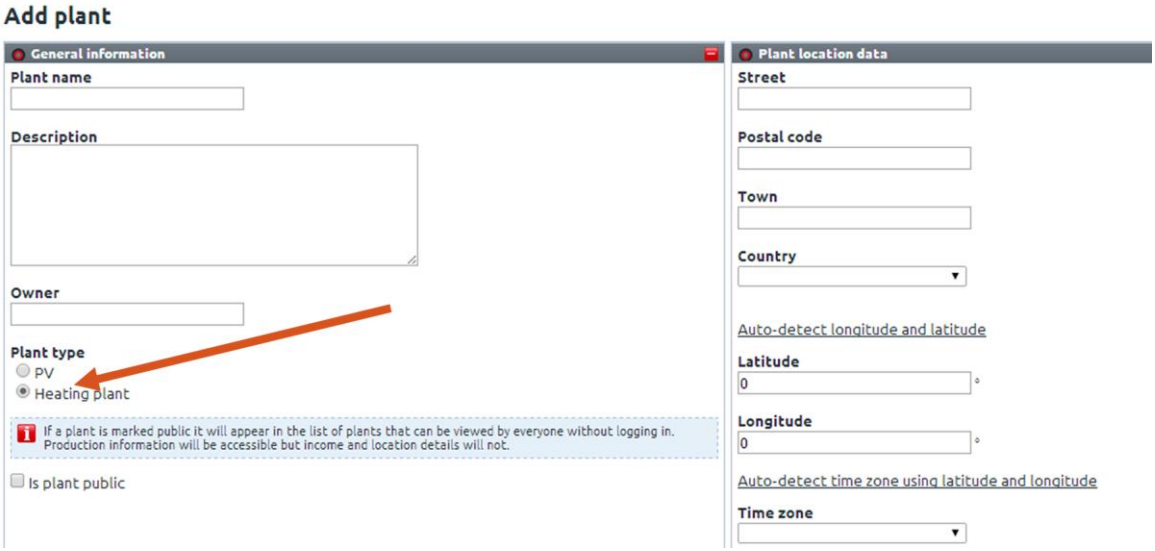
To monitor the PV Heater in REFUlog, proceed as follows:

☑ Ensure that PV Heater is connected to the network.

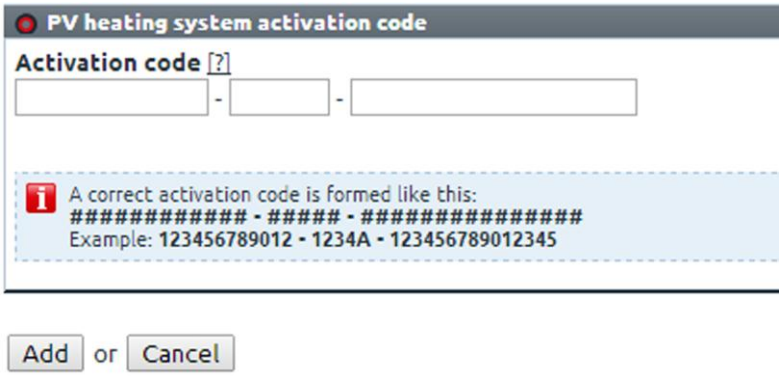
1. Note code to activate the PV Heater. This is located on the nameplate of the PV Heaters on the right side of the device.
   Optionally, the barcode can be scanned with a smart phone so that the activation code can be read from the screen of the smartphone.

2. Sign in under www.refulog.de or register here when needed. A detailed description of REFUlog is located in the download area of http://europe.refusol.com.
3. Press “Add plant”.

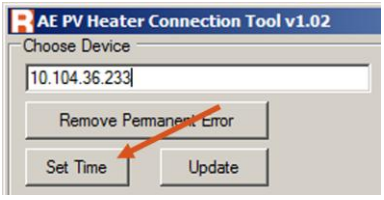
   ⇗ A screen appears with plant data that must be filled in.
4. First select the type of installation "PV-thermal plant" (arrow).



5. Enter the remaining required data.
6. Last to enter the activation code listed above in the valid format.



7. Click “Add” button for completing the operation.
8. Call AE PV Heater Connection Tool (version 1.02) and PV embed Heater for configuration. For details see chapter 6, page 25.
9. Click one times the button “Set Time”.



10. Switch off PV Heater and switch it on again. Let PV Heater start up.

    ⇗ Your PV Heater is now registered in the REFUlog portal.

8 Maintenance and Repair

⇒ Function control of LEDs: See chapter. 5.2 point 20, page 23.

⇒ Check threaded hole of the heating rod annually for leaks. Get heating expert in case of leakage!

⇒ If necessary, remove dust from air vents.

⇒ Housing surface, if necessary with a mild detergent and soft clean cloth.

⇒ We recommend that the internal battery type CR2032 every 10 years to swap.

Regular review of the PV- and the primary heating system by specialist needed.

8.1 Replacement battery

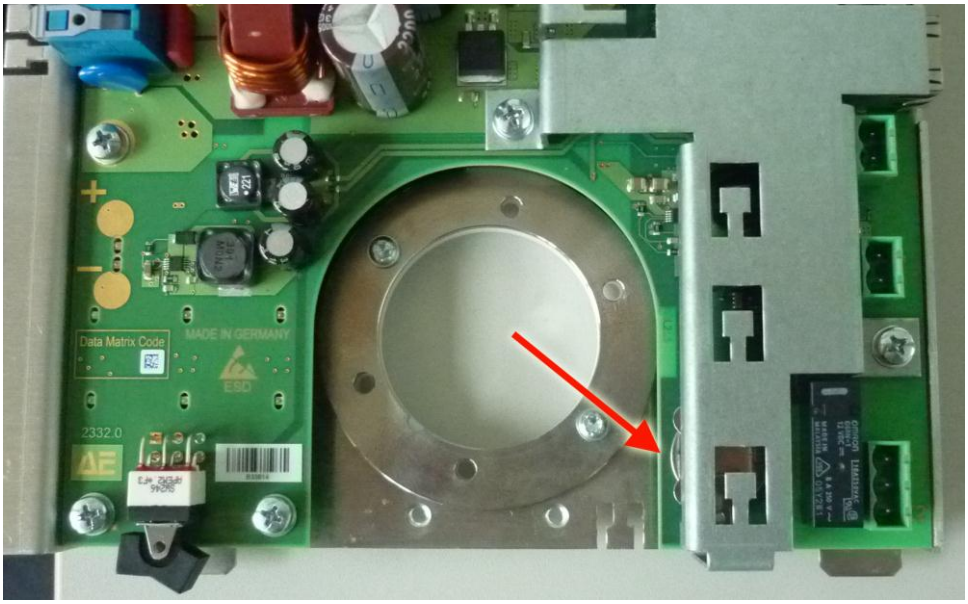


Image 27 : Location of the battery (arrow)

1. Press outr Battery with a sharp, non-electrically conductive object such as match.
2. Put in new battery type CR2032.

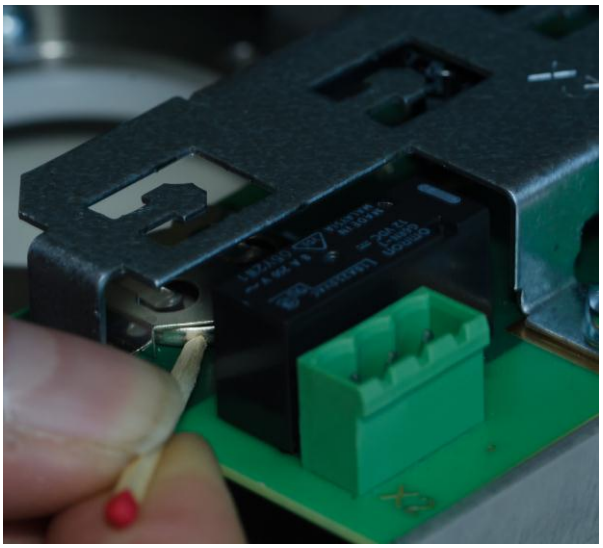


Image 28 : Removing battery

9 Case of Error

9.1 Determine the error code "WARNING"

☑ LED "Warning" lights up for 10 seconds and is off for 20 seconds.

1. While LED "Warning" lights, count how many times LED1 flashes and note (Hundreds digit).
2. While LED "Warning" lights, count how many times LED2 flashes and note (Tenth digit).
3. While LED "Warning" lights, count how many times LED3 flashes and note (First digit).
4. The warning number results from the 3 digits. Details in the table below:

Example: During the 10 seconds, the LED "WARN" lights, flashes LED1 once, LED2 once, and LED3 flashes three times. Results in the error number 113.

No.	Name	Description	What to do
111	Isolation warning circuit 1	One of the three generator / heating Rod circles show a low insulation value less than 20 kΩ.	Disconnect the related generator circuit and measure with a suitable measuring instrument both poles to PE. Eliminate insulation fault. **Note:** Insulation fault can occur often during wet weather through inadequate sealing of cables and modules
112	Isolation warning circuit 2		
113	Isolation warning circuit 3		
222	Enable off	On the enable input (X 4) there is no voltage.	Status information

Note: If the led "Warning" lights, PV heater continues to operate normally. Exception is the error number 222.

9.2 Determine the error code "ERROR"

☑ LED "Error" lights up for 10 seconds and is off for 2 seconds.

1. While LED "Error" lights, count how many times LED1 flashes and note (Hundreds digit).
2. While LED "Error" lights, count how many times LED2 flashes and note (Tenth digit).
3. While LED "Error" lights, count how many times LED3 flashes and note (First digit).
4. From the 3 digits, there is the error code. Details in the table below:

No.	Name	Description	Possible Measures
211	Auxiliary supply 1	Auxiliary supply 1 outside the limits	Switch off the device. Contact this service.
212	Auxiliary supply 2	Auxiliary supply 2 outside the limits	
311	Over temperature sensor 1	Measurement of the sensor 1 is above the regular measurement range	Check: Contact heating element sensor in X14? contact service
312	Over temperature sensor 2	Measurement of the sensor 2 is above the regular measurement range	

No.	Name	Description	Possible Measures
313	Over temperature sensor 3	Measurement of the sensor 3 is above the regular measurement range	If sensor 3 available? Cable break? contact service
314	Over temperature sensor 4	Measurement of the sensor 4 is above the regular measurement range	If sensor 4 available? deactivate sensor cable break? contact service
315	Measured value difference between sensor 1 and Sensor 2	Invalid measurement deviation of two redundant sensors	Control the connector X 14. contact service
316	Short circuit sensor 1	Sensor 1 is lower impedance than permitted	Short circuit in the cable? Contact service
317	Short circuit sensor 2	Sensor 2 is lower impedance than permitted	Short circuit in the cable? Contact service
318	Short circuit sensor 3	Sensor 3 is lower impedance than permitted	Sensor 3 available? Activate sensor. Short circuit in the cable? contact service
321	Over temperature	Over temperature inside the unit or on the cooler	Check supply and exhaust air openings and clean if necessary. Temporary disturbance: PV heater goes back into operation when the temperature has dropped.
411	Overvoltage circuit 1	Exceed voltage in circuit 1 >50 VDC	Disconnect the generator. Check the generator. Series connection of modules not allowed.
412	Overvoltage circuit 2	Exceed voltage in circuit 2 >50 VDC	
413	Overvoltage circuit 3	Exceed voltage in circuit 3 >50 VDC	
421	Reverse polarity circuit 1	Generator 1 is connected with reverse polarity at input X11	Connect the generator with the correct polarity
422	Reverse polarity circuit 2	Generator 2 is connected with reverse polarity at input X11	Connect the generator with the correct polarity
423	Reverse polarity circuit 3	Generator 3 is connected with reverse polarity at input X11	Connect the generator with the correct polarity
511	Primary switch error 1	Failure of the primary switching element in heating circuit 1	Contact service
512	Primary switch error 2	Failure of the primary switching element in heating circuit 2	Contact service
513	Primary switch error 3	Failure of the primary switching element in heating circuit 3	Contact service
521	Secondary switch error 1	Failure of the secondary switching element in heating circuit 1	Contact service

No.	Name	Description	Possible Measures
522	Secondary switch error 2	Failure of the secondary switching element in heating circuit 2	Contact service
523	Secondary switch error 3	Failure of the secondary switching element in heating circuit 3	Contact service
611	Heating element 1 high	Circle 1 of the heating element with high impedance +50% R_{nenn}	Check contacts Replacing the heating element
612	Heating element 2 high	Circle 2 of the heating element with high impedance +50% R_{nenn}	Check contacts Replacing the heating element
613	Heating element 3 high	Circle 3 of the heating element with high impedance +50% R_{nenn}	Check contacts Replacing the heating element
621	Heating element 1 low	Circle 1 of the heating element with high impedance -50% R_{nenn}	Check contacts Replacing the heating element
622	Heating element 2 low	Circle 2 of the heating element with high impedance -50% R_{nenn}	Check contacts Replacing the heating element
623	Heating element 3 low	Circle 3 of the heating element with high impedance -50% R_{nenn}	Check contacts Replacing the heating element
888	Enduring safety failure	One or more of safety-critical errors have happened 7 days in a row.	Device must steadily stop due to legal standard's requirements. Enduring safety failure status can be reset by button in AE Connection Tool or by REFUsol Service. But first, solve the underlying safety issue!

10 Accessories

About AE REFUsol the appropriate temperature sensor with the item number 0034916 is available.

The two external temperature sensors 1 and 2 can be uses, for example, to monitor the course of the storage temperature in detail in the REFUlog portal.

11 Dismantling and Returning

The dismantling takes place in reverse order as the installation.

Carefully repack the PV heater DCLV in case of return under warranty. We recommend you to use the original packaging.

Image 29

12 Disposal

Dispose of the packaging and parts replaced in accordance with the provisions of the country in which the device was installed.

Do not dispose of the appliance with the household waste!

Dispose of the internal battery disconnected to a battery collection point.

The device is RoHS - compliant. Thus the device can only be delivered to local sites for the disposal of household appliances.

REFU sol GmbH take back the device completely. Please contact for the service!

13 Technical Data

Technical data	PV Heater DCLV
Art. No.	**401R1K5**
ELECTRICAL DATA	
Recommended max. PV Power	2,7 kWp
Heat output	1500 W
MPPT Range	18 … 42 V
DC Start Voltage	16 V
Maximum DC Voltage	50 V
Max DC Power	3 x 20 A, Overcrowding up to 30 A permitted
Recommended Type of module	60, 66 or 72 cells, mono or poly
MPP- Trackers	3
Number of DC connections	3 x Spring terminal 2,5 - 6 mm^2
Max / Europ. efficiency	>99 %
From production / Consumption Night	2 W / 0 W
ENVIRONMENTAL CONDITIONS	
Cooling	natural convection
Ambient temperature	-25... +50 °C, De-rating 4 %/K till 70 °C
Air humidity	> 95 %, Condensation not allowed
Altitude, m above N.N	4000 m above N.N
Noise	< 35 dBa
Storage temperature	-25 – 60 °C
STANDARDS AND APPROVALS	
Product standard	EN60335-1, EN60335-2-21, EN60730-1
EMV	EN 61000-6-3, EN 61000-6-2
Internal over voltage protection, type	Type 3 (after EN 61643-1)
Protection class	III (after IEC 62103), PELV
Over voltage category	DC: II (after IEC 60664-1)
Certificates	CE
MANAGEMENT AND COMMUNICATION	
Interfaces	6 Status LED, 1 digital input, Ethernet, 1 x changeover contact (5A, 30V DC). 2 external PT1000 sensors
Monitoring	integrated data logger, Power meters, REFUlog
Maximum heating temperature and security boundary	Shutdown at 85 ° C. configurable up to 80 ° C
MECHANICAL DATA HOUSING	
Type of protection	IP21 after EN 60529
Dimensions width/height/depth, mm	210 x 235 x 90
Weight, kg	1,7
MECHANICAL DATA REFU sol immersion heater	
Material heater rod	High nickel iron chromium alloy
Maximum operating pressure	10 bar
Unheated area	100 mm
Dimension length / Diameter	400 mm / 40 mm
Connection thread	1 ½”
Fitting length	14 mm
Use	Hot water treatment
Weight	1,0 kg

14 Contact

Questions regarding errors or technical problems please contact:

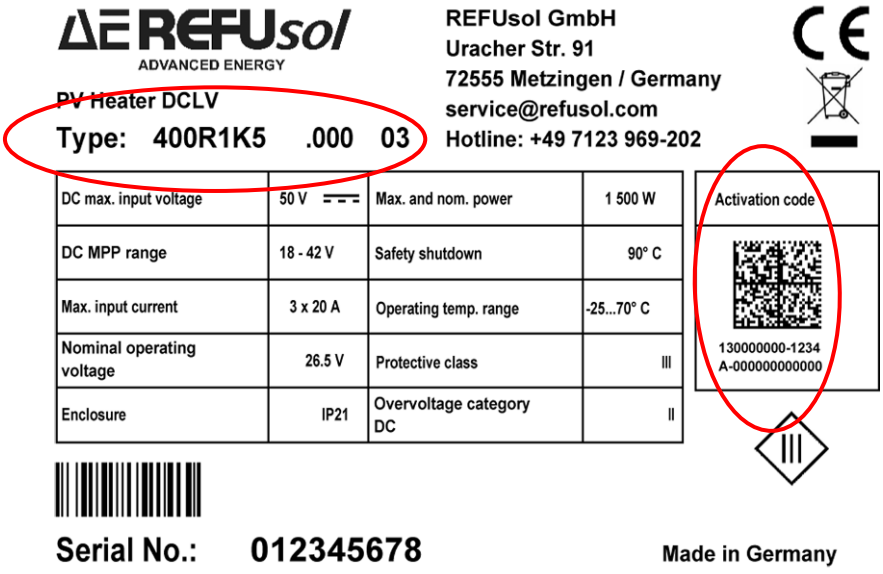
Service-Hotline: +49 7123 969-202 (on working days from 8:00 -17:00 o'clock)

Telefax: +49 7123 969-30202

Email: service@refusol.com

You should have the following information ready

- Exact description of the error.
- Nameplate data
- If required activation code for REFU *log*



Note: The type plate is located on the right side cover. Die Seriennummer ist zusätzlich links auf dem Gerät unter dem Deckel angebracht, um die Zuordnung Gehäusedeckel zu Gerät sicher zu stellen.

15 Certificates

The EG declaration of conformity is available on the homepage for download of the REFU sol GmbH www.refusol.com.

16 Warranty

CERTIFICATE of WARRANTY

for PV heater

We hereby provide a warranty that, if the PV heater breaks down or suffers from a malfunction, we will exchange it on the terms outlined below:

Duration of the warranty: 2 years

1. The REFUsol manufacturer's warranty shall commence upon the PV heater first being commissioned. The warranty shall end upon the expiry of the warranty period.
2. We guarantee that, if the PV heater should break down or malfunction should occur during the warranty period we will send the holder of the warranty a replacement device on the following terms, either ourselves or through a company instructed by us. REFUsol shall be entitled to supply a replacement product, either of identical construction or otherwise a compatible device from a successive series in the same performance category.
3. In order to assert the warranty claim, the failure or malfunction of the device is to be notified to the REFUsol helpline by e-mail, telefax or letter, presenting a copy of the sales receipt.
4. Once a guarantee case has been filed, REFUsol will, either itself or through a company instructed, send the warranty holder a replacement product together with a return delivery note. The replacement product will be free of charge for the holder of the warranty if a warranty claim actually exists (breakdown of the device or malfunction that does not fall under Clause 7), and the holder of the warranty sends the device complained about, with a legible model identification plate, together with a copy of the sales receipt, in the container in which the replacement product was delivered, to the address given on the return delivery note, no later than 10 business days after delivery of the replacement product.
5. The costs of sending the equipment back and forth from/to the site of the product complained of are to be borne by the warranty holder.
6. This warranty does not cover any claims not expressly mentioned in this certificate of warranty.
7. The warranty does not cover any defects caused by modifications to or intervention with the device undertaken by individuals not authorised by REFUsol in this respect, defective installation or commissioning by the holder of the warranty or a third party, not adhering to the instructions given in the operating manual (e.g. the rules in regard to shipping, packaging, storage, protection from corrosion, handling, installing, commissioning and use), technical specifications and any pertinent safety regulations, improper use or Acts of God (e.g. being struck by lightning, excess voltage, storm, fire, being nibbled by rodents, etc.). Also excluded from the warranty are any defects in construction based on instructions given by REFUsol's customer if REFUsol had pointed the risks out to the customer in writing, as well as the usual wear and tear of the heating element. The usual wear and tear of the heating element shall primarily also depend upon the water hardness, and shall, for technical reasons, be increased with increased or decreased water hardness.
8. The holder of the manufacturer's warranty may transfer its rights and obligations arising from this warranty to third parties. REFUsol shall likewise be entitled to assign any rights and obligations arising from this manufacturer's warranty to third parties.
9. Should it transpire that no warranty claim exists, or should the warranty holder making a claim not fulfil its obligations, REFUsol shall be entitled to charge the warranty holder for any expenditure incurred to REFUsol through the warranty claim being asserted, including the costs of the replacement product.
10. This manufacturer's warranty is governed by German law, with the exception of German international private law. It does not limit the warranty claims of REFUsol's customer, and is given in addition to the customer's warranty claims.

17 Notes

REFUsol GmbH

Uracherstraße 91

D-72555 Metzingen / Deutschland

Tel: +49 7123.969 202

Fax: +49 7123.969 302 02

info@refusol.com

www.refusol.com

Art.No.: 0034956