

PV PROTECTOR BOX

FLOW ELECTRIC WATER HEATER

ACTIVATED WHEN GRID VOLTAGE EXCEEDS 253V

THERMATEC
PV PROTECTOR BOX

243 LU 242

248

PV PROTECTOR BOX

FLOW ELECTRIC WATER HEATER ACTIVATED
WHEN GRID VOLTAGE EXCEEDS 253V

INSTALLATION AND OPERATION MANUAL

Our primary goal is customer satisfaction, which is why we introduce devices made from components of renowned global manufacturers and materials that ensure long-lasting and trouble-free operation. From the beginning of our company's operation, we have placed great emphasis on the design of our products.

We believe that devices such as heat pumps, hydraulic cabinet assemblies, or even domestic hot water storage tanks should be a part of good design. To meet these expectations, our devices present themselves exceptionally well against the backdrop of our customers' dream homes and offices.

We attach great importance to the utility, quality of workmanship, and durability of our products, ensuring that we deliver devices prepared for years of trouble-free and efficient operation.

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IMPORTANT!

- This installation and operation manual contains essential information for the safe use and proper installation and operation of the device.
- Before using the device, carefully read and fully understand this manual.
- Keep the installation and operation manual for future reference.
- Pass this manual on to any subsequent owner of the device.
- While using the device, always comply with applicable regulations and health and safety standards.

1. SAFETY SYMBOLS

The safety symbols and warning signs shown below are used to emphasize particularly important information regarding safety and proper use of the PV PROTECTOR BOX:

SYMBOL	MEANING
 DANGER	Immediate danger! Failure to comply may result in death or serious bodily harm.
 WARNING	Possible danger! Failure to comply may result in death or serious bodily injury.
 ATTENTION	Hazardous situation! Non-compliance may result in minor or moderate bodily injury or property damage.
	Please read the instruction manual.
	Warning of electric shock.

2. RULES FOR SAFE INSTALLATION AND OPERATION

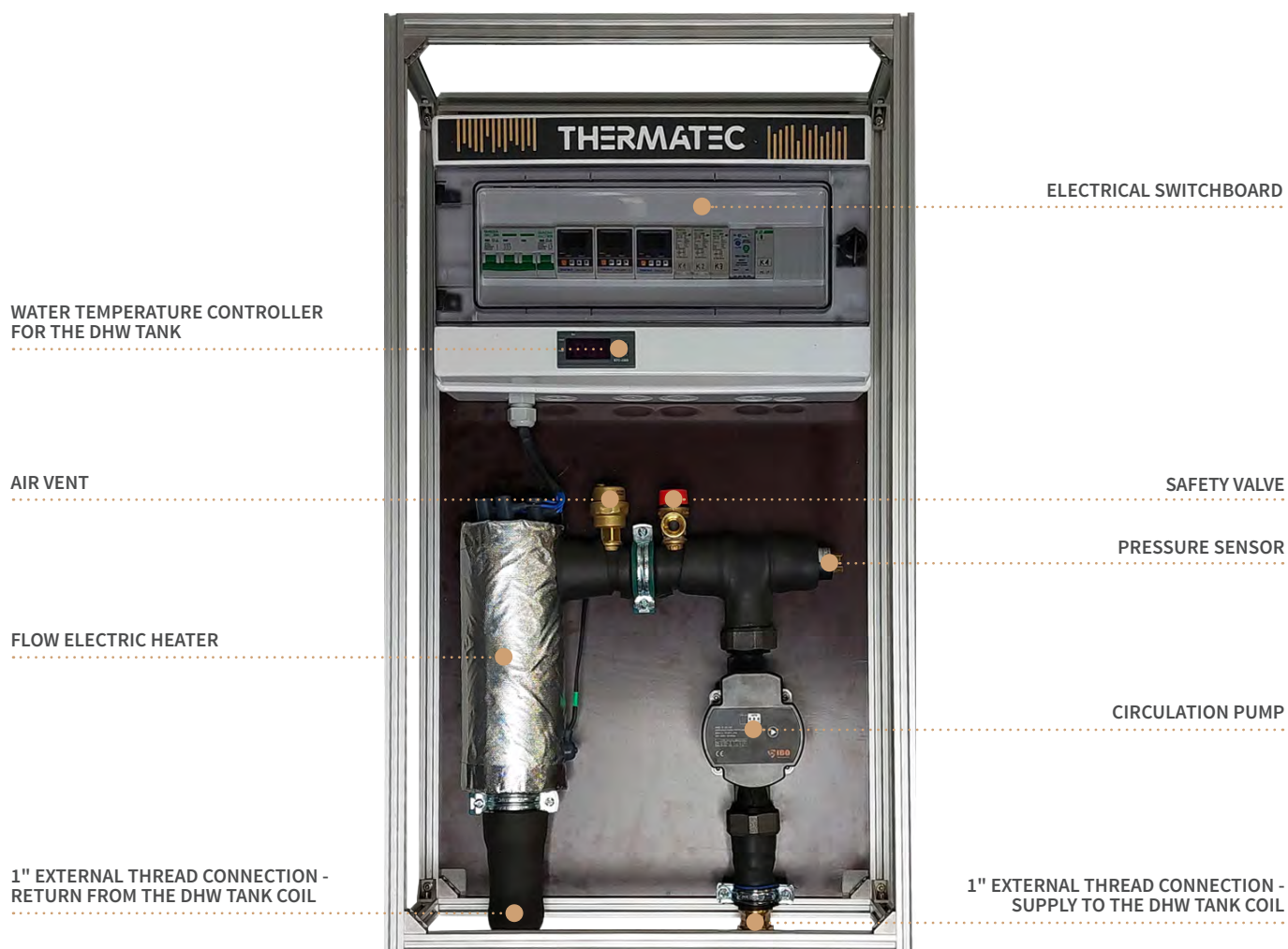
For safe installation and operation of the device, you must:

- Use the device only in a technically sound condition and in accordance with its intended purpose.
- Ensure installation, commissioning, operation, and dismantling are carried out exclusively by trained personnel and authorized users.
- Do not dismantle module components while the device is in operation.
- Do not make any modifications to the hydraulic system that are not specified in the manual.
- Perform hydraulic and electrical connections according to the instructions and markings provided in the manual.
- Assign electrical installation tasks to a qualified electrician with the appropriate certifications and authorizations.

3. DESCRIPTION AND APPLICATION

PV PROTECTOR BOX is a flow-through electric water heater activated when the grid voltage exceeds 253V. The device is designed to heat water and prevent the inverter in a PV installation from shutting down in cases where the voltage on any phase exceeds 253V. If the grid voltage exceeds 253V, the system activates a contactor that switches on the electric heater on the phase where the voltage was exceeded and also activates the circulation pump. Activating the electric heater causes the voltage on that phase to drop. The system continues to heat water until the voltage falls below the set threshold of 248V. When the voltage drops, the voltage relay switches the circuit back and deactivates the contactor, which turns off the electric heater. Voltage relays monitor the voltage on all three phases independently. The activation/deactivation voltage parameters can be freely adjusted. The device should be hydraulically connected to the coil circuit of the domestic hot water (DHW) tank or to a buffer tank. The circulation pump used in the heating system is controlled by the heater contactors and a time relay. The pump operates while the electric heaters are running and continues for 5 minutes after the heaters are turned off. The control system for the electric heaters is equipped with a 1 bar water pressure sensor, a 75°C temperature sensor, a 93°C thermal fuse for the flow-through electric heater, and a temperature controller with a sensor for monitoring the DHW tank water temperature. PV PROTECTOR BOX is intended for indoor installation in closed-loop systems of a buffer tank or a DHW tank coil.

4. CONSTRUCTION OF THE PV PROTECTOR BOX



5. TECHNICAL DATA

DEVICE TYPE	PV PROTECTOR BOX	
ENCLOSURE DIMENSIONS (W x H x D)	mm	490 x 730 x 170
CONNECTION OUTLETS	cal	GZ 1"
MAXIMUM OPERATING PRESSURE OF HEATING MEDIUM	bar	3
MAXIMUM OPERATING TEMPERATURE	°C	85
PRESSURE SENSOR	bar	contact opening 0.25, contact closing 1.0
CIRCULATION PUMP POWER SUPPLY VOLTAGE	V	230 V~
MINIMUM HEATING MEDIUM FLOW DURING OPERATION	l/min	10
FLOW ELECTRIC HEATER TEMPERATURE SENSOR	°C	contact opening 70°C
FLOW ELECTRIC HEATER POWER	W	6000 (3 x 2000)
ELECTRICAL SWITCHBOARD RH-18	IP protection level	65
POWER SUPPLY VOLTAGE	V	3 x 230/400~

The device consists of an aluminum structural frame to which the components are mounted. The module frame is equipped with brackets for wall mounting. For connection to the heating system, the device is equipped with water connectors with G1" external threads, which should be fitted with shut-off valves and connected to appropriate pipe sections. The device should be installed in close proximity to the DHW tank. A sample connection diagram is provided for a tank with either a single or dual coil configuration. The room where the device is installed must be protected from frost and excessive humidity. The device must be mounted in a way that allows easy access for servicing, ensuring that maintenance tasks can be carried out without difficulty.

PV PROTECTOR BOX

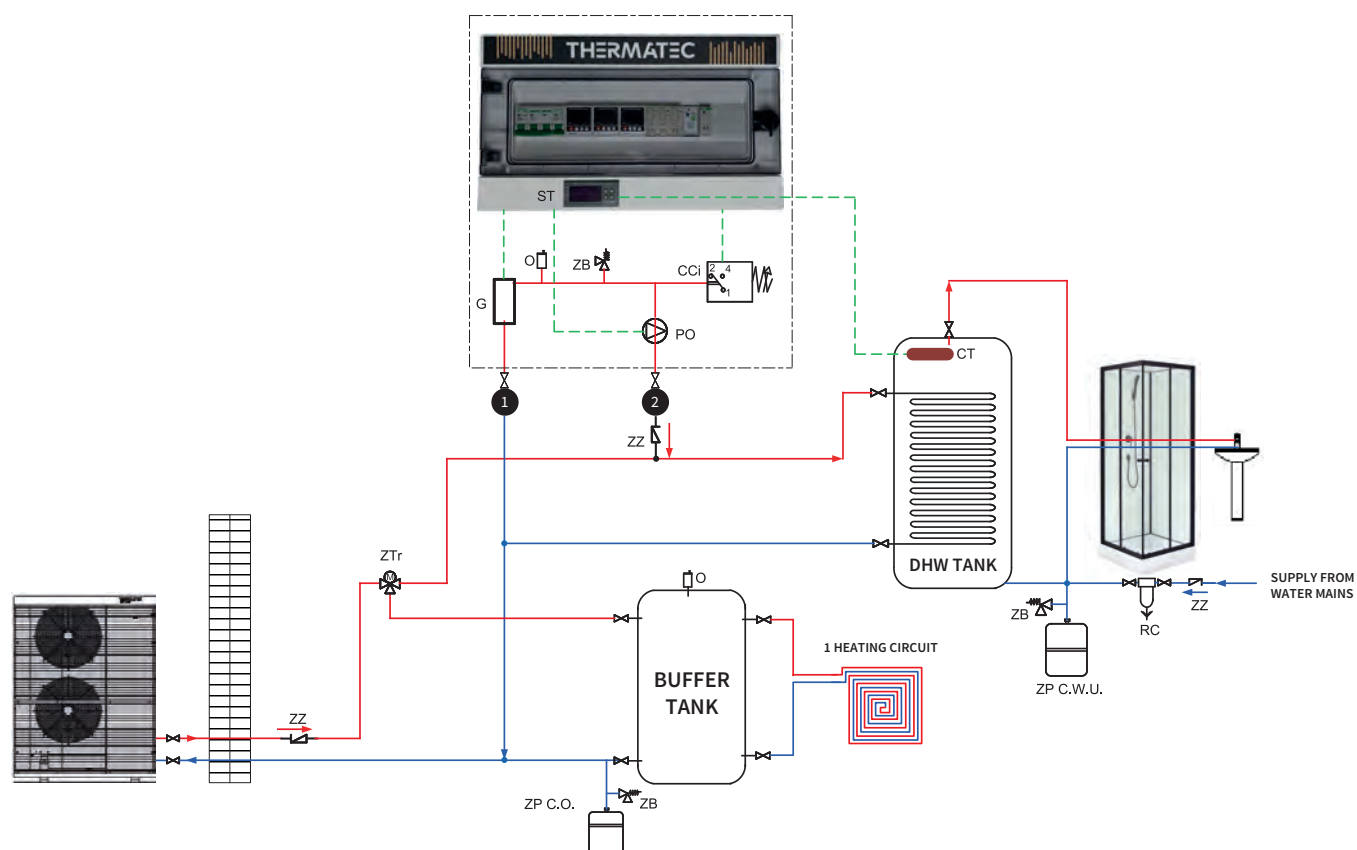
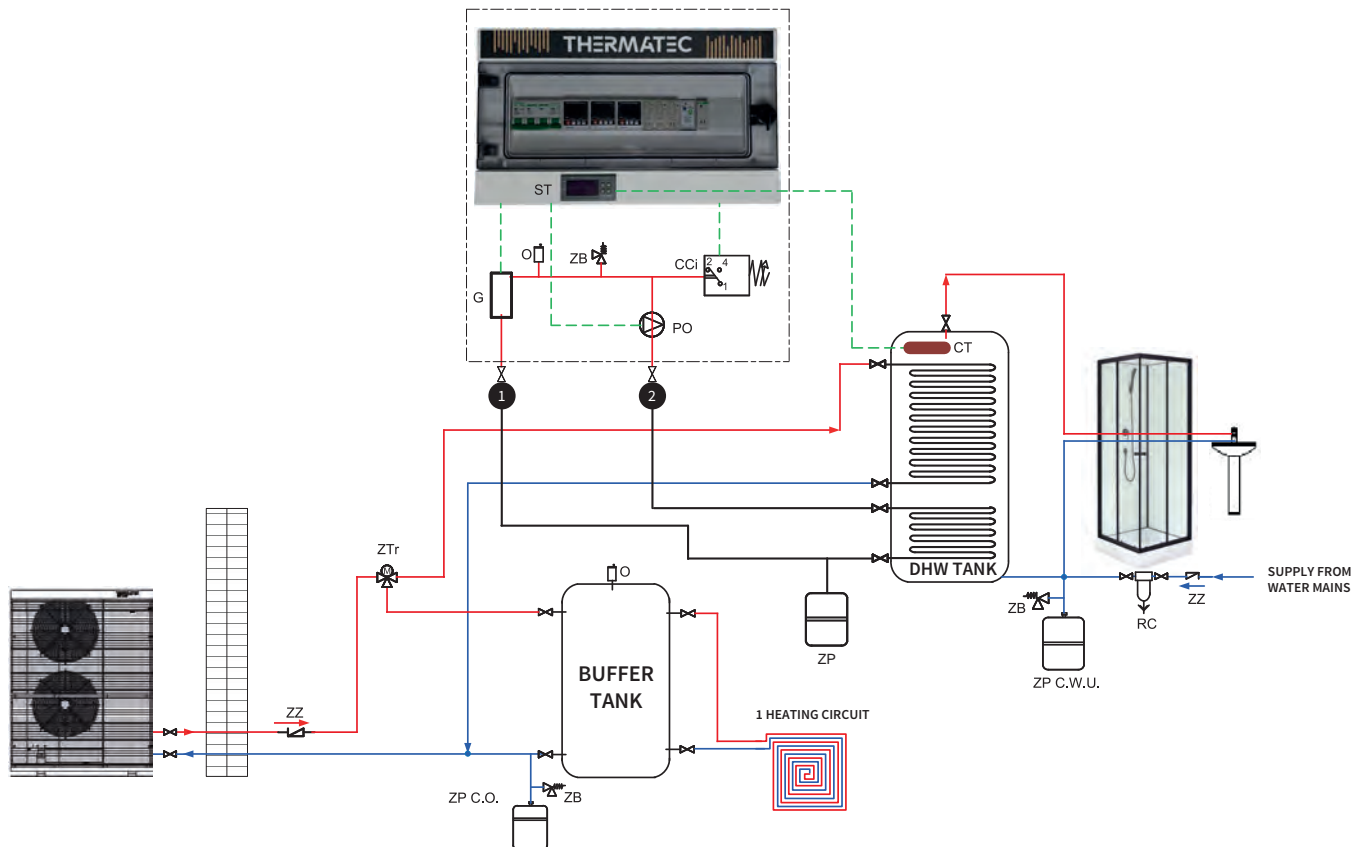


Diagram of an example connection of the device to the central heating system (C.O.)
for a DHW tank with a single coil configuration.

PV PROTECTOR BOX



*Diagram of an example connection of the device to the central heating system (C.O.)
for a DHW tank with a dual coil configuration.*

The diagram illustrates the recommended hydraulic components installed outside the device to ensure proper operation. These components are not included in the device's standard equipment.

Legend:

- O – Air Vent
- RC – Pressure Reducer
- ZB – Safety Valve
- ZP C.O. – Expansion Vessel for Central Heating
- ZP C.W.U. – Expansion Vessel for Domestic Hot Water
- ZZ – Check Valve
- PO – Circulation Pump
- CCI – Water Pressure Sensor
- ZTr – Three-Way Valve
- CT – Water Temperature Sensor in the DHW Tank
- ST – Water Temperature Controller for the DHW Tank
- 1 – Return from the DHW Tank Coil
- 2 – Supply to the DHW Tank Coil

5.1. Components of the PV PROTECTOR BOX:

5.1.1. Flow Electric Heater

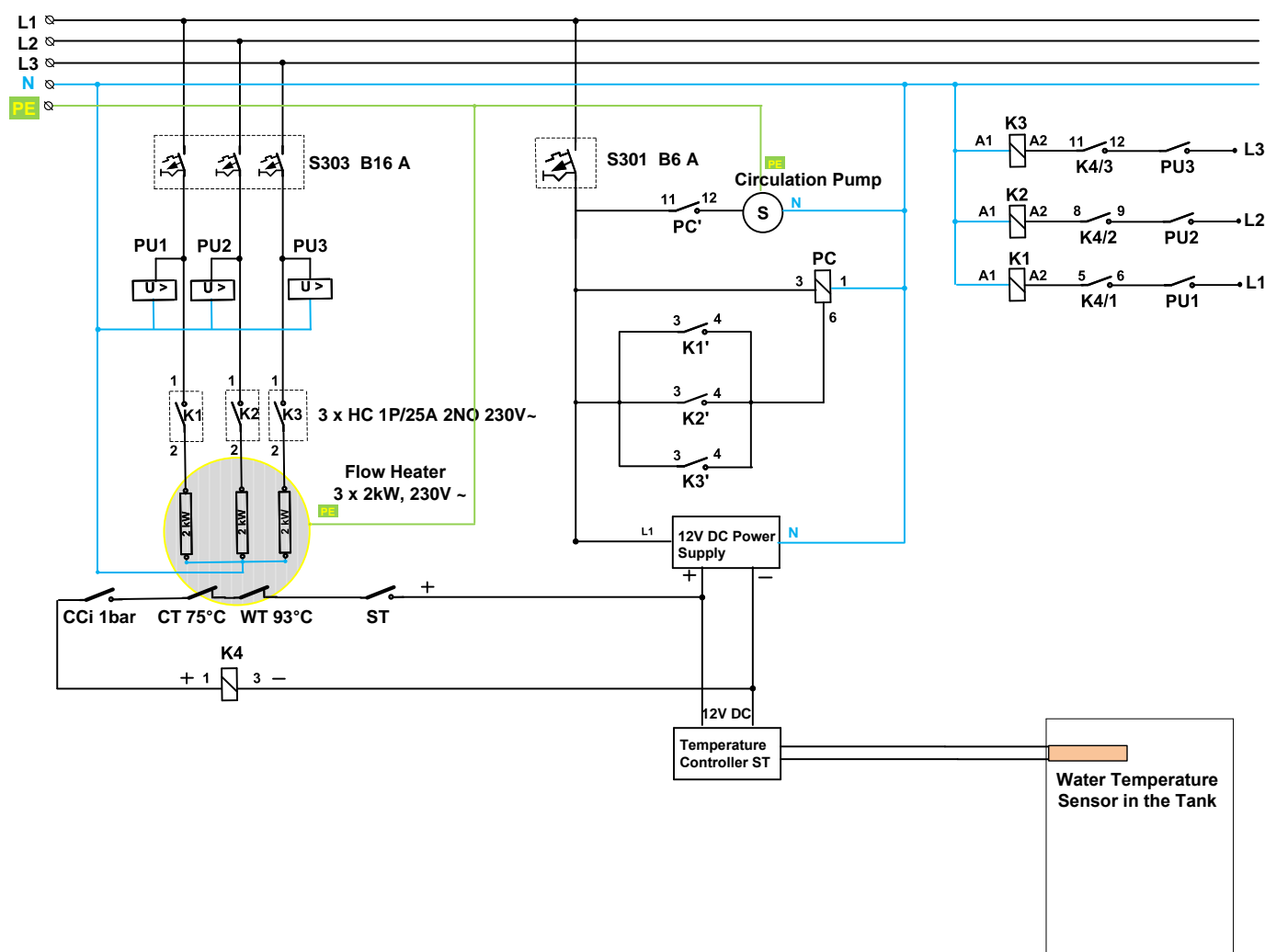
The flow-through electric heater used in the PV PROTECTOR BOX is a heater with a maximum power of 6 kW, consisting of three independent 2 kW heating elements, powered by a three-phase 230V~ supply. Each heating element is switched on via the current circuit of contactors K1, K2, and K3. The control system is equipped with voltage relays that monitor the voltage independently on all three phases. If the grid voltage reaches 253V on phases L1, L2, or L3, and the safety contactor K4 is engaged, the corresponding heater contactor (K1, K2, or K3) will be activated. The auxiliary contacts of contactors K1', K2', K3' control a time relay (PC), which activates the water circulation pump in the coil circuit of the DHW tank. If the auxiliary contacts K1', K2', or K3' are disengaged, the pump will be switched off with a 5-minute delay.

The control circuit of the safety contactor K4 is switched off when any of the following sensors are triggered:

- Water pressure sensor indicating pressure below 1 bar.
- Temperature sensors of the flow-through heater detecting housing temperature above 75°C / 93°C.
- DHW tank temperature controller (ST) indicating tank water temperature above 85°C.

The heater contactors K1, K2, and K3 will remain active until the grid voltage drops below 248V, or until the safety circuit of contactor K4 is interrupted by at least one of the aforementioned sensors or the temperature controller ST.

WARNING! The flow-through heater is equipped with an additional thermal fuse G5A01 Tr 93°C (which must be replaced after activation). If the heater housing temperature exceeds 93°C, this fuse will interrupt the operation of the safety contactor K4.



Control schematic for an electrical device connected to a 3-phase 230/400V~ network.

5.1.2. Pressure Sensor

The water pressure sensor is installed in the heating medium circuit after the flow heater. When the heating system of the device is filled with water and the pressure rises above 1 bar, the safety circuit contact of contactor K4 closes, allowing it to control the electric heater contactors (K1, K2, K3). In the event of a water leak and a pressure drop below 0.25 bar in the heating system, the sensor contact opens, interrupting the control circuit for contactors K1, K2, K3. This prevents the operation of the heaters and circulation pump in dry conditions without water.

TECHNICAL DATA:

PARAMETER	UNIT	VALUE
Maximum Operating Pressure	bar	4,5
Voltage / Maximum Current	V / A	250V~ /4A
Connection	cal	1/4 ”
Contact Closes at Pressure	bar	1
Contact Opens at Pressure	bar	0,25



5.1.3. AGM Heating Circuit Pump

TECHNICAL DATA:

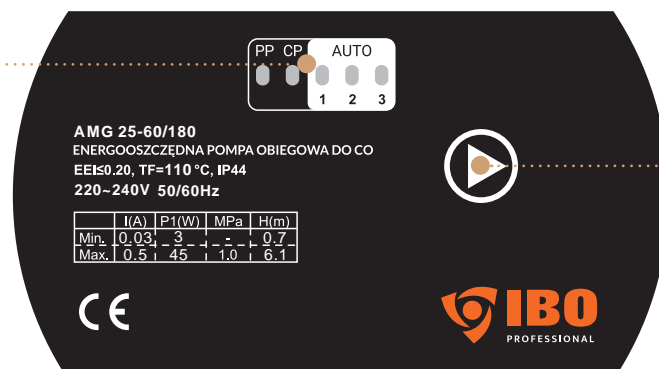
PARAMETER	UNIT	VALUE
Power Supply	V	230V~, 50 Hz, PE
Maximum Power Consumption	W	65
Maximum Head	m	8
Flow Rate	l/min	10
Permissible Ambient Temperature	°C	0 to 40
Current Consumption	A	0,65
Permissible Water Temperature	°C	+2 to 110
Maximum Pressure	bar	10
Protection Rating	-	IP44



To prevent pump bearing damage caused by cavitation, the following minimum inlet pressure must be maintained

Heating Medium Temperature [°C]	< 85°C	90°C	110°C
Minimum Inlet Pressure	0,05 bar	0,28 bar	1,08 bar
	0,5 m water column H ₂ O	2,8 m water column H ₂ O	10 m water column H ₂ O

LED INDICATOR




MODE CHANGE BUTTON

PROCEDURE FOR SELECTING THE OPERATING MODE

Upon startup, all mode indicators will briefly light up, after which the pump will resume the last operating mode used before shutdown.

Pressing the main mode change button once will switch the mode in the following sequence:

AUTO, PPI, PPII, PPIII, CPI, CPII, CPIII, CSI, CSII, CSIII.

Pressing the  button once will switch to the next mode on the list. Entering a specific mode is indicated by the corresponding indicator lighting up on the control panel.

SETTING	PUMP PERFORMANCE CURVE	FUNCTION
AUTO	Proportional Pressure Performance Curve From highest to lowest	<ul style="list-style-type: none"> The AUTO Function automatically controls the pump's performance within a specified range. Adjusts the pump's performance based on the size of the system. Adapts the pump's performance according to load variations over time. In AUTO mode, the pump operates in proportional pressure control mode.
PP: I / II / III	Proportional Pressure Curves	The operating point will move up and down along the proportional pressure curve based on the system's flow demand. When the flow demand decreases, the pump's water pressure will drop, and when the energy demand increases, the pressure will rise.
CP: I / II / III	Constant Pressure Curves	The pump's operating point moves back and forth along the constant pressure curve based on the system's demand. The pump pressure remains constant and is independent of the flow demand.
S: I / II / III (Factory Settings)	Constant Speed Curves	I, II, III (1-3): The pump is set to the maximum curve under all operating conditions. When the pump is set to mode III, it will quickly self-vent during operation.

PERFORMANCE CURVE

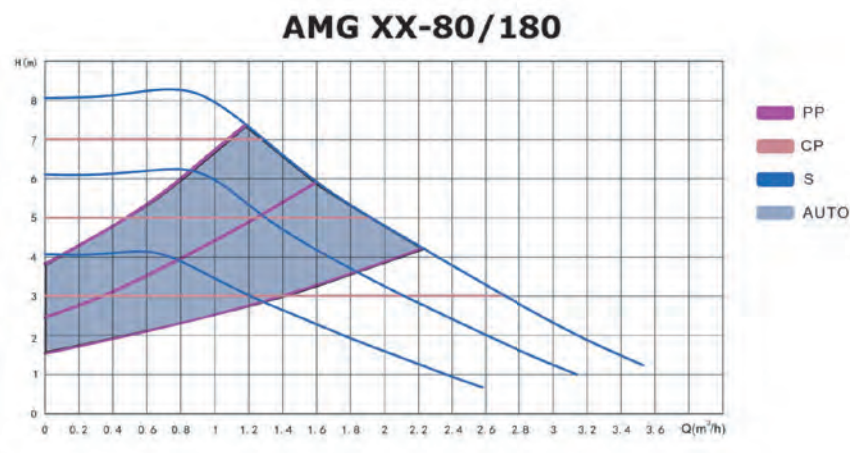
Guide to the Performance Curve:

Each pump setting corresponds to a specific performance curve (Q/H curve).

The AUTO/ECO mode with auto-adaptation encompasses a range of performance curves.

Each Q/H curve is associated with a power input curve (P1 curve).

The power curve represents the power consumption (P1) of the pump in watts for the respective Q/H curve.



POSSIBLE ISSUES AND TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	SOLUTION
Pump Does Not Start	Blown installation fuse	Check the cause and replace the fuse
	Overcurrent circuit breaker tripped	Turn on the circuit breaker
	Damaged pump	Replace the pump
	Pump rotor is blocked	Unblock the rotor
Noisy System Operation	Air in the system / Excessive flow rate	Perform system venting to remove trapped air
Insufficient Heat in the System	Insufficient Inlet Pressure - Cavitation	Increase the inlet pressure to the pump
	Pump Parameters Too Low	If possible, adjust the pump to a higher performance mode; otherwise, install a more powerful pump

5.1.4. Voltage Control Relay TVPS1-63PV

TECHNICAL DATA:

PARAMETER	UNIT	VALUE
Supply Voltage	V	140-303V / 50 Hz
Power Consumption	W	<2
Electrical Lifespan	-	100000 cycles
Maximum Resistive Load	A	63
Protection Rating	-	IP20



VOLTAGE CONTROL RELAY ON/OFF INDICATION

Voltage Control Relay OFF: LED Display - Alternates between "LU" and the current voltage, e.g., 243. Indicator Light - Red LED "FAULT" is lit. Status - Heating contactors K1, K2, K3 are OFF.

Voltage Control Relay ON: LED Display - Shows the current voltage, e.g., 253. Indicator Light - Green LED "POWER" is lit. Status - Heating contactors K1, K2, K3 are ON.

PROGRAMOWANIE PRZEKAŹNIKÓW KONTROLI NAPIĘCIA

Press "SET", and the code "P1" will appear. Adjust the parameter using the ▲ and ▼ arrows. Press "SET" again to display the next parameter, and repeat the process to make any necessary changes. After displaying "U5", the display will show "END", and the device will save all settings and switch to operational mode.

Pressing "ON" will turn off the device regardless of the voltage, and the display will show "OFF". Pressing it again will turn the device back on. After a power outage and restoration, the device will always turn back on, regardless of its last state (ON/OFF).

NO.	FUNCTION	ADJUSTMENT RANGE	FACTORY SETTINGS
P1	Power-on delay	1-500 sec	10 sec
U1	Relay Disconnection Threshold (Umin) [V]	220-300V	248V
U2	Output switch-off delay	1-500 sec	5 sec
U3	Relay activation threshold Umax [V]	223-303V	253V
U4	Output switch-on delay after exceeding Umax [V]	1-500 sec	5 sec
U5	Voltage Calibration	-20V-+20V	0V

Restoring factory settings occurs by pressing and holding the ▼ arrow for more than 12 seconds, which resets the factory settings and restarts the voltage control relay.



REMEMBER:

- Voltage Calibration:** The voltage monitoring relay must be calibrated to match the inverter (the voltage readings of the relay and the inverter must be identical).
- Hysteresis (U1, U3 Settings)** For the device to operate correctly, the hysteresis must be at least 1V greater than the voltage drop caused by the heater load.
- Example:** If the heater causes a voltage drop of 4V and the activation voltage (U3) is set to 253V, then the deactivation voltage (U1) should be set to a maximum of 248V. **The hysteresis must not be less than 3V.**
- Incorrect Hysteresis Setting:** Setting the hysteresis too low, resulting in frequent switching of the voltage relay, may lead to permanent damage to the device, which is **NOT COVERED** under warranty.
- Pre-Installation Analysis:** Before installing the device, it is necessary to analyze its effectiveness by measuring the household power supply system, focusing on overvoltage conditions that may cause the inverter to shut down, and on the power level of the photovoltaic installation.

5.1.5. Temperature Controller ST

The ST temperature controller monitors the water temperature in the DHW tank. It is powered by a safe 12V DC supply. The water temperature in the DHW tank is measured using an NTC temperature sensor, which should be placed in the sensor pocket located in the upper part of the DHW tank. The ST controller features a digital display for setting and reading the temperature and a relay output (NO/NC) connected to the safety circuit of contactor K4. The heating temperature of the water in the DHW tank should be set to a maximum of 85°C or another value specified by the DHW tank manufacturer. Once this temperature is reached, the relay contact of the ST controller will open, interrupting the power circuit to the heater contactors K1, K2, K3.

TECHNICAL DATA:

PARAMETER	UNIT	VALUE
Supply Voltage	V	12V DC
Power Consumption	W	<3
Temperature Measurement Range	°C	-50 to 99
Measurement Accuracy	°C	± 0,1
Nominal Relay Current	A	10
Temperature Sensor	-	NTC



The user can configure 4 parameters:

F1 - Temperature setting

F2 - Hysteresis: 0.3°C – 10°C

F3 - Relay activation delay (LED blinking): 1 to 10 minutes

F4 - Temperature sensor calibration: -10°C to 10°C

When the temperature exceeds the set value (F1 + F2), cooling is activated, and when it drops below the set value, heating is activated.

Checking Parameters:

During normal operation, press the ▲ button once to display the set temperature. Pressing the ▼ button once will display the set hysteresis.

Setting Parameters:

During normal operation, press and hold the "S" button for about 3 seconds. This will activate the temperature setting mode, and "F1" will appear on the display, with the SET indicator light on. Use the arrow buttons (▲ or ▼) to navigate through the setting options, which are described in the table below. To change the value of a desired parameter: Select the appropriate setting option. Hold the "S" button and adjust the value using the ▲ or ▼ buttons. After setting the desired value, release the "S" button and press the Power button once. This will save the set values and return the device to the mode displaying the current temperature.

If no actions are performed within 10 seconds after entering the settings mode, the device will automatically return to normal operation. If an error occurs during parameter saving (indicated by "Er" on the display), the controller will return to normal operation mode within 3 seconds.

Menu Function Table:

CODE	FUNCTION	RANGE	DEFAULT VALUE
F1	Set Temperature Value	-50.0°C – 99.9°C	10.0°C
F2	Hysteresis Value	0.3°C – 10.0°C	0.5°C
F3	Compressor Delay	1 – 10 minutes	3 minutes
F4	Temperature Calibration Value	-10.0°C – 10.0°C	0°C

Restoring Factory Settings:

In the event of an error, "Er" will appear on the display. Pressing any button at this point will restore the default settings and return the device to normal operation mode.

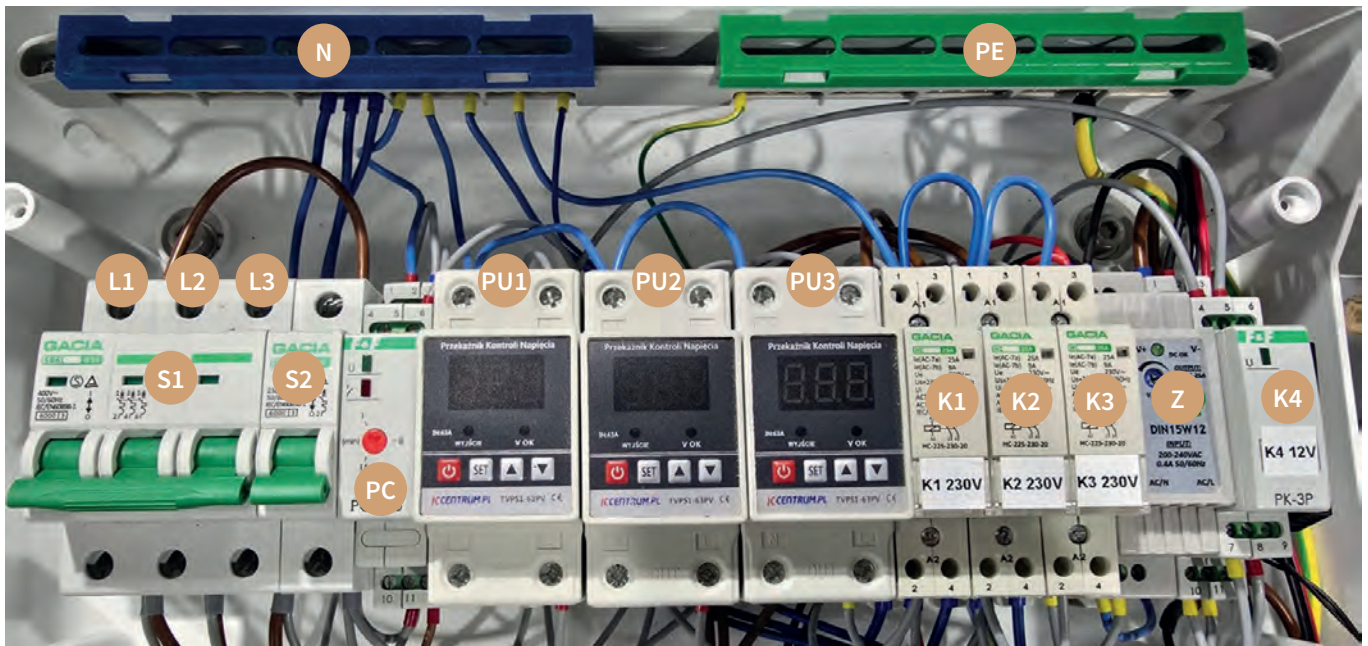
Error Descriptions:

- **Sensor error:** the controller activates a sensor alarm when the sensor circuit is open or shorted. The controller stops working and signals the error with a sound signal and the message "EE" on the display. To turn off the alarm, press any button. When the fault is removed, the controller will switch to normal operation mode.
- **Temperature outside the permissible range:** when the temperature exceeds the permissible measurement values, the controller stops working and signals the error with a sound signal and the message "HH" on the display. To stop the alarm, press any button. When the temperature is within the permissible measurement range, the controller will return to normal operation mode.

6. PODŁĄCZENIE ELEKTRYCZNE

PV PROTECTOR BOX is equipped with a complete hermetically sealed electrical switchboard TH-18. The switchboard includes N and PE terminal blocks, circuit breakers, voltage monitoring relays, electromagnetic contactors, a time relay, and a 230V/12VDC power supply. Power supply (3 x 230/400V~) must be provided using a 5 x 2.5 mm² cable, connected to the appropriate terminals from the main distribution board, which must be equipped with a 30 mA AC type residual current device (RCD). If there is no residual current device installed in the main distribution board, one must be added to ensure safe operation of the device.

The method for controlling the 230V~ electromagnetic contactors (K1, K2, K3), which supply three 2 kW/230V~ heaters via the NO current contacts, is detailed in the electrical schematic.



LEGEND:

- L1, L2, L3, N, PE – Input power supply 3 x 230/400V~
- S1 – 3-phase circuit breaker B16A – Overcurrent protection for the 3 x 2 kW/230V~ flow heater
- S2 – Single-phase circuit breaker B6A – Overcurrent protection for the circulation pump and 230V~/12V DC power supply
- PU1, PU2, PU3 – Voltage control relays for phases L1, L2, and L3, respectively
- K1, K2, K3 – 230V~ electromagnetic contactors – Control the flow electric heater and circulation pump
- PC – 230V~ time relay – activates and deactivates the water pump with a 5-minute delay
- Z – 230V~/12V DC power supply
- K4 – 12V DC safety contactor



CAUTION! Electrical installation tasks must be performed by a qualified electrician with the appropriate certifications and authorizations.

The electrical switchboard is designed for connection to a TN-S network with a voltage of 3 x 230/400V~. Before performing any tasks related to device installation or wiring connections, ensure that the device is disconnected from the 230/400V~ power supply.

The device must be connected to an electrical network equipped with a functional grounding system.

7. SAFETY INFORMATION

The PV PROTECTOR BOX is designed for installation exclusively in closed systems involving the coil circuit of a DHW tank. During the installation of the PV PROTECTOR BOX, the requirements specified in the manufacturer's manual for the DHW tank must be followed.

The device may only be used for its explicitly intended purpose; any other use should be considered improper and consequently unsafe.

The installation of the device must be carried out in compliance with applicable standards and regulations, according to the manufacturer's instructions, and by qualified personnel. Improper installation may cause injury to people and animals or damage to property, for which the manufacturer assumes no liability.

The installation and initial commissioning of the device should be performed by an authorized service partner of the manufacturer or by a person with the appropriate qualifications and electrical certifications.



The installer should inform the user about the functions of the device and provide the necessary information regarding its safe operation.



ATTENTION

The device should not be used by children or individuals with limited physical, sensory, or mental capabilities, or by persons lacking the required experience and knowledge, unless they are supervised or instructed on the proper use of the device by someone responsible for their safety. The device should be stored out of the reach of children.



Before starting operation, carefully read and fully understand this user manual, and adhere to the rules and guidelines contained within.

8. OPERATION

Before starting operation, check the overall technical condition of the PV PROTECTOR BOX. Ensure the following:

1. The device has been installed in accordance with the hydraulic and electrical schematics.
2. All pipe connections are leak-free, and the water circuits are properly filled and vented.
3. The 3 x 230/400V~ power supply to the electrical switchboard is connected, and the PV PROTECTOR BOX is powered via an **AC type residual current device (RCD) with a 30 mA rating**.



ATTENTION

Failure to comply with the above information will result in the voiding of the warranty.
In the event of any irregularities, the device must be returned to the manufacturer's service center.

9. INSPECTION AND MAINTENANCE

External parts can be cleaned with a damp cloth and commercially available cleaning agents. Do not use any abrasive cleaning accessories or solvents to clean the device. In hospitals and other public buildings, applicable regulations regarding cleaning and disinfection must be followed. If the hydraulic system is taken out of operation or there is an extended period of inactivity, the system must be drained after disconnecting the power supply.

A visual inspection of the device's technical condition, including checking the connections for leaks, should be conducted every 2 weeks. A comprehensive inspection of the device should be carried out every 12 months.

10. DISPOSAL

For disposal:

1. Drain the water from the water system into the sewage system; if glycol is used in the heating system, the medium should be pumped out into a container and sent for disposal
2. Unscrew the individual turning elements of the device
3. All plastic elements should be disposed of
4. Electric pumps and electrical components should be disposed of via appropriate electronic waste collection points
5. Send clean metal components to a recycling facility.



11. SERVICE



Improper repair or poorly performed servicing of the device may damage the device and/or cause personal injury.

To ensure the highest quality and safety, all repairs and servicing of the device should be carried out by a service partner who determines the scope and method of repair in consultation with the manufacturer.

MANUFACTURER'S STAMP

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