



Original operating instructions

PV Max-Heater F12

As at July 2026

INFORMATION

These operating instructions form part of the technical documentation for the device in accordance with:

- Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
- Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment

These operating instructions are intended for the operator and must be provided to staff who come into contact with the equipment. The operator must ensure that the information contained in these operating instructions and the accompanying documents is read and understood.

NOTE

In case of the slightest doubt, the operating instructions must be consulted and kept in a known and easily accessible place.

The manufacturer accepts no liability for damage to persons, animals, property or the equipment itself resulting from:

- improper use,
- failure to observe instructions,
- insufficient attention

of the safety guidelines contained herein, or caused by:

- modification of the device,
- the use of unsuitable spare parts.

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ratiotherm

Smart Energy Systems

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For ease of reading, the generic masculine form is used in this original operating manual. The terms used to refer to persons apply to all genders.

Date: 7 October 2024

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1. INFORMATION ABOUT THIS DOCUMENT

The following notes serve as a guide through the complete documentation. Other documents are valid in conjunction with these operating instructions. These operating instructions for qualified tradespeople form an integral part of the PV Max-Heater unit. The ratiotherm PV Max-Heater unit must not be operated without this document.

The operating instructions must be made available to the operator and the qualified installer at all times for reference. If the PV Max-Heater is sold, the instructions must be supplied with it. We accept no liability for damage resulting from failure to comply with these instructions.

1.1 SAFETY AND WARNING NOTICES

Signal words and colours

The following signal words are based on DIN ISO 3864-2 and are used in this documentation. The safety colours have been adopted from the DIN ISO 3864-1 standard. The design complies with DIN EN 82079-1 and ANSI Z 535.4.

Signal	Explanation
DANGER	Indicates a dangerous situation which, if ignored, will result in death or serious injury.
WARNING	Indicates a dangerous situation which, if ignored, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if ignored, may result in minor injuries and damage to property.
NOTE	Indicates tips to make operation easier and cross-references. A note does not involve any risk of property damage or personal injury.

1.2 SAFETY SYMBOLS

1.2.1 OTHER SYMBOLS IN ACCORDANCE WITH DIN EN ISO 7010

Some of the following specific safety symbols in accordance with DIN EN ISO 7010 and DIN ISO 3864 are used at the relevant points in this operating manual and, depending on the combination of signal word and graphic symbol, require special attention. Please note the distinction between:

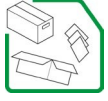
- Mandatory signs ⇨ prescribe an action (e.g. 'Use eye protection').
- Warning signs ⇨ depict a source of danger and accompany a warning message.
- Prohibition signs ⇨ prohibit certain actions.

Symbol	Explanation	Symbol	Explanation
	General warning sign		Warning: flammable substances
	Warning of electrical voltage		General prohibition sign
	Warning: hot surfaces		No entry
	Follow instructions		General mandatory sign
	Disconnect before maintenance or repair		Use hand protection

1.2.2 OTHER SIGNS IN ACCORDANCE WITH DIN ISO 7000

Symbol	Explanation	Symbol	Explanation
	Refer to the operating manual (user guide)		Service indicator, Refer to the user manual (operating instructions)
	User guide/Operating instructions (user manual)		

1.2.3 OTHER SYMBOLS

Symbol	Explanation	Symbol	Explanation
	Recycling		Dispose of packaging material in accordance with regulations

2. IDENTIFICATION AND NOTES

2.1 PRODUCT DATA

Product name: PV heater / surplus electricity heater Type: PV
 Max-Heater
 Year of manufacture: see type plate
 Country of origin: Germany

2.2 INTENDED USE

The PV Max-Heater unit uses surplus electricity from renewable energy systems (e.g. PV systems) to directly support the heating system and provide hot water. Any other or extended use of the unit is considered improper and therefore incorrect. In such cases, the unit's safety and protective functions may be compromised. ratiotherm GmbH & Co. KG accepts no liability for any damage resulting therefrom. Intended use also includes:



- following all instructions in this operating manual,
- obeying all warnings, and
- adhering to the inspection and maintenance requirements.

The PV Max-Heater is state-of-the-art and has been manufactured in accordance with recognised safety standards. The appliance is intended exclusively for domestic and/or commercial use for direct heating support and hot water production from surplus electricity.



Improper or unauthorised use may pose a risk to the life and limb of the user or third parties. Furthermore, it may result in damage to the device and other property. The device is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or by persons with a lack of experience and/or knowledge. The risk is borne solely by the operator and the user.

2.3 TARGET GROUPS

For safety reasons, the design of the device does not permit its use by people with disabilities (e.g. visual impairments).

DANGER Only carry out tasks for which you are authorised.

2.3.1 TARGET GROUP MATRIX

Tasks	Operators and users	Qualified personnel
Transport/Storage		X
Assembly/Installation		X
Commissioning/Adjustment		X
Automatic operation (control)	X	X
Set-up/Conversion/Technical Modification		X
Maintenance/inspections/repairs		X
Cleaning	X	X
Troubleshooting/Fault rectification		X
Decommissioning/Dismantling/Disposal		X

2.3.2 TARGET AUDIENCE DEFINITION

Users and operators

A person who has purchased the appliance for use in an existing system for direct heating support and domestic hot water production. The person must have knowledge of the necessary safety devices and protective measures.

Qualifications for operators and users:

- Of legal age and physically and mentally capable of carrying out work on the appliance
- Knowledge of how to operate the product, provided by qualified personnel and the operating instructions



Qualified personnel

A person employed by a qualified specialist firm for heating systems and domestic hot water supply. The qualified personnel must have acquired specialist knowledge and experience through professional training. The person must have knowledge of relevant standards, be able to assess the tasks assigned to them (e.g. instructing staff, switching on, programming and switching off) and be able to identify potential hazardous situations.

Qualifications for qualified personnel:

- Of legal age and physically and mentally fit to carry out work on the equipment
- Knowledge and several years' experience of working on heating and hot water supply systems

2.4 INCORRECT USE

2.4.1 REASONABLY FORESEEABLE MISUSE

Reasonably foreseeable misuse that poses a risk to personnel, third parties or the appliance applies to all operating modes:

- Using the appliance contrary to its intended use
- Fitting components that are not certified by the manufacturer
- Operating the device outside its physical operating limits
- Modifying the control software without prior consultation with ratiotherm GmbH & Co. KG
- Modifications to the equipment, as well as additions and alterations, without prior consultation with ratiotherm GmbH & Co. KG
- Operating the device contrary to the provisions of the risk assessment
- Bypassing or deactivating protective and safety devices
- Operating the device whilst it is clearly malfunctioning
- Operating the appliance by persons with reduced physical, sensory or mental capabilities, or by children



DANGER

Unauthorised modifications to the equipment

Unauthorised modifications pose a risk of death or injury.

Do not carry out any unauthorised modifications to the appliance without prior approval from ratiotherm GmbH & Co. KG.

2.4.2 UNFORESEEABLE INCORRECT USE/MISUSE

Unforeseeable misuse may occur as a result of:

- disasters,
- the impact of foreign objects and/or
- force majeure.

2.5 WARRANTY, LIABILITY, GUIDELINES, STANDARDS AND LAWS

In principle, the 'General Terms and Conditions of Sale and Delivery' of ratiotherm GmbH & Co. KG apply. The 'General Terms and Conditions of Sale and Delivery' are made available to the operator no later than upon conclusion of the contract. Warranty and liability claims for personal injury and property damage are excluded if the damage is attributable to one or more of the following causes:

- Improper use of the appliance
- Improper handling of the appliance
- Operation of the appliance whilst safety devices are defective
- Failure to observe the safety and warning instructions in the operating instructions
- Unauthorised structural modifications to the equipment
- Failure to carry out the specified maintenance measures
- Disasters involving foreign objects or force majeure

The operating instructions must be read before handling the equipment. The operating instructions familiarise staff with the handling of the equipment and provide details on all stages of the equipment's service life.

The operating instructions must be accessible to staff at all times. The safety and warning instructions contained in the operating instructions and on the appliance must be observed and complied with. Should you have any further questions beyond the scope of these operating instructions, please contact ratiotherm GmbH & Co. KG.

When using the appliance in Germany, the following directives, standards and laws must be observed in particular:

- VDE and electricity supply company regulations and provisions (in particular VDE 0100)
- Regulations and provisions of the local utility companies
- DVGW Worksheet W 382 'Installation and operation of pressure-reducing valves in drinking water consumption systems'
- DIN 1988 – TRWI Technical Rules for Drinking Water Installations
- DIN 4753 – Water heating systems for drinking water and service water
- Accident Prevention Regulations VGB 20 'Refrigeration Systems' with implementation instructions
- Energy Saving Ordinance (EnEV) – Ordinance on energy-saving thermal insulation and energy-saving building services equipment in buildings, 2009



NOTE

Guidelines, standards and legislation

Further guidelines, standards and laws, e.g. building regulations, may apply locally. As a general rule, the statutory guidelines, standards and laws applicable in the respective country must be observed.

3. SAFETY INSTRUCTIONS

DANGER

Read and follow the operating instructions before you start working on or with the equipment.

Despite all the precautions taken, there may still be residual risks that are not immediately apparent. You can reduce these residual risks by observing and complying with the general safety instructions and warnings, as well as by using the equipment for its intended purpose.

3.1 GENERAL SAFETY INSTRUCTIONS

Observe the following general safety instructions:

- The volume of water increases during the heating process. Therefore, never block the safety valve's discharge pipe.
- Be aware that hot water may escape from the relief pipe.
- If there are any leaks in the vicinity of the unit, switch it off and isolate it from the rest of the heating system. The leaks must then be rectified immediately.
- To prevent corrosion of the appliance, do not use the following products: sprays, solvents, chlorine-based cleaning agents, paints, adhesives, etc.
- Components that have not been tested with the appliance may cause damage to it or impair its functions. Use only original spare parts and original wear parts.
- Have the assembly, installation, commissioning and adjustment of the appliance carried out only by qualified personnel.
- Observe the applicable regulations, rules and guidelines, as well as local installation requirements.
- To prevent injuries of any kind, the general accident prevention regulations must be observed under all circumstances and appropriate personal protective equipment must be used.
- Technical modifications to the system are not permitted. This also applies to the retrofitting of safety devices and to welding on load-bearing parts. Safety devices must not be taken out of service. Only original spare parts and original accessories from the manufacturer must be used.

3.2 ADDITIONAL NOTES

Local accident prevention regulations apply to all work carried out on the equipment. The following must also be observed:

- applicable mandatory regulations on accident prevention
- recognised technical rules for safe and professional working practices
- existing environmental protection regulations
- any other applicable regulations

The outlet temperature at the hot water taps can reach up to 60 °C. Carefully check the water temperature at the hot water taps before placing your hands fully under the water jet.

Do not make any modifications to the following components:

- PV Max-Heater and water and electricity pipes
- Safety valve
- structural conditions that may affect the operational safety of the appliance
- structural conditions in the vicinity of the appliance, insofar as these may affect the operational safety of the appliance

3.3 RESIDUAL RISK



WARNING

Actions/work carried out by unauthorised/unqualified personnel

Measures/work carried out on the equipment and/or its components and connections by unauthorised/unqualified personnel pose a risk of serious injury.

In the event of a fault, ensure that any work on the device and/or its components and connections is carried out only by qualified personnel.



WARNING

Damaged insulation

Damaged insulation poses a serious risk of burns from hot and/or cold surfaces.

Protect yourself with suitable PPE (e.g. heat- and cold-resistant protective gloves). Allow hot or cold surfaces to cool down or warm up before carrying out any work. Replace any damaged insulation.



WARNING

Ignition sources in the hazard zone

Ignition sources in the hazard zone can cause flammable substances to ignite and/or explode.

Keep ignition sources away from the hazard zone.

4. DESIGN AND FUNCTION

4.1 TECHNICAL SPECIFICATIONS

Max-Heater	F12	F12 + 9 kW immersion heater	Unit
Hydraulics			
Flow rate	500 to 2500	500 to 2500	Ltr./h
Max. temperature	85	85	°C
Connections	6/4" male thread	6/4" male	
Capacity	approx. 4	approx. 5	litres
Max. system pressure	3	3	bar
Max. temperature difference at full load	20	35	K
Unit data			
Dimensions	1364 x 460 x 198	1564 x 460 x 198	WxHxD (mm)
Unladen weight	39	390 + 11	kg
Electrical			
Mains connection	400 V / 3-phase / 50 Hz	400 V / 3-phase / 50 Hz	
Max. operating current	24	32	A
Fuse rating	B25	B32	
Components			
Material			
Seal	Rubber and paper seal		
Insulation	Armaflex		
Heating element	Stainless steel		

4.2 FUNCTIONAL DESCRIPTION

The PV Max-Heater F12 has been developed to utilise surplus electricity from renewable energy systems, such as domestic PV installations, and offers a genuine alternative to EEG feed-in tariffs. It also provides a solution for systems that are phasing out of the EEG scheme.

The integrated energy meter reliably records surplus electricity and determines the available energy in real time (after deducting all domestic consumers). The surplus energy is fed to the continuously adjustable electric heating elements, which convert the electricity into heat and thereby charge the heat storage tank. The PV Max-Heater F12 varies the speed of the integrated pump depending on the amount of electricity available, thereby consistently producing heating water at a fixed temperature – comparable to a conventional heating system. Heat is produced exclusively at the required temperature level. This is one of the greatest advantages of the PV Max-Heater over conventional heating elements!

In this way, the surplus power from a PV system is converted into thermal energy and stored as renewable energy. The intelligent control system increases self-consumption of renewable electricity and reduces the costs of conventional generation.

The PV Max-Heater can also be used as an emergency heater powered by mains electricity.

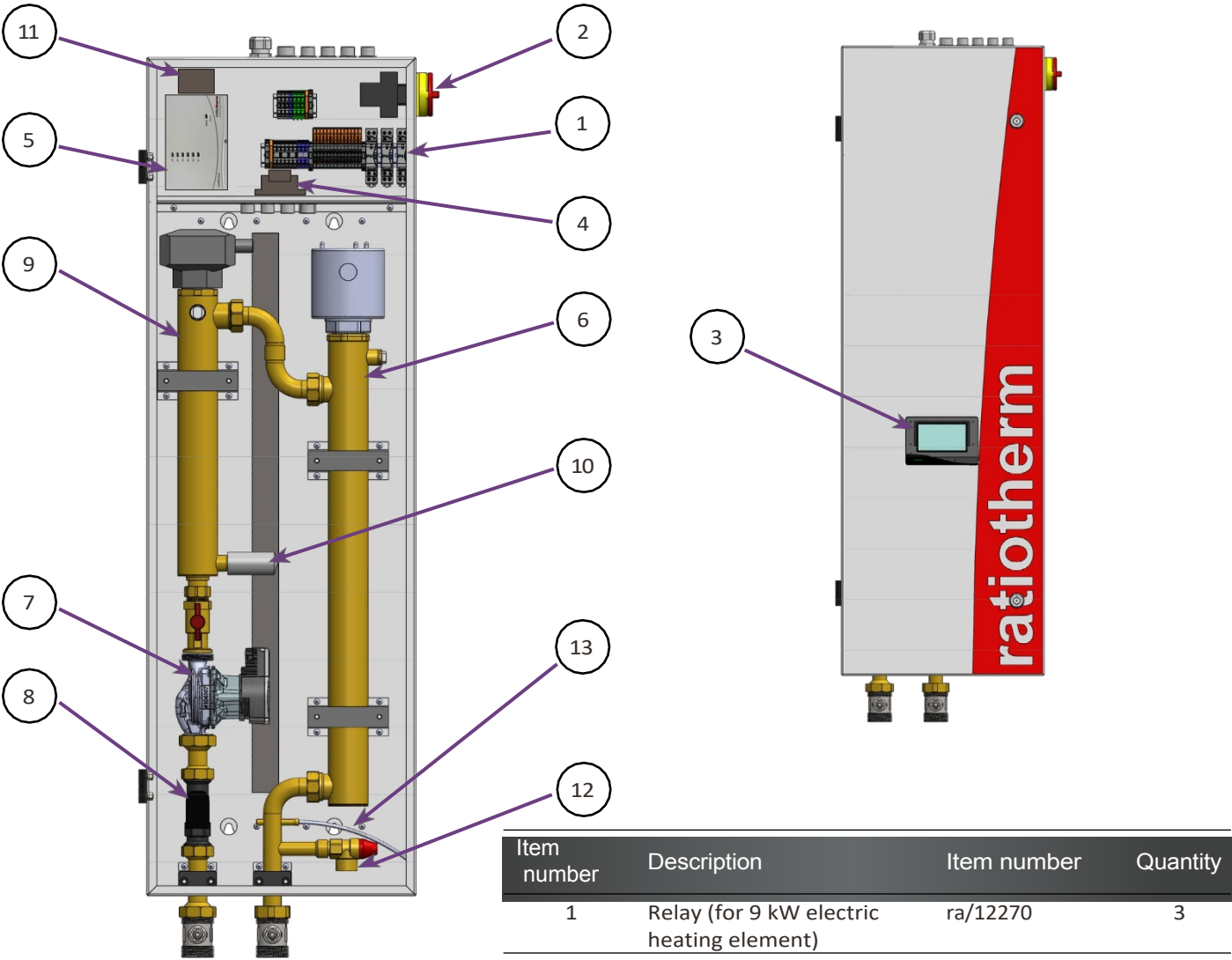
ADVANTAGES

- Direct heating support and hot water production using surplus green electricity
- Significantly more effective than a conventional heating element
- Cost-effective use and storage of natural energy outside the scope of the EEG
- Higher returns as grid feed-in contracts come to an end
- Quick and easy retrofitting for existing buildings
- Sustainable, climate-friendly and independent
- Fixed flow temperature setting for immediate use of the energy
- Can also be used as an emergency heat generator (mains power supply)
- Power range: 0.1 to 12 kW, fully modulating
- With ratiotherm components, a fully coordinated and future-proof system



4.3 CONSTRUCTION AND SPARE PARTS

The ratiotherm PV Max-Heater is dispatched in a fully operational condition. The unit is controlled by the UVR 610K o.D. controller and the CAN-MTx2 from Technische Alternativen. The CAN-MTx2 display shows all the unit's parameters and operating statuses. The ratiotherm PV Max-Heater can be operated in conjunction with most electric, gas or oil boilers.



RAL 9016
Traffic white

Item number	Description	Item number	Quantity
1	Relay (for 9 kW electric heating element)	ra/12270	3
2	Main switch	ra/14466	1
3	CAN monitor	ra/95.10.3212	1
4	C.M.I.		1
5	Universal controller	ra/14414	1
6	9 kW electric heating element	ra/14437	1
7	Pump	ra/13310	1
8	Flow sensor	ra/95.85.4525	1
9	3 kW heating element	ra/14425	1
10	Pressure sensor	ra/11656	1
11	Contactor (for auxiliary heating element)		1
12	Diaphragm safety valve		1
13	Temperature sensor		1
14	Immersion probe		

4.4 CONTROL LOGIC AND DRIVE

Control logic in conjunction with PV Max-Control (CAN-EZ3):

- The PV Max-Heater communicates with the PV Max-Control via CAN bus.
- The PV Max-Heater automatically regulates to a specified surplus level.

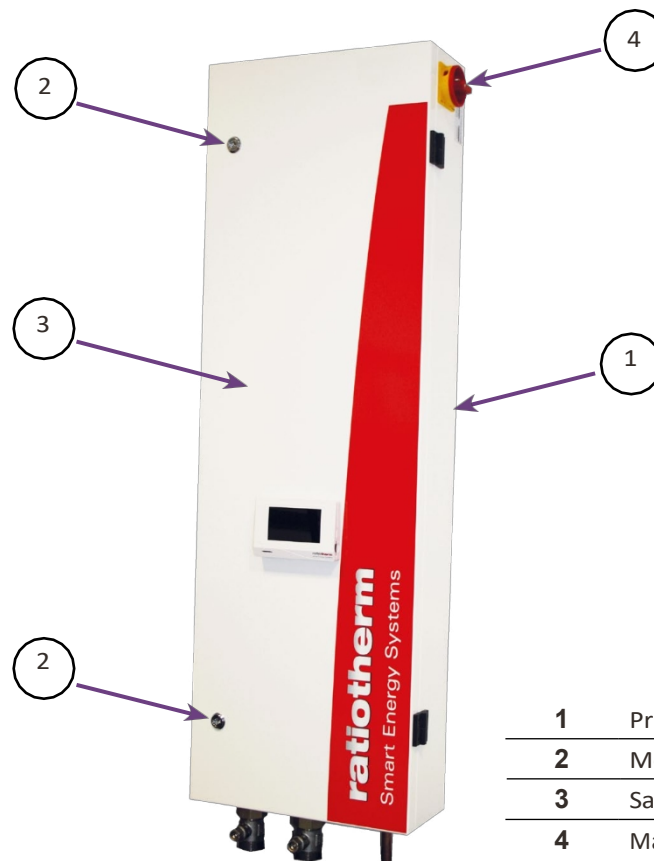
Control logic in conjunction with third-party controllers:

- The command from an external controller takes priority over the ratiotherm controller.
- An enable contact can be switched by an external control system. The external control system is connected to the universal controller. A separate tank sensor must always be provided when using external control.
- If a potential-free contact is present, the PV Max-Heater automatically regulates itself to a setpoint output.
- If a 0–10 V signal is applied, the 'Temperature control' fixed value can be used to determine whether a setpoint power or a setpoint temperature is to be transmitted.



4.5 SAFETY DEVICES

The unit is equipped with various safety devices. The safety devices are shown in the following diagram:



1	Protective enclosure or housing
2	Mechanical lock
3	Safety door
4	Main ON/OFF switch

5. TRANSPORT, ASSEMBLY AND INSTALLATION

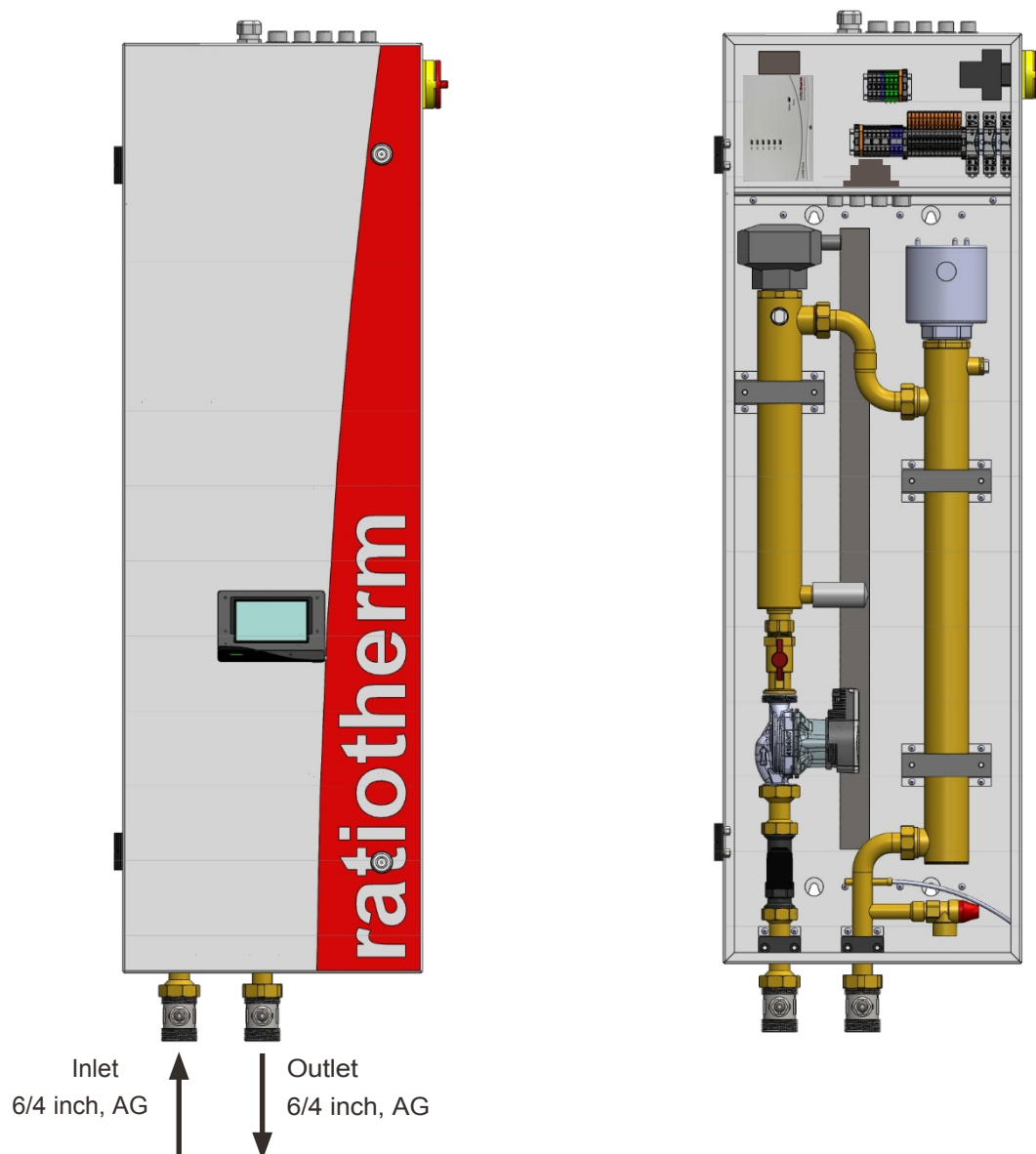
5.1 TRANSPORT AND UNPACKING

The following instructions regarding the transport of the unit must be observed:

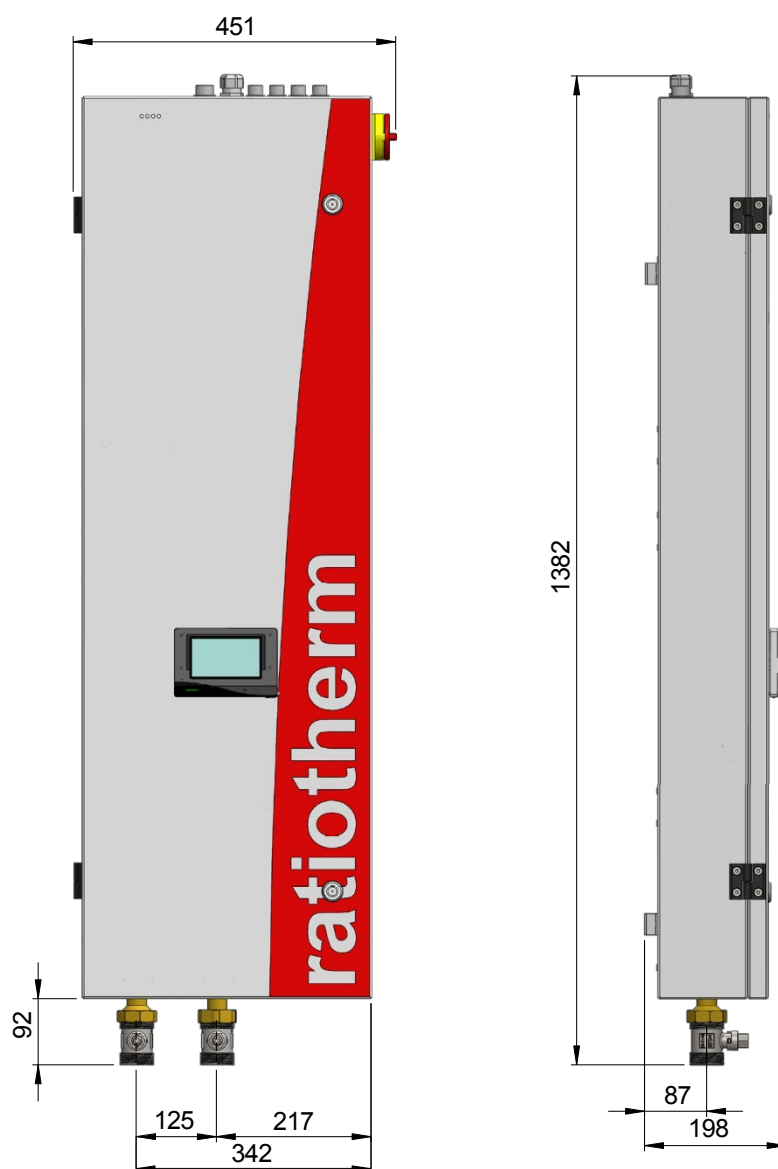
- Only allow qualified specialist personnel to carry out transport.
- Protect yourself by wearing PPE (e.g. safety footwear, etc.).
- Take the weight of the unit into account (approx. 39 kg or 50 kg with additional heating element) when selecting the appropriate lifting equipment (forklift, pallet truck, handcart, etc.).
- Take the device's centre of gravity into account.
- Remove all packaging materials.

NOTE Do not damage the device when removing the packaging materials.

- When disposing of the transport and storage packaging, comply with local waste disposal regulations and applicable environmental protection laws.
- When unpacking the device, check that the delivery is complete.
- Use the delivery notes and packing lists supplied to check the contents.



5.2 MECHANICAL INSTALLATION



Front and side views. All dimensions are given in millimetres.

The responsible qualified tradesman (qualified personnel) must ensure the following measures are taken:

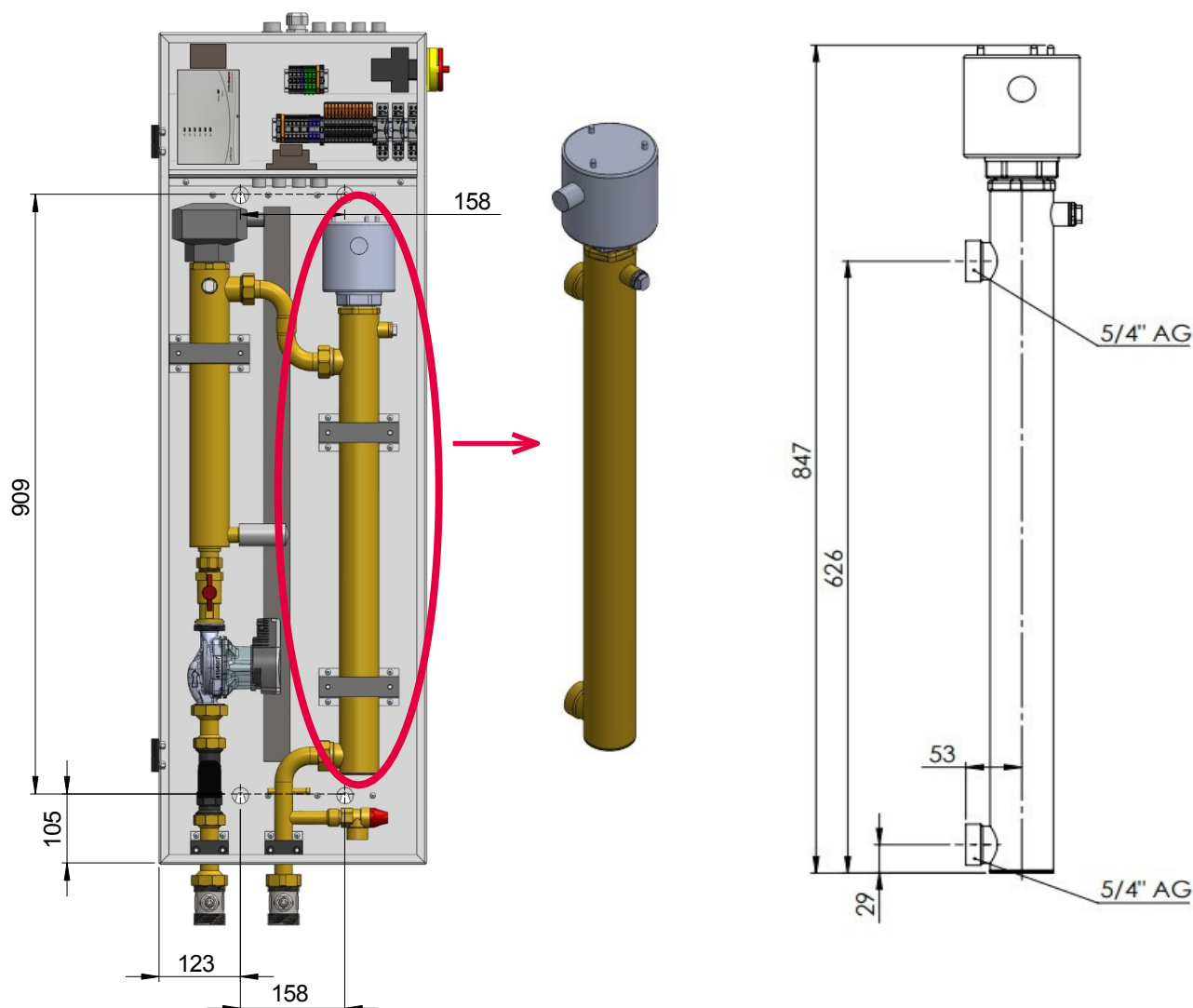
- Illuminate the work area for assembly and installation with additional lighting units where necessary.
- Staff have the necessary qualifications and receive the required training.
- Staff have read and understood the operating instructions.
- Staff have access to the operating instructions at all times.
- Local accident prevention and environmental regulations are implemented and complied with.
- Staff are briefed by the relevant supervisor and unauthorised persons are kept away from the unit.
- The unit is only handed over and operated when it is in a safe and serviceable condition, and any damage to the heat pump is rectified immediately or the damaged heat pump is taken out of service straight away.

Storage conditions:

- Care must be taken to ensure frost-free storage.

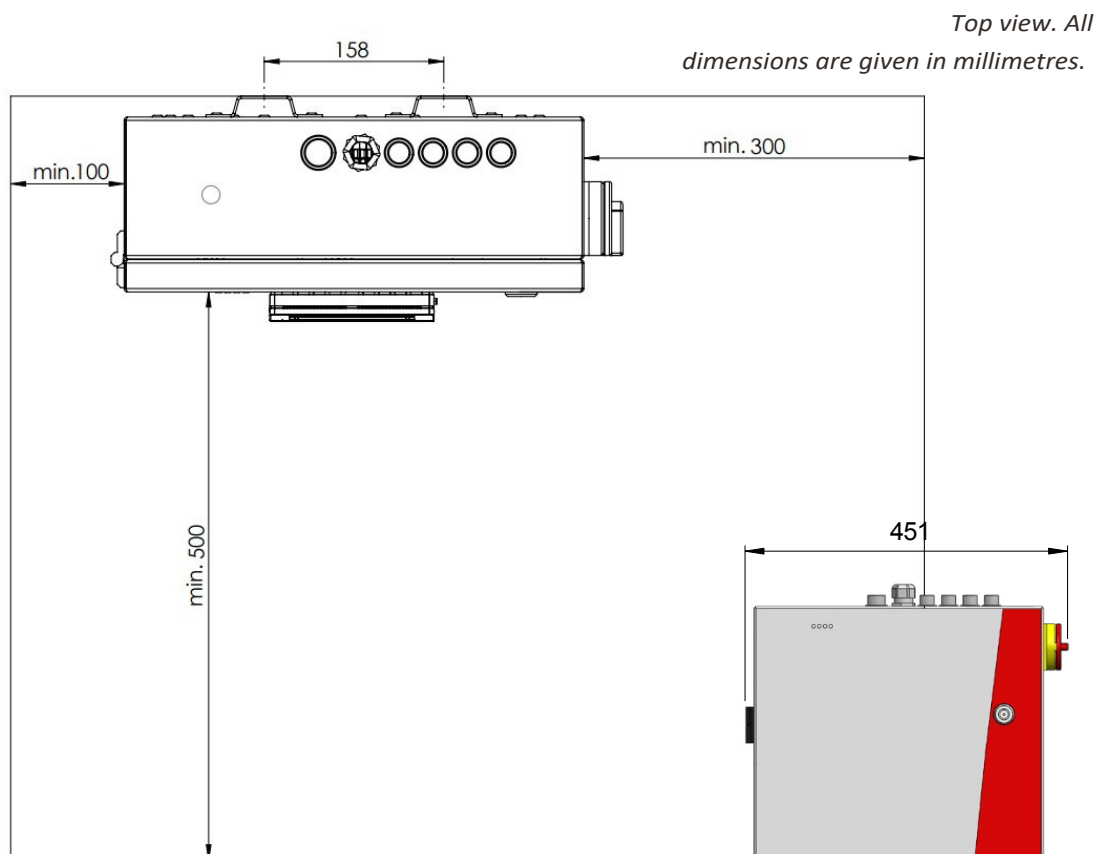
Installation conditions:

- A floor drain must be provided to protect against water damage.
- The ratiotherm PV Max-Heater must be installed in a clean, well-ventilated and dry location.
- The ambient temperature must be consistently $> 5^{\circ}\text{C}$ and $< 40^{\circ}\text{C}$.
- The minimum clearances must be observed for maintenance purposes.
- The weight of the WP Max-Heater is approximately 43 kg (55 kg with additional heating element) during operation. The static load-bearing capacity of the wall must be checked before installing the unit.
- A suitable fixing system must be selected depending on the nature and construction of the wall. The recommended installation height is 2 metres. The height can be adjusted as required.
- Drill holes: 4 x 10 $\varnothing$



All dimensions are given in millimetres.

5.2.1 MAINTENANCE AREA



5.3 HYDRAULIC INSTALLATION

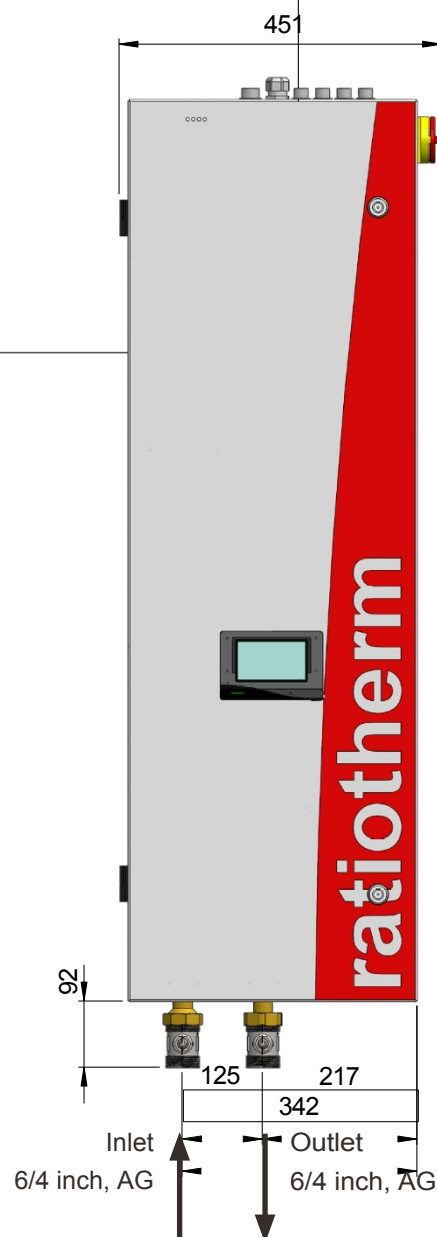
5.3.1 CONNECTION DIMENSIONS AND SIZES

- Vent valves must be fitted at high points.
- A magnetite separator and a sludge separator should be fitted.
- Please hold the connections in place whilst tightening!

	DN25	DN32	DN40
PV Max-Heater F12	up to 6 m	up to 21 m	up to 56 m
PV Max-Heater F12 + 9 kW immersion heater	-	up to 7 m	up to 25 m

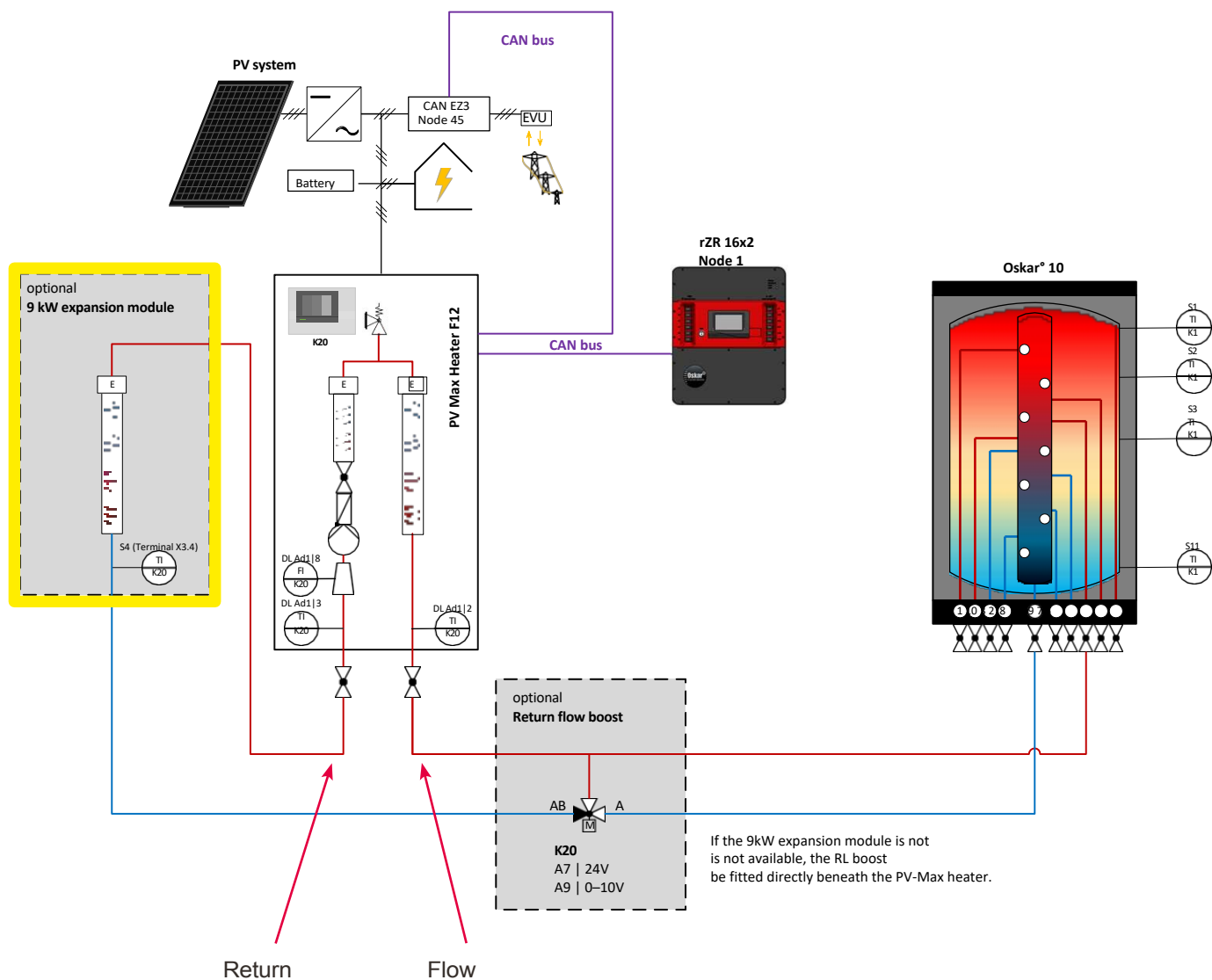
Available pressure head over the entire length: 10,000 Pa

Assumed pipe friction coefficient: $\lambda = 0.0070$ mm



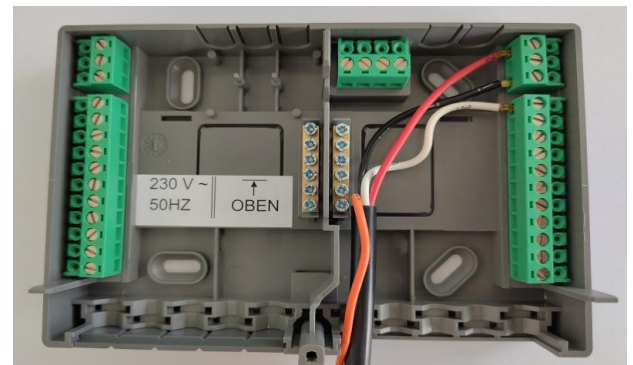
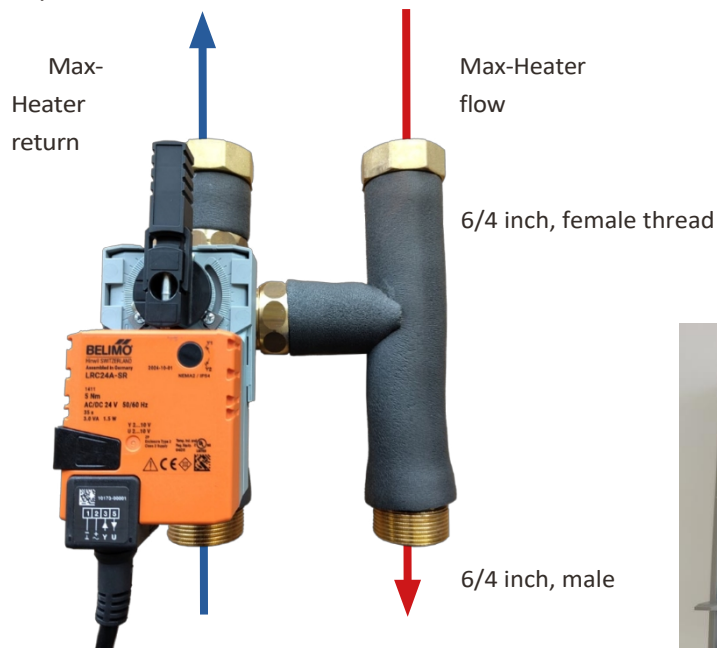
5.3.2 OPTION: ADDITIONAL HEATING ELEMENT

The additional heating element must be installed in the return pipe of the main unit.

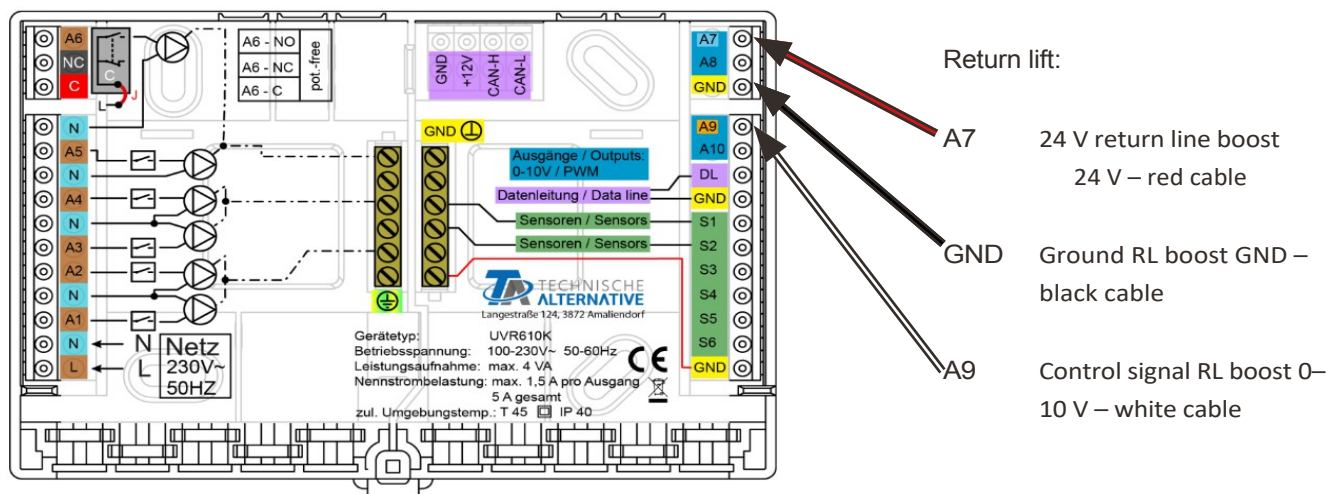


5.3.3 OPTION: RETURN FLOW RAISE

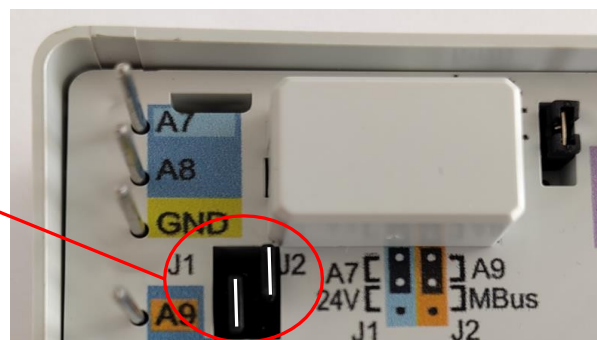
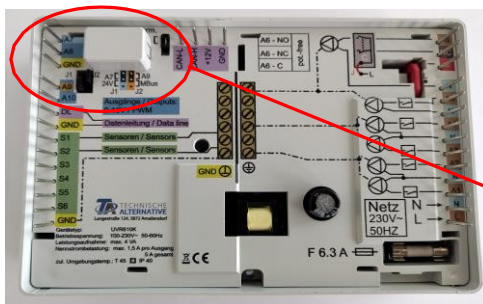
It is possible to integrate the PV Max-Heater hydraulically with a return flow boost. To do this, an electric 3-way valve is fitted between the flow and return lines of the Max-Heater. This enables the PV Max-Heater to deliver high temperatures immediately.



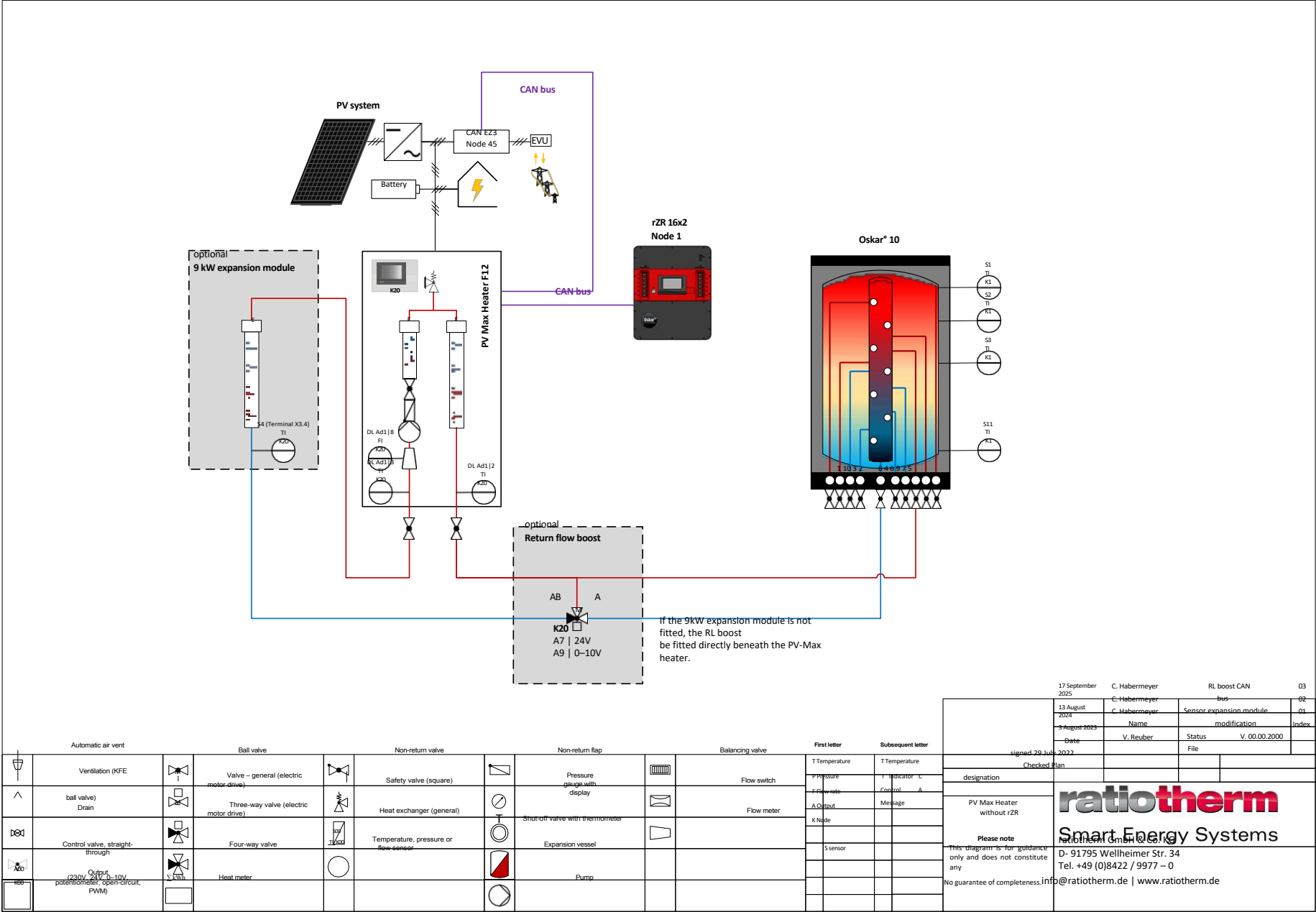
Node 20:



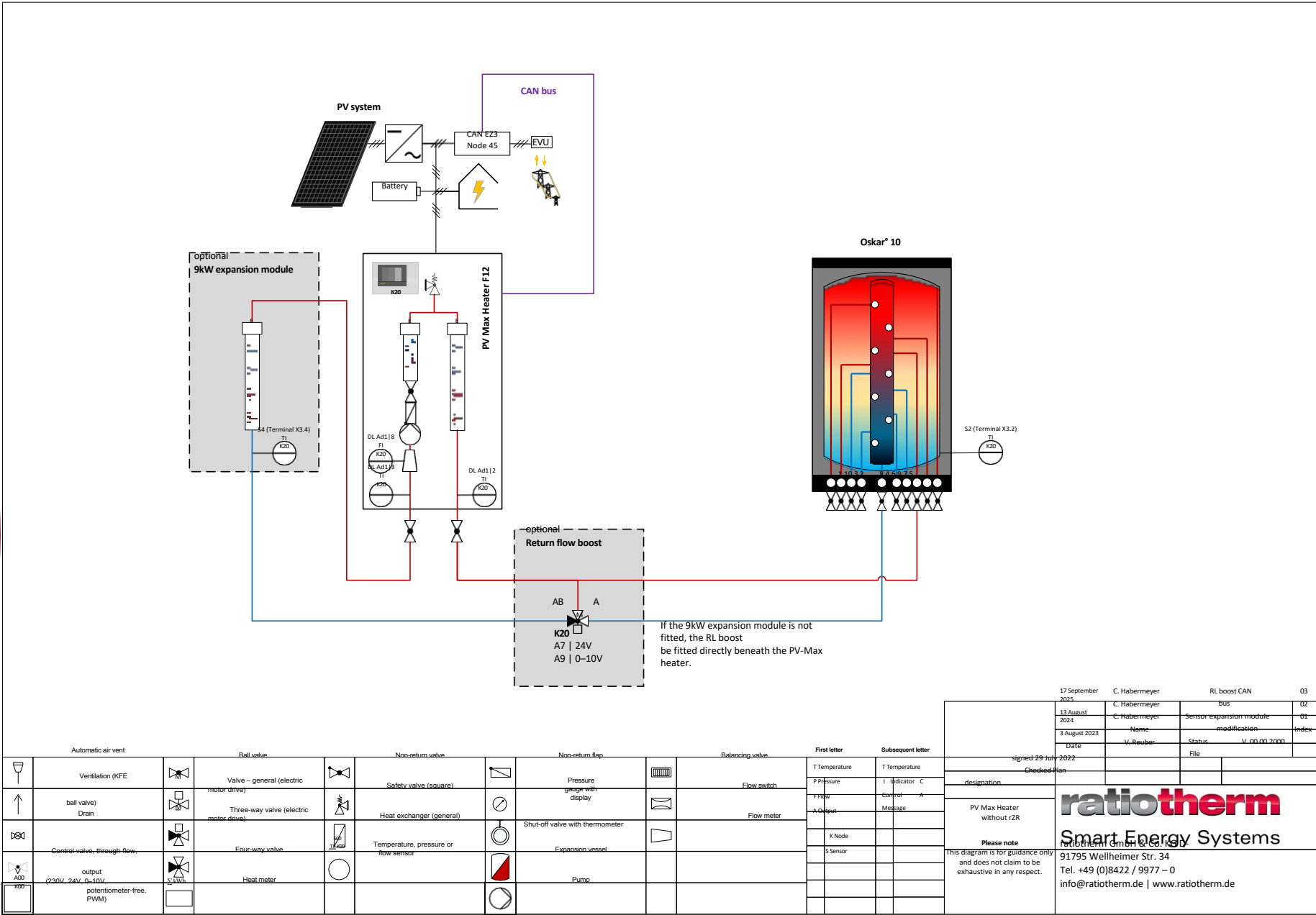
Jumper J1 must be set to 24 V:



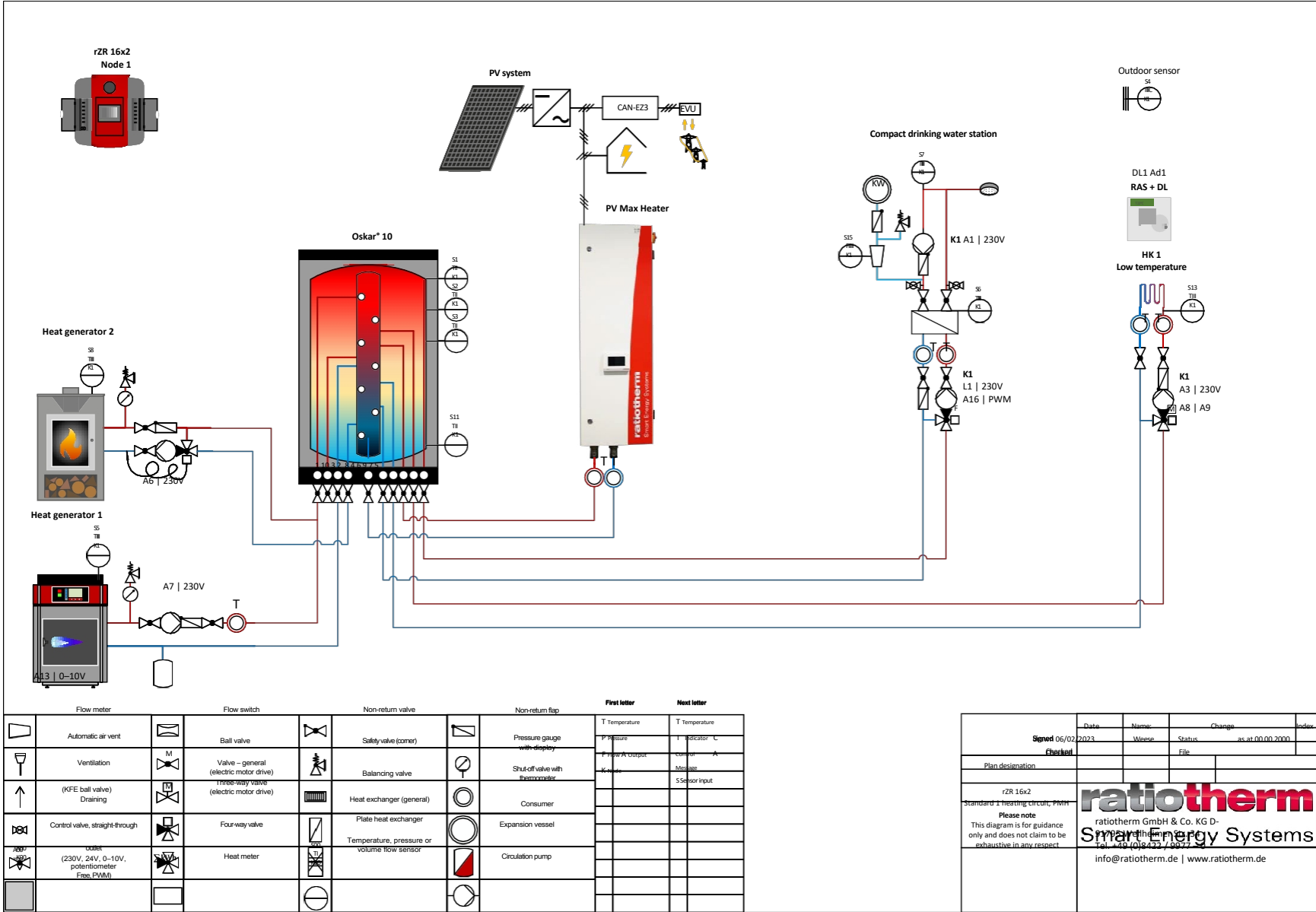
5.3.4 HYDRAULIC DIAGRAM WITH rZR 16x2



5.3.5 HYDRAULIC DIAGRAM WITHOUT rZR 16x12



5.3.6 HYDRAULIC DIAGRAM: STANDARD WITH ADDITIONAL HEATER



5.3.7 REQUIREMENTS FOR THE SYSTEM WATER

Parameter	Unit	Concentration	Copper, brazed
pH	/	< 6.0	-
		6.0 – 7.5	°
		7.5 – 8.5	+
		8.5–10.0	°
		> 10	°
Conductivity	μS/cm	< 10	+
		10–500	+
		500–1,000	°
		> 1,000	-
Chloride	mg/L	< 10	+
		10–50	+
		50–80	+
		80–100	+
		100–1,000	°
Free chlorine	mg/L	< 0.5	+
		0.5–1.0	+
		1.0–5.0	°
		> 5.0	-
Total hardness	°dH	< 5	+
		5–15	+
		15–30	°
		> 30	-
Ammonia (NH_3 , NH_4^+) ₄	mg/L	< 2	+
		2–20	°
		> 20	-
Alkalinity (HCO_3^-)	mg/L	< 60	+
		60–300	+
		> 300	°
Sulphate (SO_4^{2-}) ₄	mg/L	< 100	+
		100–300	°/-
		> 300	-
$\text{HCO}_3^- / \text{SO}_4^{2-}$ _{3 4}	mg/L	> 1.5	+
Nitrates (NO_3^-) ₃	mg/L	≤ 1.5	°/-
		< 100	+
Hydrogen sulphide (H_2S) ₂	mg/L	> 100	°
		< 0.05	+
Free carbon dioxide (CO_2)	mg/L	> 0.05	°/-
		< 5	+
		5–20	°
Manganese	mg/L	> 20	-
		< 0.1	+
Iron (Fe)	mg/L	> 0.1	°
		< 0.2	+
Aluminium	mg/L	> 0.2	°
		< 0.2	+

NOTE

- The system water must contain no more than 50% glycol.
- Ensure that the system water meets all requirements. If the properties are not optimal (°) for more than two criteria, or if a criterion does not meet the minimum requirement (-), no warranty claim can be made.

5.4 ELECTRICAL INSTALLATION



DANGER

- The heater’s power supply comes from the building’s distribution board and must be protected by a separate Type A residual current circuit breaker (RCD) with a trip current of no more than 30 mA and with an appropriately rated capacity.
- The RCD must be clearly labelled separately for the heater, e.g. as ‘P2H’. Please ensure the correct assignment of phase and neutral conductors during wiring.
- Ensure that the rotating field is clockwise.
- The appliance must be earthed.
- Use cable cross-sections appropriate to the heater’s power rating.
- The electrical installation must comply with the applicable standards and generally accepted rules of good engineering practice.
- Never carry out work on the hydraulic or mechanical parts of the unit whilst it is live.
- The same applies when filling the system or pressurising it subsequently.
- Even when the unit’s main switch is switched off, voltage is still present at the cable terminal.
- To completely isolate the unit from the mains supply, the RCD in the control cabinet must be switched off.
- Maintenance work must only be carried out by an authorised person.
- Never short-circuit the heat pump’s safety pressure relief valve.

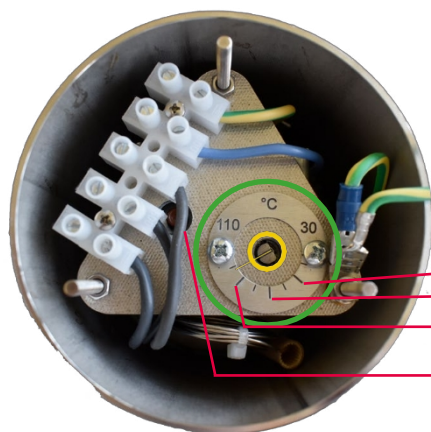
5.4.1 ELECTRICAL CONNECTION SPECIFICATIONS

WARNING

- We reserve the right to correct any errors and to amend all information, images and drawings.
- Warning! Installation and wiring must only be carried out by authorised qualified personnel.
- The generally applicable and recognised rules of good engineering practice, as well as any local regulations, must be strictly observed.
- The values apply to installation in conduits with a cable length of up to 100 m.

	Type	
PV Max-Heater F12	Fuse	B25 3-pole
	Cable cross-section	5G 4 mm ²
PV Max-Heater F12 + 9 kW heating element	Fuse	B32 3-pole
	Cable cross-section	5G 4 mm ²

5.4.2 ADJUSTMENT OF THE AUXILIARY HEATING ELEMENT



When using the additional heating element, ensure that the screw tip, outlined in yellow, is set to 90 °C. If this is not the case, the screw tip must be carefully turned to 90 °C.

The heating element can be set between 30 °C and 110 °C.

- 50 °C
- 70 °C
- 90 °C
- Safety temperature limiter (STB)

5.4.3 INTERFACE DESCRIPTION OF THE PV MAX HEATER

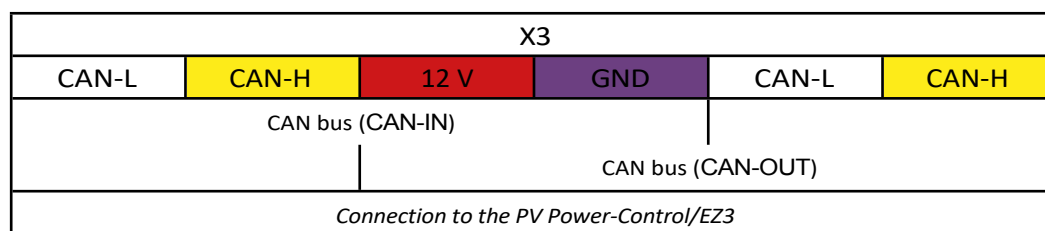
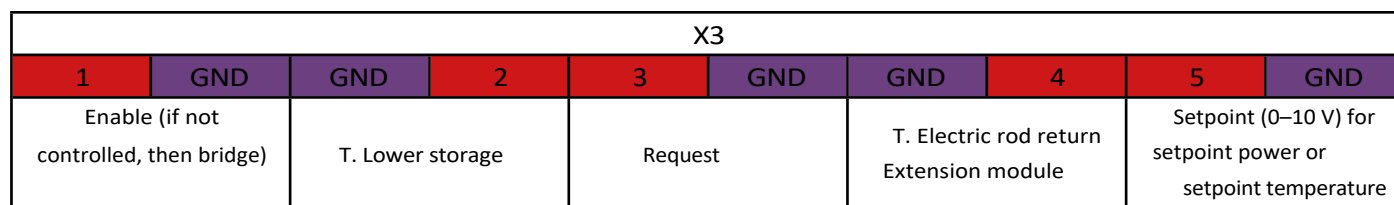
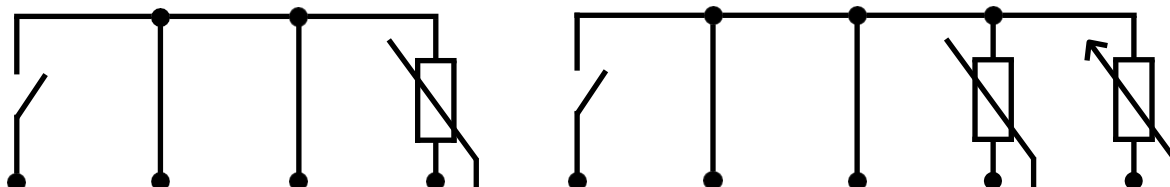
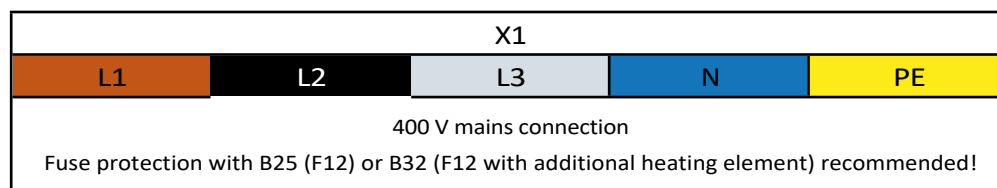
The PV Max-Heater has three relevant inputs:

1. Request input:
Digital input used to activate the PV Max-Heater, causing it to operate at a set and constant power output. This enables forced and emergency operation.
2. Request input 0–10 V:
An analogue input; this can be used to set a target power or a target temperature for the PV Max-Heater. This input can be used for surplus PV operation.
3. C.M.I.:
With the optional maintenance module, the PV Max-Heater also provides a Modbus TCP interface, which can likewise be used for surplus PV.

There are two ways to integrate the PV Max-Heater with surplus PV:

1. The PV Max Control is used as a transformer meter for transformer measurement. This measures the surplus current just before the utility connection and thus provides the PV Max Heater with a power setpoint via the internal CAN bus.
2. If an energy meter is already in place that measures the surplus PV energy and can communicate this surplus to us via a 0–10 V signal, this signal is connected to the '0–10 V Request' input.
3. The Modbus TCP interface is used for communication with the inverter; this transmits the necessary information to the PV Max-Heater.

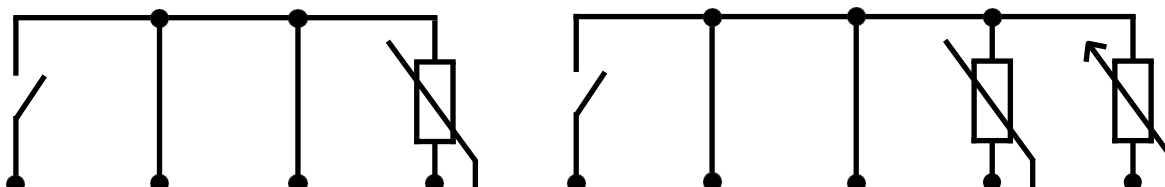
5.4.4 TERMINAL DIAGRAM: PV MAX-HEATER F12 (OR F12 WITH ADDITIONAL HEATING ELEMENT)



- Terminal block X1 is intended for the 400 V supply cable. Please fit a fuse rated at a minimum of 25 A (F12) and a minimum of 32 A (F12 with auxiliary heating element) and use 4 mm² cable.
- X3.1 is an enable contact that can be switched by an external control unit or battery storage system.
- X3.2 is used to connect a storage tank sensor. This can be connected either to the PV Max-Heater or to the PV Smart-Control.
- X3.3 is used for an external forced-heating signal. When the contact is closed, the heater operates at an adjustable power setting or heats to a setpoint temperature.
- X3.4 is used to connect the return sensor for the immersion heater of the 9 kW expansion module. (Additional immersion heater)
- X3.5 is intended for control via a setpoint command. If a signal > 1.0 V is present, the heater activates and heats either at a set power level or to a set temperature.
- The contactor for the extension heating element is connected directly to output A4 on the UVR610 (K20).

5.4.5 TERMINAL DIAGRAM: PV MAX-HEATER F12 SINGLE-PHASE

X1								
L1.1	L1.2	L1.3	N	N	N	PE	PE	PE
3 x 230 V mains connection (fuse protection: L1.1 with B25, L1.2 and L1.3 with B16 recommended!)								

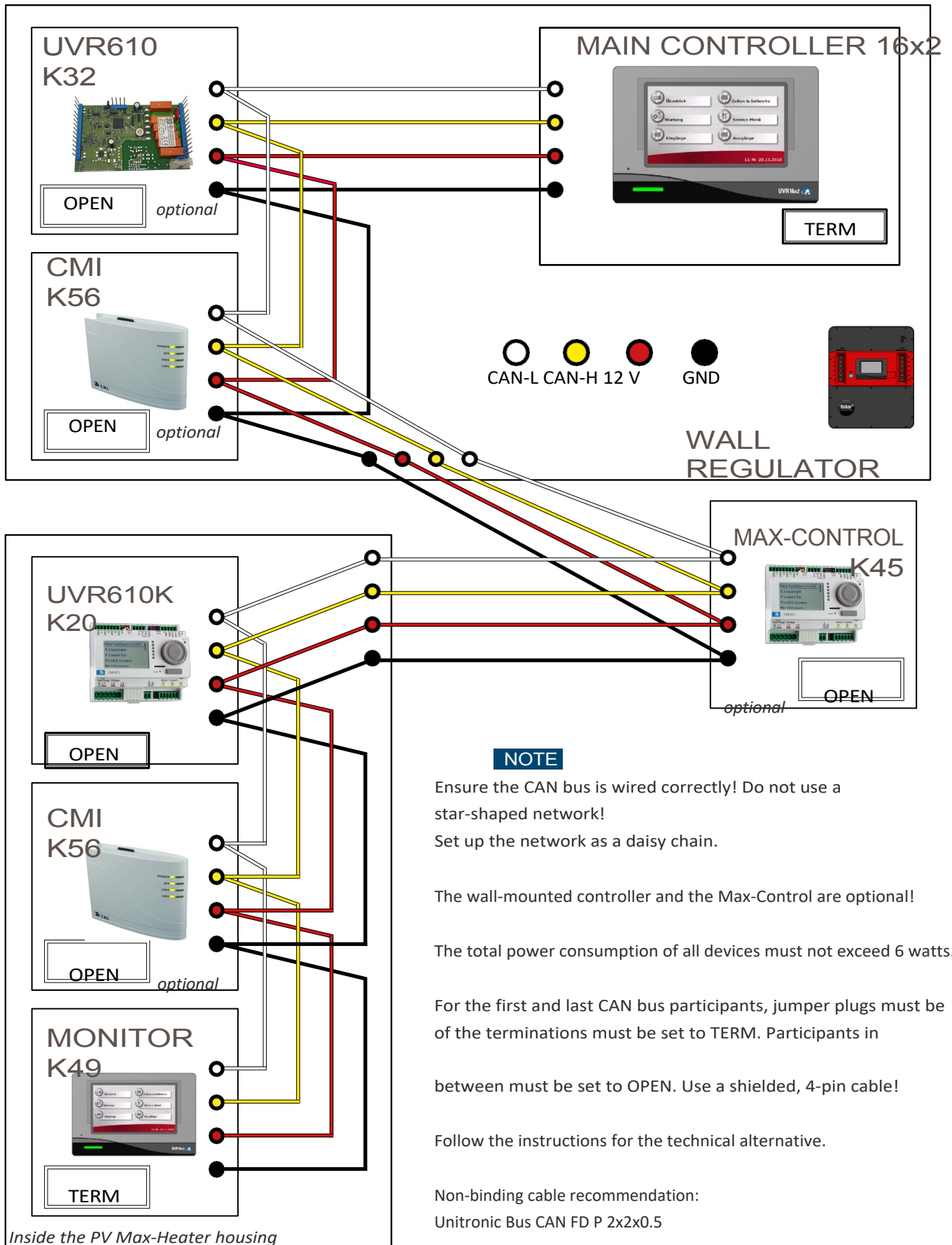


X3									
1	GND	GND	2	3	GND	GND	4	5	GND
Enable (if not controlled, then jumpers)		T. Lower memory		Request		T. Electric rod return, expansion module		Setpoint (0–10 V) for setpoint power or setpoint temperature	

X3					
CAN-L	CAN-H	12 V	GND	CAN-L	CAN-H
CAN bus (CAN-IN)			CAN bus (CAN-OUT)		
Connection to the PV Power-Control/EZ3					

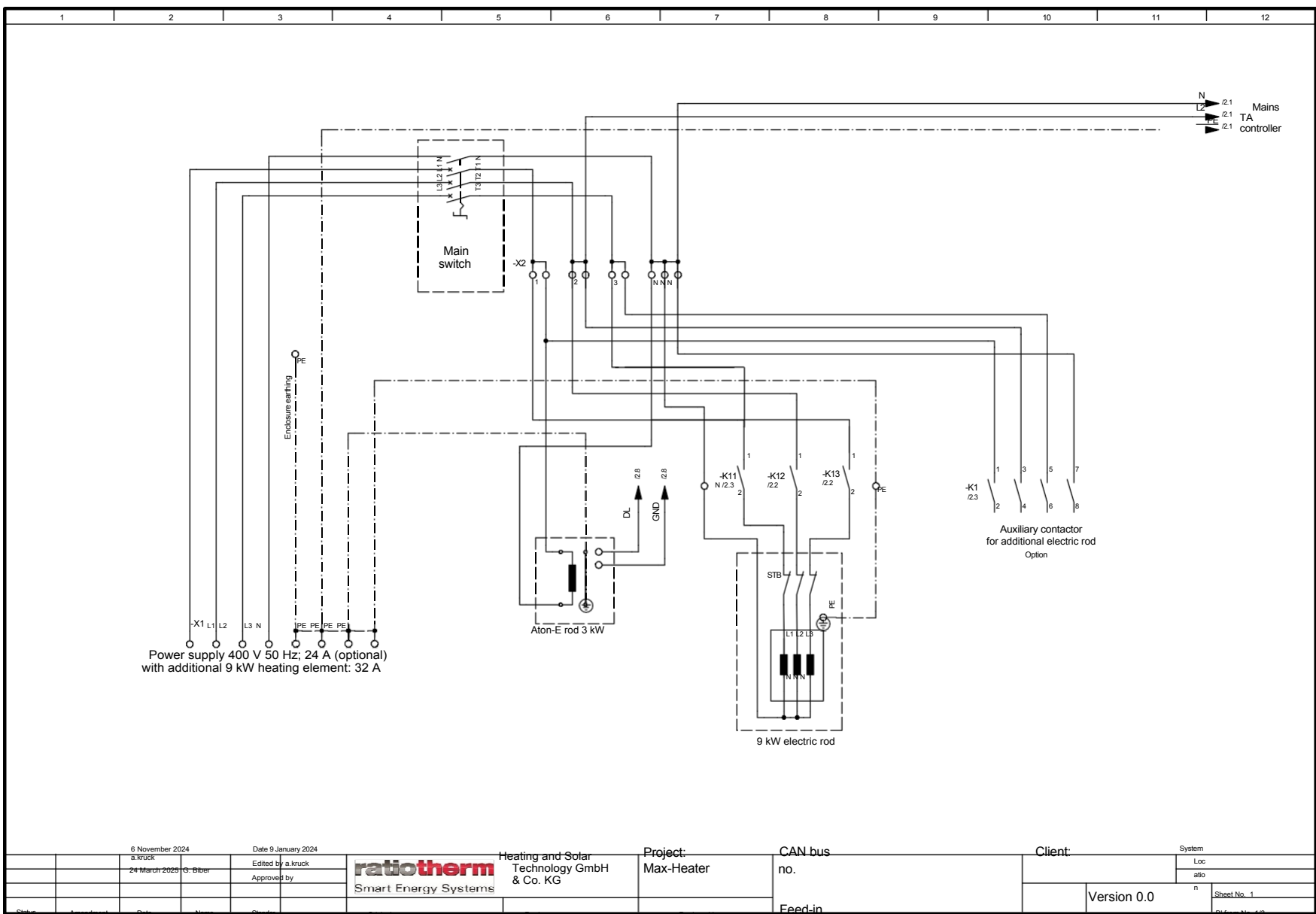
- Terminal block X1 is designed for 3 x 230 V supply cables. Please fit a 25 A fuse to L1.1 and 16 A fuses to both L1.2 and L1.3. The cable cross-section for each supply cable should be 2.5 mm².
- X3.1 is an enable contact which can be switched by an external control unit or battery storage system.
- X3.2 is used to connect a storage tank sensor. This can be connected either to the PV Max-Heater or to the PV Smart-Control.
- X3.3 is used for an external forced-heating request. When the contact is closed, the heater operates at an adjustable power setting or heats to a setpoint temperature.
- X3.4 is used to connect the return sensor for the heating element of the 9 kW expansion module. (Additional heating element)
- X3.5 is intended for control via a setpoint command. If a signal > 1.0 V is present, the heater activates and heats either at a set power level or to a set temperature.

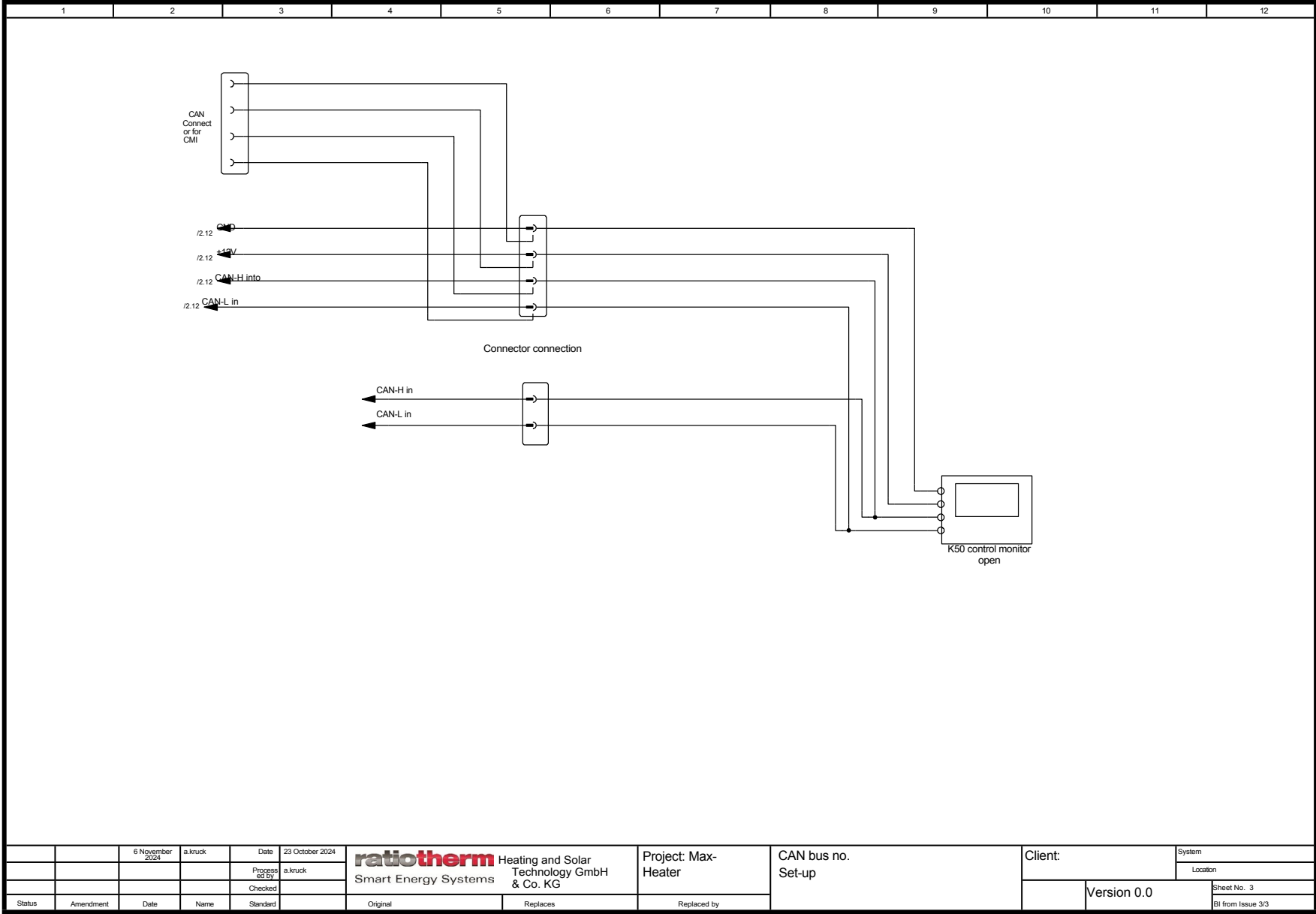
5.4.6 CAN BUS DIAGRAM (STANDARD)



ratiotherm

Smart Energy Systems

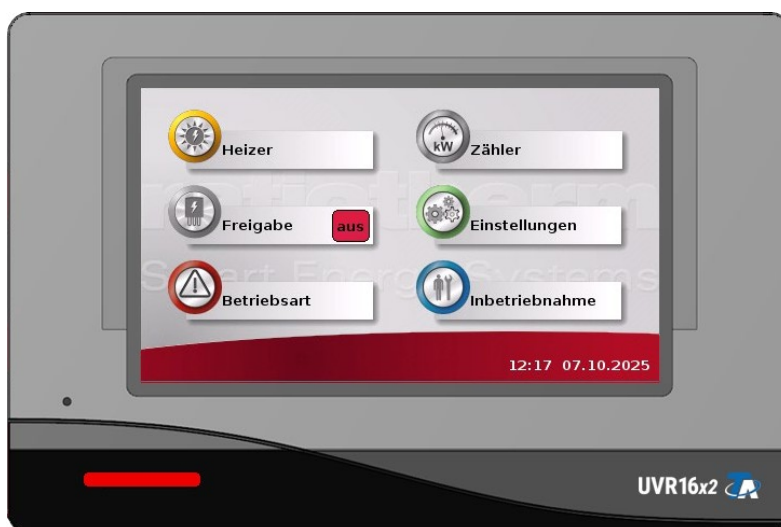




		6 November 2024	a.kruck	Date	23 October 2024	ratiotherm Heating and Solar Technology GmbH & Co. KG Smart Energy Systems	Project: Max-Heater	CAN bus no. Set-up	Client:	System	
				Processed by	a.kruck					Location	
				Checked							
Status	Amendment	Date	Name	Standard		Original	Replaces	Replaced by		Version 0.0	Sheet No. 3 BI from Issue 3/3

6. OPERATION

6.1 CONTROLLER OPERATION



- The rZR16x2 is operated via a 4.3" touch screen.
- For ease of use, a stylus is provided, which is stored above the controller (under the cover).
- The stylus can be used to tap on control areas and to scroll through the display by dragging the scroll bar.
- Selecting one of the windows takes you to the corresponding sub-menu.

The indicator light can display various states:

- **Steady red light** – The controller is booting (= start-up routine after switching on, a reset or an update) or a message is displayed that has not yet been cleared.
- **Steady orange light** – Hardware initialisation after booting.
- **Steady green light** – Normal operation of the controller.
- **Green 'flashing'** – After hardware initialisation, the controller waits for approx. 30 seconds to receive all the information required for operation (sensor values, network inputs).

Controls:

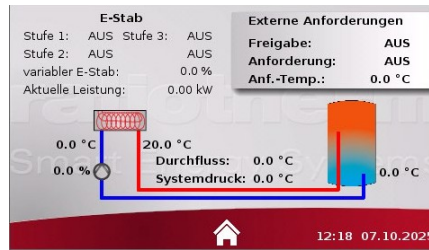
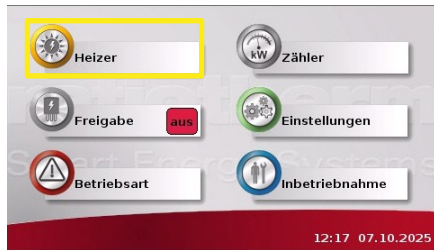


Main switch:

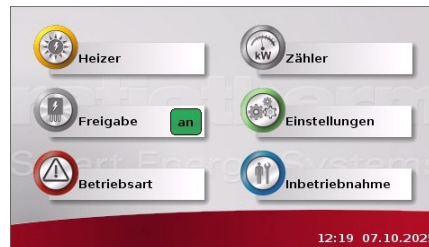
ON/OFF switch



6.1.1 MENU STRUCTURE



Energiezähler		Wirkleistung: 0 W	
	Max-Heizer gesamt	Max-Heizer PV-Betrieb	Einspeisung
aktuelle Leistung	0.00 kW	0.00 kW	0 W
Tageszähler	0.0 kWh	0.0 kWh	0.0 kWh
Monatszähler	0.0 kWh	0.0 kWh	0.0 kWh
Jahreszähler	0.0 kWh	0.0 kWh	0.0 kWh
Gesamtzähler	0.0 kWh	0.0 kWh	0.0 kWh



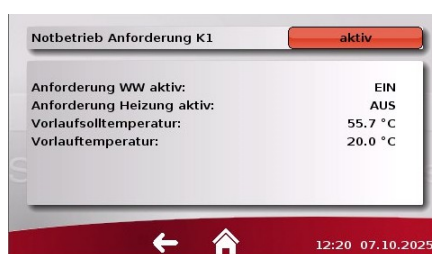
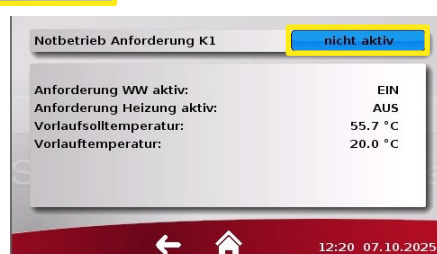
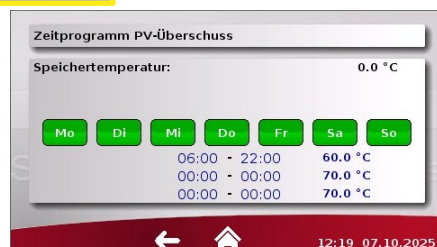
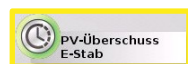
- Enable: ON
- The PV Max Heater may start up when required.

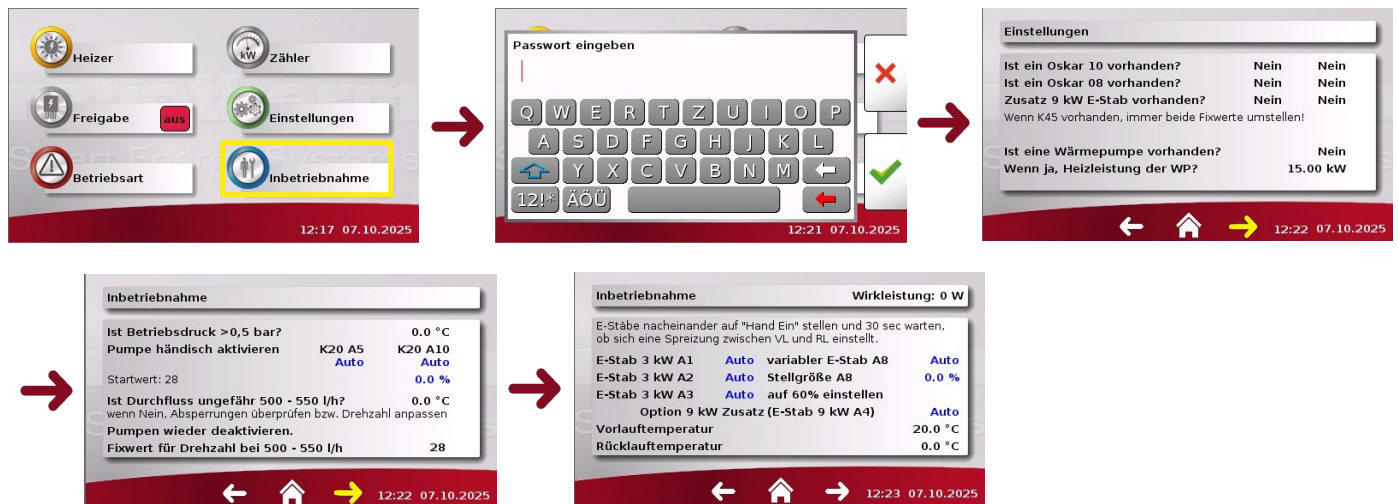


Einstellung Anforderung über CAN EZ3	
Freigabe PV-Überschuss	EIN
Zählerfreigabe PV-Überschuss	0.0 kWh
Reserve-Leistung	-500 W
Temperaturgrenze WP	50.0 °C
Stellgröße max WP (0 = 0%; 1000 = 100%)	600
Solltemperatur Pumpe	60.0 °C

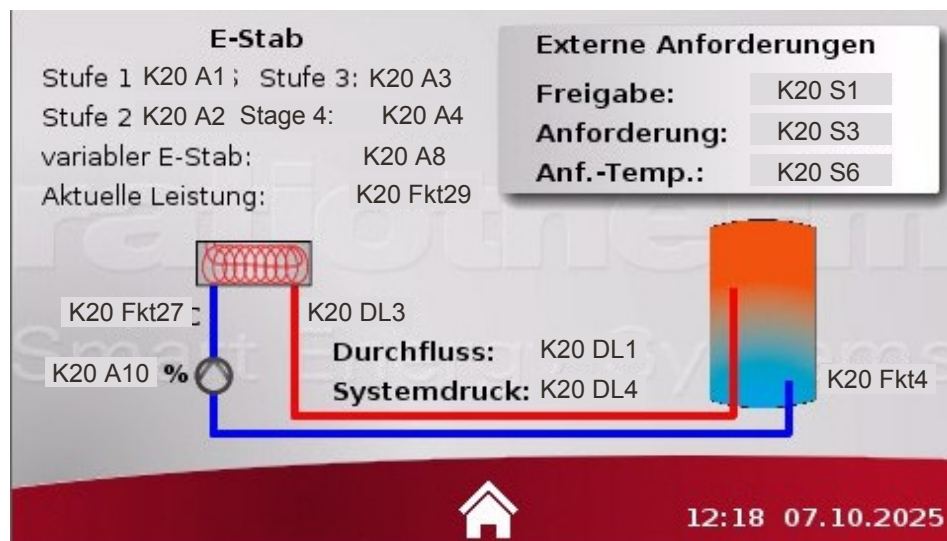


Einstellung externe Anforderung/Handbetrieb	
Zählerfreigabe PV-Überschuss Modbus TCP	XXXX
Temperaturgrenze E-Stub	XXXX
Reserve-Leistung ext. Regelung	XXXX
Temperaturregelung	XXXX
Solltemperatur Pumpe	XXXX

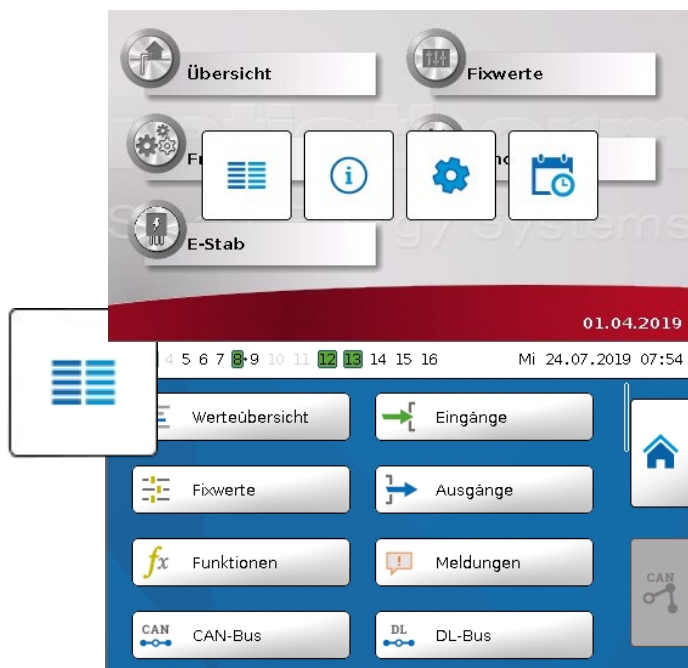




6.1.2 DESCRIPTION OF THE SYSTEM OVERVIEW



K20 S1	Approval
K20 S3	External request
K20 S6	External input 0–10 V
K20 DL1	Flow rate, charging circuit
K20 DL3	Boiler temperature VL
K20 DL4	System pressure
K20 A1	Heating element, stage 1
K20 A2	E-rod Level 2
K20 A3	E-Stab Level 3
K20 A4	Electric heating element, level 4 (9 kW auxiliary heating element)
K20 A8	Continuously variable PWM heating element
K20 A10	PWM charge pump
K20 Fkt4	Temperature – lower storage tank
K20 Fkt27	Return temperature WMZ K20
Fkt29	WMZ total

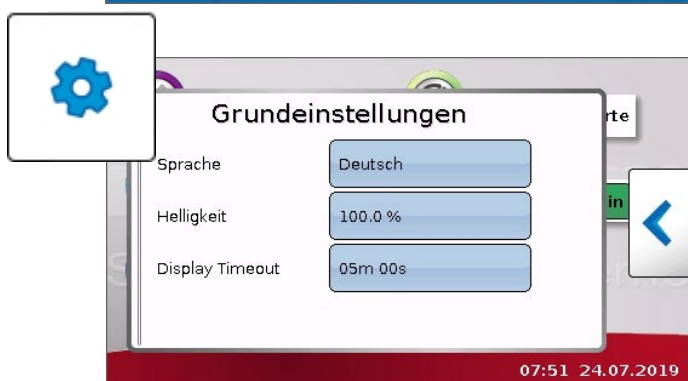


Sub-menu

By pressing and holding the display for 5 seconds, you will access the intermediate menu, which allows you to configure basic settings or switch to the controller menu.

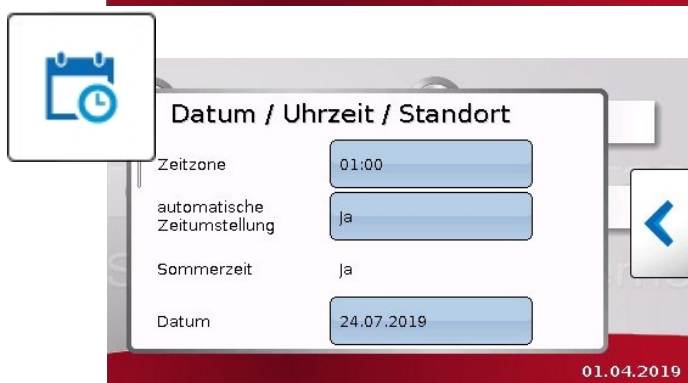
Controller menu

Shortcut to the controller menu



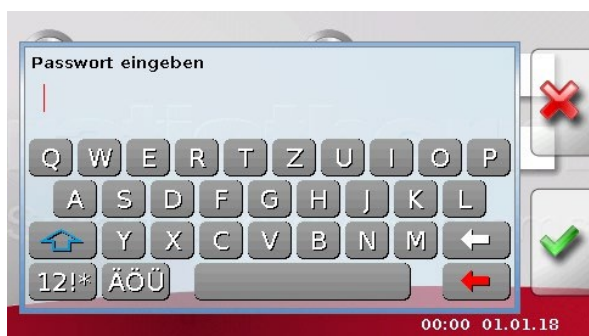
Basic settings

You can set the language, brightness and display timeout



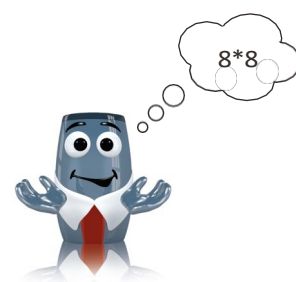
Date/Time/Location

Allows you to set the time zone and date



Enter password

Enter the technician password to access the technician menu.



7.1 SETTINGS



Fixwerte

Fixed values	Description	Setting options	Default setting
User			
Share	General sharing	OFF/ON	OFF
Target power	Target power specifies how much power is to be used.	500 W to 30,000 W	5,000 W
Setpoint temperature	Setpoint temperature to which the PV Max-Heater is designed to regulate to.	10 °C to 80 °C	60 °C
Temperature limit heating element	Temperature limit for immersion heater, control up to the maximum temperature when set manually.	20 °C to 80 °C	70 °C
Temperature controller	Temperature control, switching between temperature control and power control.	OFF/ON	OFF
Expert			
Max. heating element power	Maximum power of the PV Max-Heater. The default setting must be changed if an auxiliary heating element is fitted.	12,000 W to 21,000 W	12,540 W

7. MAINTENANCE

Regular inspection of the unit by a recognised, qualified and ratiotherm-authorized specialist technician is essential to ensure continuous operational readiness, operational safety, reliability and a long service life. We recommend having maintenance carried out annually.

NOTE We recommend taking out a maintenance contract.



WARNING

Improper handling

Improper handling of the appliance can result in a serious risk of injury. Never attempt to carry out maintenance work and/or repairs on the appliance yourself.

For maintenance work, commission a recognised, qualified and ratiotherm GmbH & Co. KG-authorized specialist tradesman (qualified personnel).

72 TROUBLESHOOTING

Error message	Limit T. Flow	
Behaviour of the PV Max-Heater	• The unit is locked out for 5 minutes. • The PV Max-Heater switches off.	
Cause of fault	• The flow rate through the unit is too low. • The temperature at the flow sensor is too high.	
Troubleshooting	• Check the pump to ensure it is working correctly. • Check the temperature sensor to ensure it is working and is correctly positioned.	

Error message	Storage tank temperature limit	
Behaviour of the PV Max Heater	• The unit is blocked for 5 minutes. • The PV Max-Heater switches off.	
Cause of fault	• The temperature at the storage tank sensor is too high. • The storage tank sensor is faulty.	
Troubleshooting	• Replace the storage tank sensor.	

Error message	Flow rate too low	
Behaviour of the PV Max-Heater	• The PV Max-Heater enters fault mode if the flow rate is too low 10 seconds after a request is made. • Reset by pressing the reset switch.	
Cause of fault	• No flow.	
Troubleshooting	• Check the pump to ensure it is working correctly. • Check the flow sensor to ensure it is working. • Check the ball valve to ensure it is open. • Repeat the commissioning procedure -> increase the minimum control variable. • Limescale deposits in the heating element.	

Error message	System pressure too low	
Behaviour of the PV Max-Heater	• The PV Max-Heater switches off.	
Cause of fault	• The unit has too low a system pressure.	
Troubleshooting	• Check the pump to ensure it is working correctly. • Check the pressure sensor to ensure it is working and is correctly positioned. • Check the ball valve to ensure it is open.	

	Max-Heater is no longer heating	
PV behaviour Max-Heater	• PV Max-Heater is no longer heating (no error message)	
Cause of fault	• Overheating of the heating elements	
Troubleshooting	• 3 kW heating element: disconnect from the mains -> the heating element will reset itself. • 9 kW heating element: remove the screw at the top of the head and press the heating element until it clicks.	

73 CLEANING

731 CLEANING THE HEATING SIDE

- Cleaning: to be carried out by a plumber
- Flushing unit: Connection to the condenser's inlet and outlet

732 CLEANING THE UNIT

- The units can be cleaned using a standard household cleaner (see below for exceptions).
- Check the air inlets and outlets (the grilles on the intake and exhaust hoods) regularly for any leaves or other debris that may have become trapped.
- Brush away any dirt. The fan should not be running whilst you are brushing, as the dirt could otherwise be sucked into the unit.



NOTE

Incorrect cleaning

Using the wrong cleaning products can damage the unit's surfaces. Please note the following:

- Do not use abrasive cleaners or cleaning agents that could damage the plastic casing, fittings or controls.
- Do not use sprays, solvents or chlorine-based cleaning agents.
- Clean the unit's casing with a damp cloth and a little soap.
- Avoid placing or leaning objects on or against the heat pump.



NOTE

Limescale deposits

Limescale deposits can cause the safety valve to become stuck.

Operate the heating system's safety valve manually once a month.

74 SYMBOLS ON THE UNIT

To provide staff with important information and warnings, standardised safety symbols based on the standards DIN EN ISO 7010, DIN ISO 3864 and DIN ISO 7000 have been used.

These safety symbols are clearly visible to all, must be kept in a recognisable and legible condition, and must be replaced when necessary.

As the design of the unit and the complexity of the production processes do not permit the use of persons with disabilities (e.g. with visual impairments) for safety reasons, the manufacturer has chosen not to include tactile symbols. The requirements for personnel and the professional qualifications required to operate the device are set out in section '2.3 Target Groups' on page 6.

75 MAINTENANCE SCHEDULE

DANGER! Do not put the device into operation if any faults are found.

Maintenance work:	Measures	Interval
operators and site operators		
Visual and functional inspection	- Check the unit for any visible external defects and mechanical damage. - Carry out a visual inspection of the control elements. - Carry out a visual and functional inspection of all safety devices.	Monthly
Cleaning the appliance	Follow the instructions in section '7.2 Cleaning'.	As required
Qualified personnel		
Inspection of electrical components	- Check the electrical components for damage. - Carry out any necessary repairs.	annually
Inspection of hydraulic components	Check the hydraulic components for damage.	y
Inspection of refrigeration components	Carry out any necessary repairs.	annually
Inspection of safety devices	- Check the refrigeration components for damage. - Carry out any necessary repairs.	annually
Inspection of symbols on the unit	- Carry out a visual and functional inspection of all safety devices. - Document these checks.	y
Inspection of third-party components	- Check the symbols on the unit. - Replace the symbols if necessary. - Follow the manufacturer's documentation for third-party components.	annually
Functional check	Carry out the IBN as per the menu to readjust the airflow.	annually

8. DECOMMISSIONING

When the unit is taken out of service, it must only be dismantled by qualified personnel. Hazardous substances and waste must be disposed of correctly. When dismantling the heat pump, please observe the instructions at the beginning of the original operating instructions as well as the safety instructions listed below.



DANGER

Fatal electric shock

There is a risk of fatal electric shock from the electrical components.

Disconnect the unit from the mains before taking it out of service or dismantling it.

Secure the unit to prevent it from being switched on again.

8.1 TEMPORARY TAKING OUT OF SERVICE



NOTE

Incorrect decommissioning

Improper decommissioning of the unit may result in damage to components and impaired functionality. Switch off the device at the main switch.

Please note the following:

- Frost may cause damage to the appliance.
- Water freezes at outside temperatures below 0 °C.
- Taking the unit out of service without draining the heating circuit is only permitted at temperatures above 0 °C.

8.2 FINAL DECOMMISSIONING AND DISPOSAL

Only a specialist company may carry out the final decommissioning/disposal. Environmental requirements regarding the recovery, reuse and disposal of operating fluids and components in accordance with current standards must be observed.



NOTE

Improper disposal

Improper disposal of the unit may result in environmental pollution and/or damage.

Dispose of electrical and electronic components, as well as the heat pump's refrigerant, correctly and in accordance with applicable local regulations.

9. EU DECLARATION OF CONFORMITY

In accordance with the Low Voltage Directive 2014/35/EU, Annex IV, and the Pressure Equipment Directive (2014/68/EU), Annex IV, we hereby declare, under our sole responsibility:

Manufacturer

ratiotherm GmbH & Co. KG
Wellheimer Straße 34
91795 Dollnstein

Email: info@ratiotherm.de
Telephone: +49 (0) 8422/9977-0
Website: www.ratiotherm.de

that the device:

Device name: **PV Max-Heater F12**
Year of manufacture: see type plate
Intended use: The unit uses surplus electricity from PV systems to provide direct supplementary heating and hot water supply.

In the version supplied, it complies with the directives

- Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
- Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment

as well as the harmonised standards and directives listed below, to which this declaration refers:

Technical documentation is available. Name and address of the person authorised to carry out the technical

Harmonised standards applied:

- DIN EN 378-1-4
- DIN EN ISO 12100
- DIN EN 60204-1
- DIN EN 60335-1
- DIN EN 60335-2-40

Relevant EC Directives

- Directive 2014/30/EU
- Directive 2014/35/EU
- Directive 2014/68/EU
- Directive 2009/125/EC
- Directive 2011/65/EU

Documents to be compiled:

Name: Julian Kruck, Head of Heat Pump Technology
Address: ratiotherm GmbH & Co. KG, Wellheimer Straße 34, 91795 Dollnstein

We hereby certify that the certification procedure has been carried out in accordance with the Low Voltage Directive 2014/35/EU, Annex IV, and the Pressure Equipment Directive (2014/68/EU), and that the provisions of standard DIN EN ISO/IEC 17050-1 'Conformity assessment – Supplier's declaration of conformity – Part 1: General requirements' have been observed in issuing this declaration of conformity. Should any modification be made to the equipment without our prior agreement, this declaration shall cease to be valid. Any unauthorised modification of this nature shall exclude any liability on our part.

Dollnstein, on _____ Signature of authorised representative: _____ Details of the person authorised to issue this declaration on behalf of the manufacturer or its authorised representative:

Name: _____ Position: _____
Address: ratiotherm GmbH & Co. KG, Wellheimer Straße 34, 91795 Dollnstein

Find us here



ratiotherm

Smart Energy Systems

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