Contents

Safety rules

Explanation of safety notices

⚠ DANGER!

Indicates immediate danger.

▶ If not avoided, death or serious injury will result.

⚠ WARNING!

Indicates a potentially hazardous situation.

▶ If not avoided, death or serious injury may result.

⚠ CAUTION!

Indicates a situation where damage or injury could occur.

▶ If not avoided, minor injury and/or damage to property may result.

NOTE!

Indicates a risk of flawed results and possible damage to the equipment.

General

The device has been manufactured in line with the state of the art and according to recognized safety standards. If used incorrectly or misused, however, it can cause:

- Injury or death to the operator or a third party
- Damage to the device and other material assets belonging to the operating company.

All personnel involved in commissioning, maintenance, and servicing of the device must:

- Be suitably qualified
- Have knowledge of and experience in dealing with electrical installations and
- Have fully read and precisely followed these Operating Instructions

The Operating Instructions must always be at hand wherever the device is being used. In addition to the Operating Instructions, attention must also be paid to any generally applicable and local regulations regarding accident prevention and environmental protection.

All safety and danger notices on the device:

- Must be kept in a legible state
- Must not be damaged
- Must not be removed
- Must not be covered, pasted or painted over

The terminals can reach high temperatures.

Only operate the device when all protection devices are fully functional. If the protection devices are not fully functional, there is a danger of:

- Injury or death to the operator or a third party
- Damage to the device and other material assets belonging to the operating company

Any safety devices that are not fully functional must be repaired by an authorised specialist before the device is switched on.

Never bypass or disable protection devices.

For the location of the safety and danger notices on the device, refer to the section headed "General remarks" in the Operating Instructions for the device.

Any equipment malfunctions which might impair safety must be remedied before the device is turned on.

This is for your personal safety!

Environmental conditions

Operation or storage of the device outside the stipulated area will be deemed as not in accordance with the intended purpose. The manufacturer accepts no liability for any damage resulting from improper use.

Qualified personnel

The servicing information contained in these operating instructions is intended only for the use of qualified service engineers. An electric shock can be fatal. Do not carry out any actions other than those described in the documentation. This also applies to qualified personnel.

All cables and leads must be secured, undamaged, insulated and adequately dimensioned. Loose connections, scorched, damaged or inadequately dimensioned cables and leads must be immediately repaired by authorised personnel.

Maintenance and repair work must only be carried out by an authorised specialist.

It is impossible to guarantee that bought-in parts are designed and manufactured to meet the demands made on them, or that they satisfy safety requirements. Use only original spare parts (also applies to standard parts).

Do not carry out any alterations, installations, or modifications to the device without first obtaining the manufacturer's permission.

Components that are not in perfect condition must be changed immediately.

Noise emission values

The maximum sound power level of the inverter is specified in the Technical Data.

The device is cooled as quietly as possible with the aid of an electronic temperature control system; this depends on the amount of converted power, the ambient temperature, the level of soiling of the device, etc.

It is not possible to provide a workplace-related emission value for this device because the actual sound pressure level is heavily influenced by the installation situation, the power quality, the surrounding walls and the properties of the room in general.

EMC measures

In certain cases, even though a device complies with the standard limit values for emissions, it may affect the application area for which it was designed (e.g., when there is equipment that is susceptible to interference at the same location, or if the site where the device is installed is close to either radio or television receivers). If this is the case, then the operator is obliged to take action to rectify the situation.

Data protection

The user is responsible for the safekeeping of any changes made to the factory settings. The manufacturer accepts no liability for any deleted personal settings.

Copyright

General information

General

Intended use

With its "24 hours of sun" vision, Fronius is aiming to offer its customers solutions for generating, storing, distributing and using energy in an intelligent and cost efficient manner. The use of surplus energy for hot water preparation constitutes a simple option, with low investment costs, for storing electricity in the form of heat and using it at a time of the customer's choosing.

The Fronius Ohmpilot, which carries out precisely this task, is therefore an ideal addition to the Fronius product portfolio in the area of energy management and a further step towards "24 hours of sun".

Components of the solution as a whole

The solution as a whole consists of the following components:

- Fronius SnapInverter or GEN24 series inverters
  - Fronius Symo / Galvo / Eco or Primo (from Fronius Datamanager 2.0 software version 3.8.1-x or higher) or Fronius Symo Hybrid (from Fronius Hybridmanager software version V1.8.1.x onwards)
  - Fronius Primo / Symo GEN24
- Fronius Smart Meter
- Fronius Ohmpilot
- Resistive load (e.g. boiler with heating element)

Integrating the Fronius Smart Meter

A Fronius Smart Meter is required to operate the Ohmpilot so that the surplus energy can be measured. On the user interface of the inverter, it must be set whether the Fronius Smart Meter is installed at the feed-in point or in the consumption branch.

Description of the device

The Ohmpilot is a separate device that can control the surplus power from the PV system in a continuously variable manner using pulse width modulation for a phase between 0 and 100% (or 0 and 3 kW). In addition, the Ohmpilot has 2 additional outputs for switching further phases. This means that heating elements with an output of 300 W to 9 kW can be controlled in a continuously variable manner.

A heating element with up to 3 kW output can be controlled in a continuously variable manner using one phase.

For a heating element with 9 kW output, the surplus power of 0 - 3 kW is controlled in a continuously variable manner in phase 1. If even more power is available, the Ohmpilot also activates phase 2 and phase 1 can again control the surplus in a continuously variable manner between 3 – 6 kW. If the available power is higher than 6 kW, the Ohmpilot also activates phase 3 and phase 1 can again control the surplus in a continuously variable manner between 6 and 9 kW.

Power range	Phase 1	Phase 2	Phase 3
0 - 3 kW	0 - 3 kW continuously variable	-	-
3 - 6 kW	0 - 3 kW continuously variable	3 kW fixed	-

6 - 9 kW	0 - 3 kW continuously variable	3 kW fixed	3 kW fixed

Other resistive loads such as infrared heaters, towel dryers, etc. can also be controlled.

To be considered when designing the system

NOTE!

Ohmpilot phase control
The Ohmpilot controls to the sum of all phases. The Ohmpilot is not suitable for the rare case of phase-accurate billing.

NOTE!

Ohmpilot and Fronius Datamanager / Hybridmanager
Only one Ohmpilot can be used per Fronius Datamanager / Hybridmanager.

NOTE!

Ohmpilot and dynamic power reduction
From software version 3.13.1-x and onwards on the Fronius Datamanager or 1.11.1-x onwards on the Fronius Hybridmanager, the Ohmpilot can be used together with the dynamic power reduction of 0-100%.

NOTE!

Use of other generation sources
With the Fronius Datamanager Box 2.0, any other generation source (CHP, third-party inverter, etc.) can also be used. However, since information about the power produced and the consumption is missing, this cannot be displayed in Fronius Solar.web.

NOTE!

Due to high heat outputs, the Ohmpilot cannot be operated in backup power situations.
It is therefore recommended to install the Ohmpilot outside of the backup power branch. If the Ohmpilot is installed in the backup power branch, the existing automatic circuit breaker of the Ohmpilot must be switched off in the event of a power failure. Alternatively, the heating element measurement must be changed to manual, and the minimum temperature and legionella prevention must be deactivated. (See chapter "**Optional settings**" on page **2**). The power level required for these functions exceeds the power limits in backup power mode. Since these functions are blocked when backup power mode starts, these settings cannot be changed during a power failure.

⚠ **CAUTION!**

Danger from connecting an incorrect load (e.g. fan heater).
The result is destruction of the load.
▶ Connect only purely resistive loads.

⚠ CAUTION!

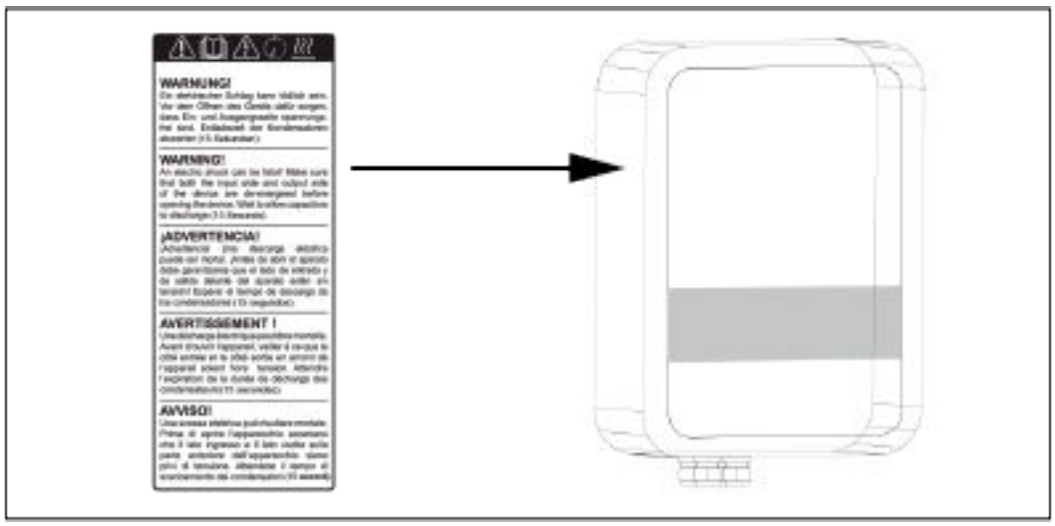
Danger from connecting an electronic thermostat.
The result is destruction of the Ohmpilot or load.
▶ Use mechanical temperature switches.

NOTE!

If the water is hard, the heating element may become calcified, especially if the minimum temperature is set above 60 °C.
An annual inspection of the heating element is recommended.
▶ To do this, remove the heating element from the energy storage device and remove the limescale.
▶ Do not scratch the surface of the heating element while doing so.

Warning notices on the device

Warning notices and safety symbols are affixed to the left side of the Ohmpilot. These warning notices and safety symbols must not be removed or painted over. They warn against incorrect operation, as this may result in serious injury and damage.



Safety symbols:

Danger of serious injury and damage due to incorrect operation

Do not use the functions described here until you have fully read and understood the following documents:
- These Operating Instructions
- All the Operating Instructions for the system components of the photovoltaic system, especially the safety rules

Dangerous electrical voltage

Before opening the machine, wait for the capacitors to discharge!

Hot surface

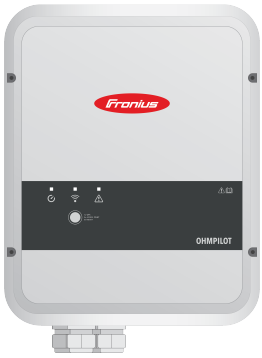
Text of the warning notices:

WARNING!
An electric shock can be fatal. Before opening the device, it must be disconnected at the input and output. Wait for the capacitors to discharge (15 seconds).

WARNING!
The device must not be covered and nothing may be hung over the device or the cables.

Control elements and connections

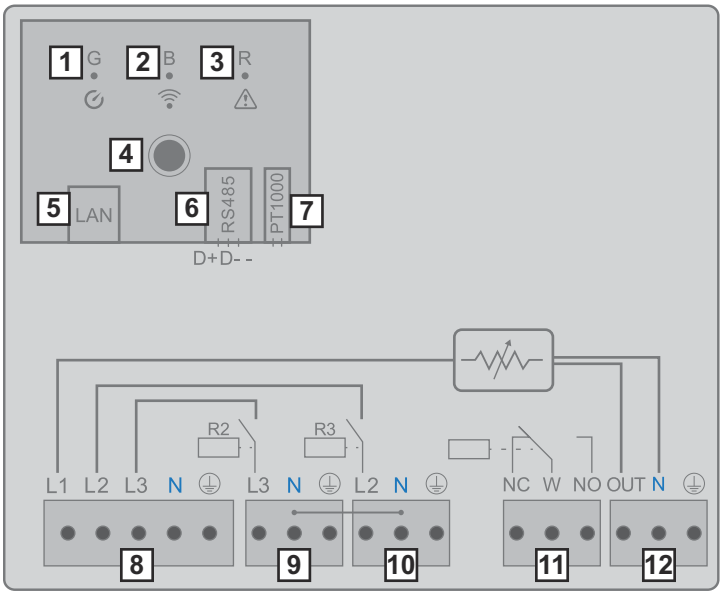
Indicators/ controls on the device



		1x WPS 2x ACCESS POINT 3x BOOSTMODE
	Press 1x	WPS (Wi-Fi Protected Setup) opens for 2 minutes or until successful pairing with the router. Pressing the WPS button on the router sends the WLAN password to the Ohmpilot.
	Press 2x	WLAN access point is activated for 30 minutes so that settings can be implemented on the Ohmpilot via the Fronius Solar.web App.
	Press 3x	Boost Mode - dimmer level is activated for 4 hours at 100%, L2 and L3 are switched through. This may result in electricity being sourced from the grid.
	Press again	Ohmpilot is returned to standard operating mode, Boost Mode, access point or WPS are deactivated.
Heating indicator	Dark	No power supply to the Ohmpilot.
	Green flashing	The faster the flashing frequency, the greater the heat output. At 0 W heat output, the LED flashes slowly, at full output fast.
	Green 2x flashing	It measures the output of the heating element and detects whether a 1- or 3-phase heater is connected.
	Steady green	Minimum temperature undercut or legionella prevention active (full heat output).
LAN / WLAN connection indicator	Dark	No connection
	Blue 1x flashing	WPS (Wi-Fi Protected Setup) open
	Blue 2x flashing	WLAN Access Point open
	Steady blue	Connection to network

Error indicator	Dark	No error
	Red 1x flashing	No connection to the inverter
	Red 2x flashing	Temperature measurement faulty
	Red 3x flashing	Heating element faulty
	Red 4x flashing	Ohmpilot faulty
	Red 5x flashing	Minimum temperature not reached
	A detailed description of the error is provided in Fronius Solar.web.	

Connection area



(1)	**Green LED**
(2)	**Blue LED**
(3)	**Red LED**
(4)	**Button**
(5)	**Ethernet RJ45** At least CAT5, screened
(6)	**Modbus RTU (default address 40)** Spring balancer 0.2 - 1.5 mm^2, max. 1000 m, screened and twisted
(7)	**Temperature sensor terminal connection** PT 1000, spring balancer 0.2 - 1.5 mm^2
(8)	**INPUT - grid supply** 1x 230 V, or 3x 230 V, spring balancer 1.5 - 2.5 mm^2
(9)	**OUTPUT - L3 heating element** Spring balancer 1.5 - 2.5 mm^2
(10)	**OUTPUT - L2 heating element** Spring balancer 1.5 - 2.5 mm^2

(11) Multi-function relay output, (see application examples)

Variable max. 13 A resistive load, spring balancer 1.5 - 2.5 mm^2

⚠ WARNING!

Dangerous voltages.
A wire detaches and makes contact with dangerous voltages.
▶ If signal cables are connected, the individual wires must be tied together with a cable tie directly upstream of the terminal.

(12) OUTPUT - heating element

Continuously variable up to 3 kW

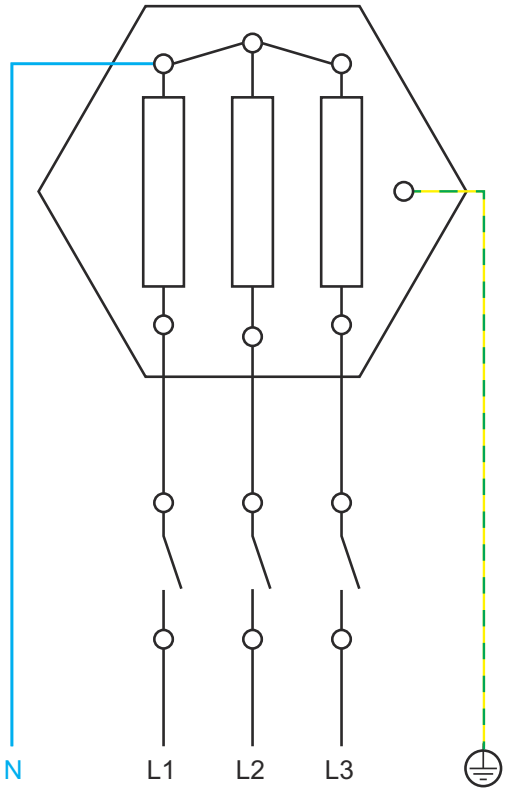
Selection of heater

1-phase heater

Controlled in a continuously variable manner from 0 to 3 kW
- 0.3 to 3 kW
- Purely resistive load (no electronic temperature limiters, fans, etc.)

3-phase heater:

Controlled in a continuously variable manner from 0 to 9 kW.
- 0.9 to 9 kW
- Equal load distribution on all 3 phases (e.g. 3 x 3 kW).
- If a mechanical temperature switch is being used, it must switch all 3 phases simultaneously.
- Purely resistive load (no electronic temperature limiters, fans, etc.)
- Neutral conductor must be implemented (this can generally also be retrofitted)



Temperature limitation
A mechanical temperature switch simplifies commissioning and use. If a mechanical temperature switch is not available, a temperature sensor can also be connected to the Ohmpilot to limit the maximum temperature. (See chapter "**Temperature limitation**" on page **2.4**)

Example for calculation of charging time

500-litre boiler, heater can be fitted at the very bottom of the boiler, temperature spread 45 - 60 °C = 15 °C;
4.5 kW heater

Possible stored energy = 500l x 1.16 kWh x 15 °C = 8.7 kWh. If the heater is fully activated, the heating up takes approx. 2 hours (8.7 kWh / 4.5 kW)

NOTE!

Power adjustment
So that optimal use can be made of the surplus power and the hot water is reheated quickly, the heater output should be adapted to the output of the photovoltaic system, e.g. 5 kWp => 4.5 kW heater.

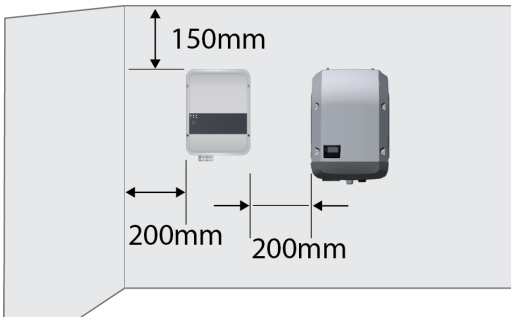
Installation and commissioning

Choice of location and installation position

Choosing location - general remarks

Please note the following criteria when choosing a location for the Ohmpilot:

Install only on a solid surface.



Max. ambient temperatures:
0 °C / +40 °C

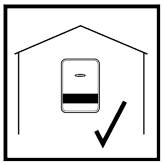
Relative humidity:
0 - 99%

The airflow within the Ohmpilot is from the bottom to the top.

If the Ohmpilot is installed in an enclosed space, then forced-air ventilation must be provided to ensure adequate heat dissipation.

IMPORTANT! The maximum cable length from the output of the Ohmpilot to the load (heating element) must not exceed 5 m.

Choice of location

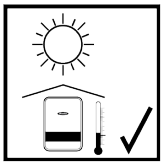


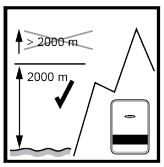
The Ohmpilot is suitable for installation indoors.

Do not install the Ohmpilot outdoors.

The housing complies with protection class IP 54 and is protected against spray water from all sides.

In order to minimise the heating up of the Ohmpilot, do not expose it to direct insolation. Mount the Ohmpilot in a protected position. The Ohmpilot must only be mounted and operated at an ambient temperature of 0-40 °C.





IMPORTANT! The Ohmpilot must not be installed or used at altitudes above 2000 m.

Do not install the Ohmpilot in:
- Areas where ammoniac, corrosive vapours, acids or salts are present (e.g. fertiliser stores, ventilation openings from cattle sheds, chemical plants, tanneries, etc.)

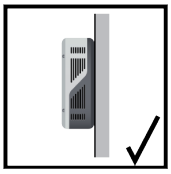
Do not install the Ohmpilot in:
- Places where there is an increased risk of damage from farm animals (horses, cattle, sheep, pigs, etc.)
- Stables or adjoining areas
- Storage areas for hay, straw, chaff, animal feed, fertilisers, etc.

The Ohmpilot is designed to be dustproof. However, in areas with a heavy build-up of dust, the thermal efficiency may still be impaired by dust forming on the cooling surfaces. Regular cleaning is necessary in such situations. We therefore recommend not installing the device in areas and environments with high dust accumulation.

Do not install the Ohmpilot in:
- Greenhouses
- Storage or processing areas for fruit, vegetables or viticulture products
- Areas used in the preparation of grain, green fodder or animal feeds

Explanation of symbols - installation position

The Ohmpilot is designed to be installed vertically on a vertical wall.



Do not install the Ohmpilot horizontally.

Do not install the Ohmpilot on a sloping surface.

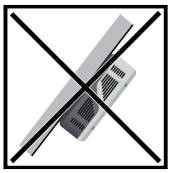
Do not install the Ohmpilot on a sloping surface with its connection sockets facing upwards.

Do not install the Ohmpilot at an angle on a vertical wall.

Do not install the Ohmpilot horizontally on a vertical wall.

Do not install the Ohmpilot such that it overhangs with its connection sockets facing upwards.

Do not install the Ohmpilot such that it overhangs with its connection sockets facing upwards.



Do not install the Ohmpilot such that it overhangs with its connection sockets facing downwards.

Do not install the Ohmpilot on the ceiling.

Wall mounting

Safety

⚠ WARNING!

Danger due to residual voltage from capacitors.
An electric shock can be fatal!
▶ Before opening the device, wait for the capacitors to discharge (15 seconds).

⚠ WARNING!

Risk of burns from the heat sink when open.
This can result in personal injury.
▶ Wear suitable protective equipment.
▶ Allow heat sink to cool.
▶ Do not touch the hot heat sink.

IMPORTANT! The IP 54 protection class only applies if the cover is firmly screwed to the back.

Selecting wall plugs and screws

IMPORTANT! Different fixings may be required to fit the Ohmpilot depending on the type of surface. Fixings are therefore not included in the scope of supply. The installer is responsible for selecting the correct fixings. It must be ensured that the screws are tight and that the wall is stable.

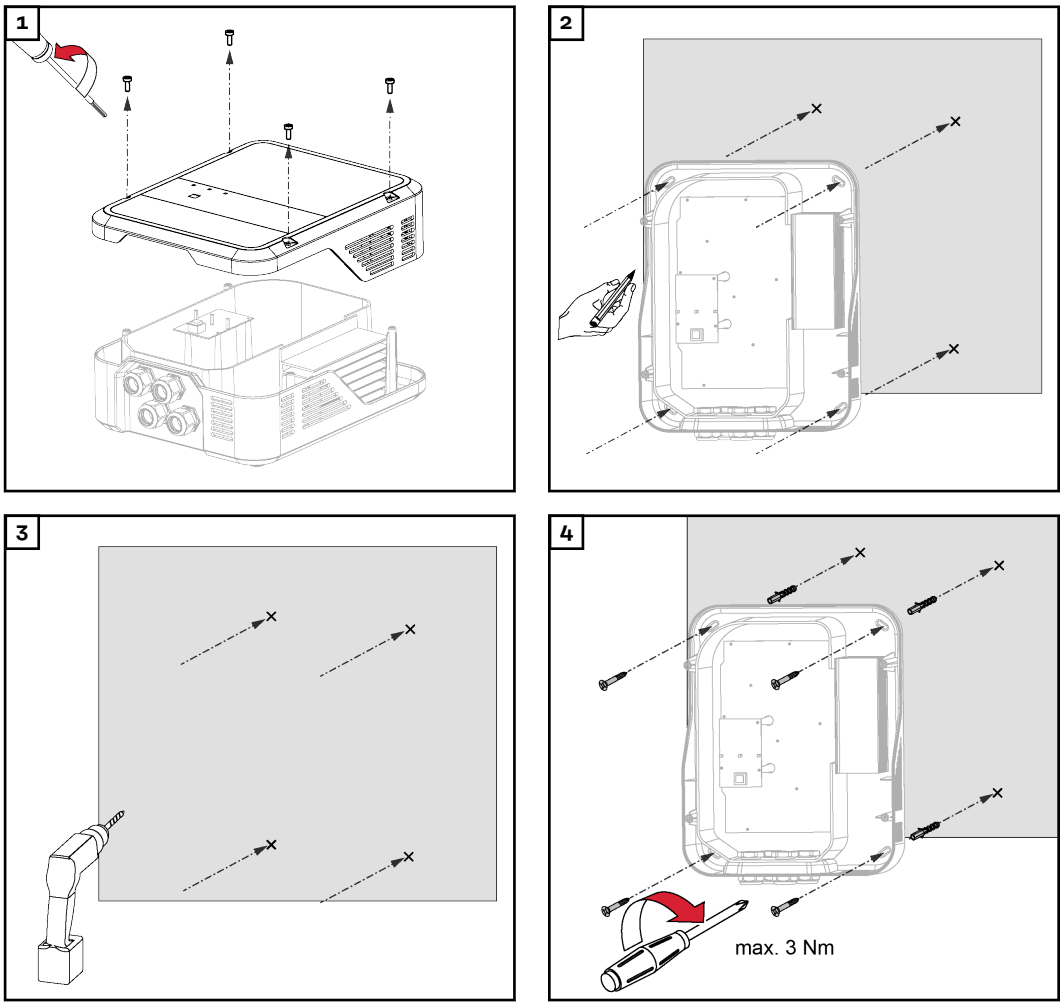
Recommended screws

To install the Ohmpilot, Fronius recommends the use of steel screws with a diameter of 4 - 6 mm.

⚠ CAUTION!

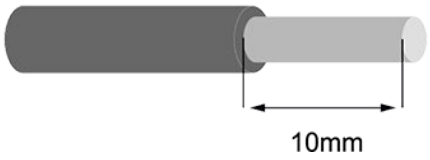
Risk of contamination or water on the terminals or electronics
This may result in damage to the Ohmpilot.
▶ When drilling, ensure that terminals and electronics do not become dirty or wet.

Mounting the Ohmpilot on the wall

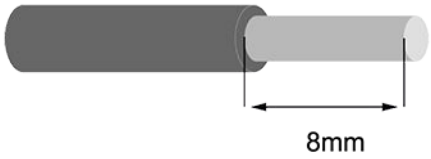


Installation

Stripping lengths



Stripping length of terminals on power stage set (L1, L2, etc.)



Stripping length of terminals on control board (D+, D-, - and PT1000)

Electrical connection

⚠ WARNING!

Danger from inadequate ground conductor connection.
This can result in severe personal injury or damage to property.
▶ Adequately dimension the ground conductor connection.

IMPORTANT! Electrical connection work may only be carried out by a specialist.

IMPORTANT! The ground conductor connection must be perfectly installed and reliably connected.

IMPORTANT! The Ohmpilot must be equipped with an overvoltage protection device of maximum B16 A and a residual-current circuit breaker on the grid side.

IMPORTANT! On the output side, it must be ensured that only purely resistive loads are connected.

IMPORTANT! The maximum cable length from the output of the Ohmpilot to the load (heating element) must not exceed 5 m due to electromagnetic compatibility.

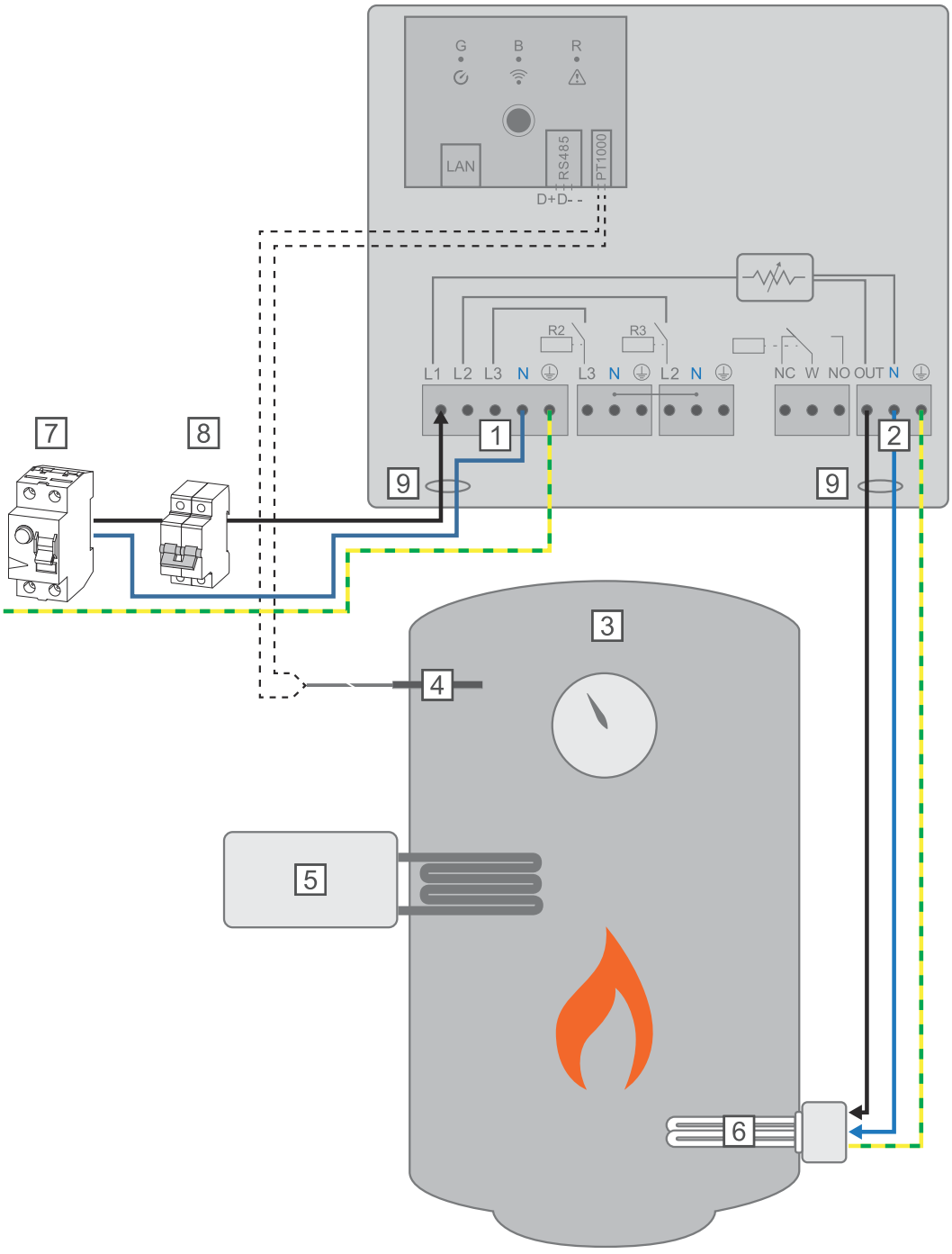
IMPORTANT! The Ohmpilot must be protected against overvoltage from the grid.

IMPORTANT! When connecting a heating element, check the grounding of the boiler/buffer and the heating system. Also check the maximum permissible inlet water and hot water temperature when setting the temperature on the heating element.

IMPORTANT! The RS485 lead should be designed as a data cable in order to prevent any mix-up with the mains lead when connecting.

1-phase heating element up to 3 kW

Application example 1



(1) **INPUT - grid supply** 1x 230V network, spring-loaded terminal 1.5 - 2.5 mm²

(2) **OUTPUT up to 3 kW** variable, max. 13 A resistive load, spring-loaded terminal 1.5 - 2.5 mm²

(3) **Hot water boiler**

(4) **Temperature sensor** PT1000

(5) **External source** (e.g. gas-fired heating)

(6) **Heating element** (max. 3 kW)

(7) **Residual-current circuit breaker**

(8) **Automatic circuit breaker** max. B16A
(9) **Ferrite** (included in scope of supply)

IMPORTANT! Plug & Play - no further settings are required for this application after successful connection to the inverter.

The Fronius Smart Meter records the current power at the feed-in point and transfers the data to the inverter. By controlling the Ohmpilot, the inverter adjusts any surplus energy that is available to zero. In detail, this takes place by continuously adjusting the heating element connected to the Ohmpilot. Surplus energy is consumed using the heating element in a continuously variable manner.

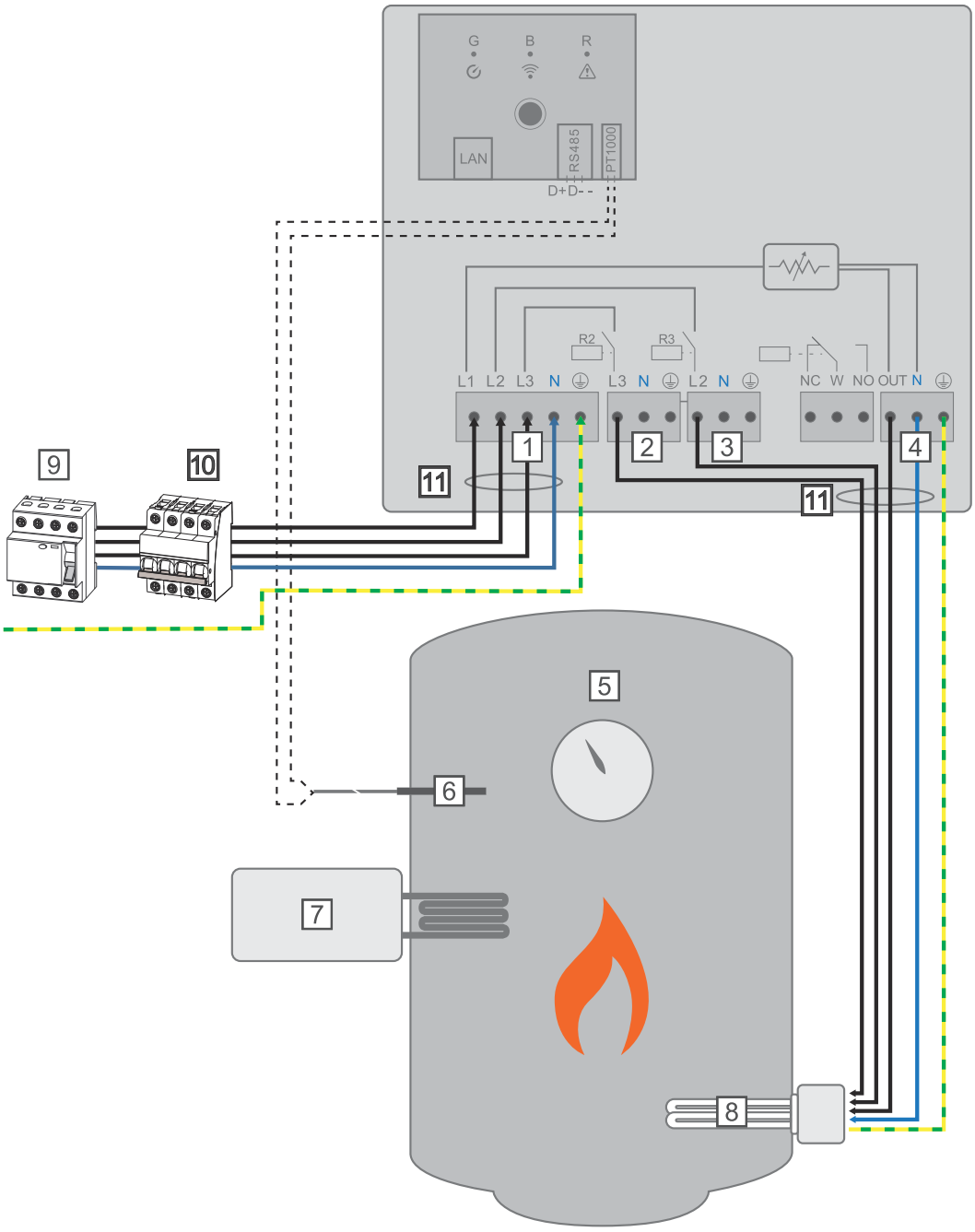
If no temperature sensor is fitted, an external source (e.g. gas-fired heating) must be used to ensure the minimum temperature is met.

As an alternative, the Ohmpilot can ensure the minimum temperature. To do this, a temperature sensor must be connected so that the Ohmpilot can measure the temperature. This may result in electricity being sourced from the grid.

The maximum temperature must be set on the heating element thermostat. If the heating element does not have a thermostat, the Ohmpilot can also carry out this task as an alternative (see chapter **Optional settings** on page **122**).

3-phase heating element 900 W up to 9 kW

Application example 2



(1) **INPUT- grid supply** 3x 230 V network, spring-loaded terminal 1.5 - 2.5 mm²
(2) **OUTPUT - L3 heating element**
(3) **OUTPUT - L2 heating element**
(4) **OUTPUT up to 3 kW** variable, max. 13 A resistive load, spring-loaded terminal 1.5 - 2.5 mm²
(5) **Hot water boiler**
(6) **Temperature sensor** PT1000
(7) **External source** (e.g. gas boiler)
(8) **Heating element** (max. 9 kW)
(9) **Residual-current circuit breaker**

(10) **Automatic circuit breaker** max. B16A
(11) **Ferrite** (included in scope of supply)

IMPORTANT! Plug & Play - no further settings are required for this application after successful connection to the inverter.

The Fronius Smart Meter records the current power at the feed-in point and transfers the data to the inverter. By controlling the Ohmpilot, the inverter adjusts any surplus energy that is available to zero. In detail, this takes place by continuously adjusting the heating element connected to the Ohmpilot. This means that the surplus energy is consumed in a continuously variable manner with the heating element.
Depending on the surplus power, the individual phases are switched on or off and the remaining power is consumed at L1. As a result, the heating element output is divided by three.

If no temperature sensor is fitted, an external source (e.g. gas boiler) must be used to ensure the minimum temperature is met.

As an alternative, the Ohmpilot can ensure the minimum temperature. To do this, a temperature sensor must be connected so that the Ohmpilot can measure the temperature. This may result in electricity being sourced from the grid.

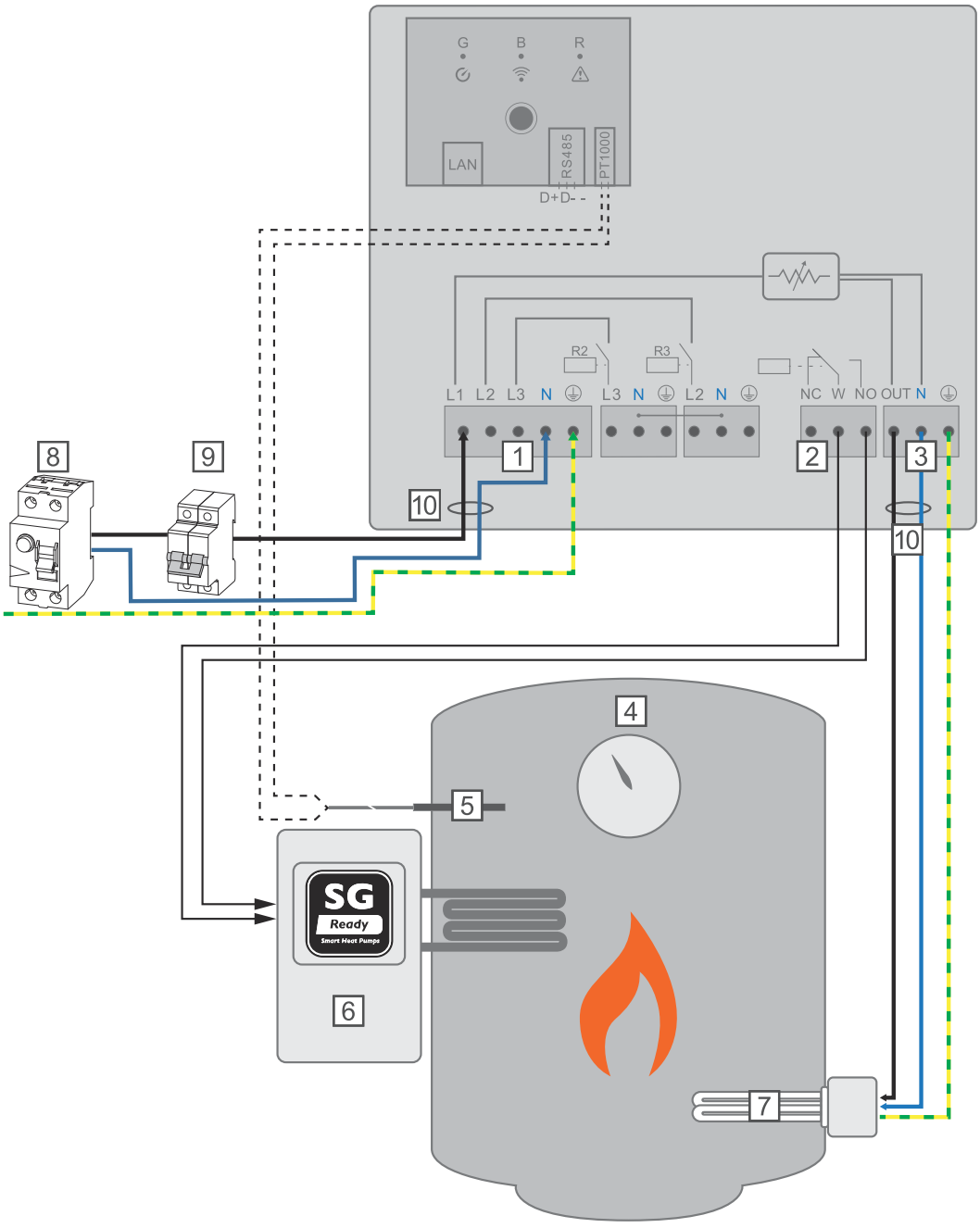
The maximum temperature must be set on the heating element thermostat. If the heating element does not have a thermostat, the Ohmpilot can also carry out this task as an alternative (see chapter **Optional settings** on page **122**).

IMPORTANT! A heating element with a neutral conductor is required.

1-phase heating element up to 3 kW with heat pump control

EN

Application example 3



(1) **INPUT - grid supply** 1x 230 V network, spring-loaded terminal 1.5 - 2.5 mm²

⚠ WARNING!

Short circuit
If current-carrying stripped wires touch each other, a short circuit is triggered.
- ▶ Carry out all connection work in accordance with the applicable electrotechnical guidelines and regulations.
- ▶ Observe the maximum stripping length of 10 mm.
- ▶ When connecting the phases, tie together the individual wires with a cable tie directly in front of the terminal.

(2) **Multifunctional relay output**
(3) **OUTPUT up to 3 kW** variable, max. 13 A resistive load, spring-loaded terminal 1.5 - 2.5 mm²
(4) **Hot water boiler**
(5) **Temperature sensor** PT1000
(6) **Heat pump** with SG Ready control input

NOTE!

Relay contacts can oxidise.
The voltage must be at least 15 V and the current at least 2 mA, so that the relay contacts do not oxidise.

(7) **Heating element** (max. 3 kW)
(8) **Residual-current circuit breaker**
(9) **Automatic circuit breaker** max. B16A
(10) **Ferrite** (included in scope of supply)

The Fronius Smart Meter records the current power at the feed-in point and transfers the data to the inverter. By controlling the Ohmpilot, the inverter adjusts any surplus energy that is available to zero. In detail, this takes place by continuously adjusting the heating element connected to the Ohmpilot and by targeted switching on of the heat pump.

For activation, the heat pump must have a control input (e.g. SG Ready or grid operator release). For example, the heat pump can be switched from operating state 2 (normal operation) to operating state 3 (increased operation) as a result of activation of heat pump input 2 by the relay. The heat pump can also be switched from operating state 1 (blocked time set by grid operator) to operating state 2 (normal operation) as a result of activation of heat pump input 1 by the relay.

A description and list of SG Ready heat pumps can be found at: **http://www.waermepumpe.de/normen-technik/sg-ready/sg-ready-datenbank/**

Relatively small surpluses are consumed by the heating element in a continuously variable manner. From a certain excess power, it makes sense to activate the heat pump, as it has a higher efficiency. The average COP (coefficient of performance) for water heating up to 53 °C is 2.5. Thus, with 1 KW of electrical energy, 2.5 KW of thermal energy can be generated.

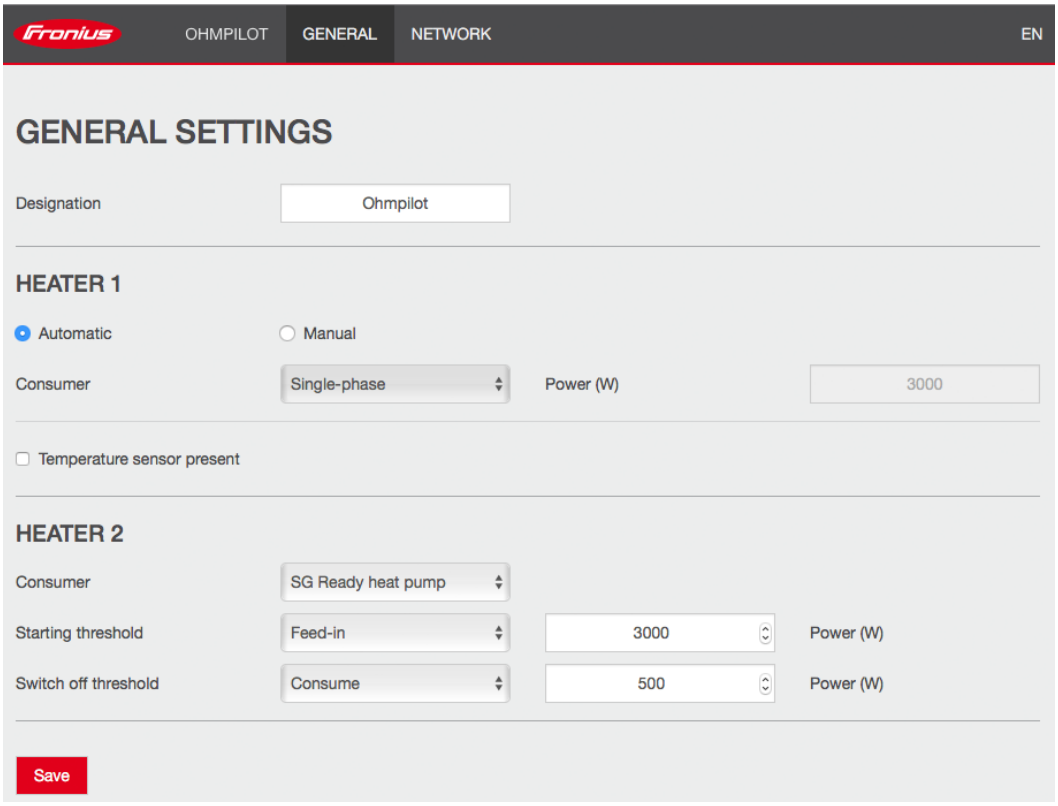
The optimal switching thresholds depend on:

- Heat pump COP. The higher the temperature to which the hot water is heated, the lower the COP.
- The electrical heat pump output.
- The feed-in tariff and the costs for purchasing energy.
- Reduction of the heat pump's start-up cycles = increase in service life of the heat pump.
- Thermal losses from the heat pump and the pipes.

If no temperature sensor is fitted, the heat pump must be used to ensure the minimum temperature is met. As an alternative, the Ohmpilot can also ensure the minimum temperature by activating the heat pump. This may result in electricity being sourced from the grid. The maximum temperature must be set on the heating element thermostat and on the heat pump. If the heating element does not have a thermostat, the Ohmpilot can also carry out this task as an alternative (see chapter **Optional settings** on page **122**).

This function can **also be combined with a 3-phase heating element**.

Settings in the menu area



General settings, symbolic representation

1 Open the Ohmpilot user interface
Chapter **Establishing the data connection** on page **113** describes how you can access the Ohmpilot user interface.

2 Under **HEATER 2** for **consumer**, select "**SG Ready heat pump**"

3 Select "**Feed-in**" under **Starting threshold** and enter the desired output in watts at which the heat pump is to be switched on.

4 Under **Switch-off threshold**, select "**Consume**" or "**Feed-in**" and enter the desired output in watts at which the heat pump is to be switched off.

Example 1: If "Consume" has been selected under the switch-off threshold and a power of 500 W has been entered, the heat pump will be switched off as soon as the power being drawn from the grid exceeds 500 W.

Example 2: If "Feed-in" has been selected under the switch-off threshold and a power of 500 W has been entered, the heat pump will be switched off as soon as the power being fed in is less than 500 W.

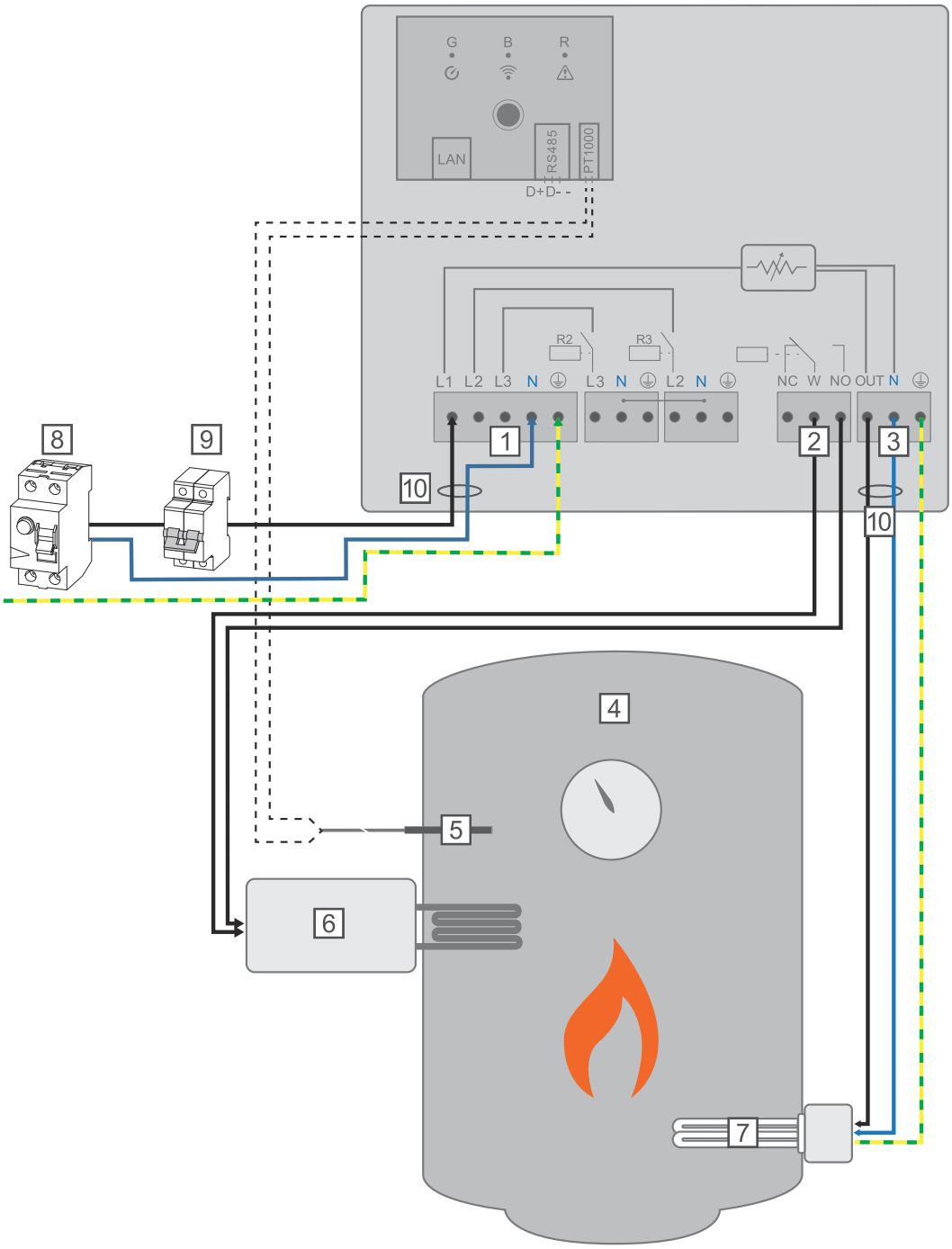
NOTE!

The heat pump must be connected to the same Fronius Smart Meter.
Between the switch-on and switch-off thresholds, the self-consumption of the heat pump must also be taken into consideration. For example, if the heat pump consumes 3000 watts of electricity and a hysteresis of 500 watts must be taken into account, the switch-on threshold can be set to feed-in 3000 watts and the switch-off threshold to purchase 500 watts.

1-phase heating element up to 3 kW and external source

EN

Application example 4



(1) **INPUT - grid supply** 1x 230 V network, spring-loaded terminal 1.5 - 2.5 mm^2

⚠ WARNING!

Short circuit
If current-carrying stripped wires touch each other, a short circuit is triggered.
- ▶ Carry out all connection work in accordance with the applicable electrotechnical guidelines and regulations.
- ▶ Observe the maximum stripping length of 10 mm.
- ▶ When connecting the phases, tie together the individual wires with a cable tie directly in front of the terminal.

(2) **Multifunctional relay output**
(3) **OUTPUT up to 3 kW** variable, max. 13 A resistive load, spring-loaded terminal 1.5 - 2.5 mm^2
(4) **Hot water boiler**
(5) **Temperature sensor** PT1000
(6) **External source** (e.g. gas boiler)

NOTE!

Relay contacts can oxidise.
The voltage must be at least 15 V and the current at least 2 mA, so that the relay contacts do not oxidise.

(7) **Heating element** (max. 3 kW)
(8) **Residual-current circuit breaker**
(9) **Automatic circuit breaker** max. B16A
(10) **Ferrite** (included in scope of supply)

The Fronius Smart Meter records the current power at the feed-in point and transfers the data to the inverter. By controlling the Ohmpilot, the inverter adjusts any surplus energy that is available to zero. In detail, this takes place by continuously adjusting the heating element connected to the Ohmpilot. Surplus energy is consumed using the heating element in a continuously variable manner.

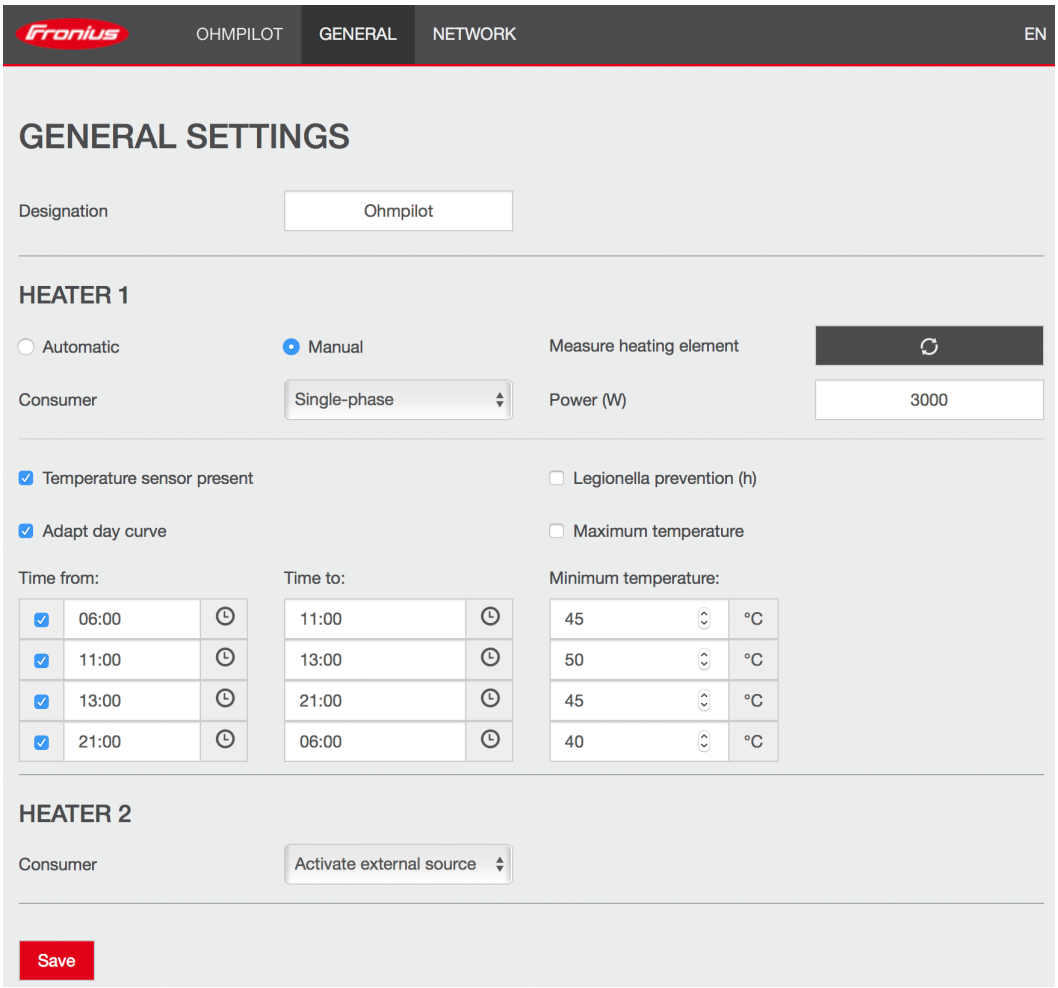
The temperature is measured by the Ohmpilot. If the temperature falls below the minimum, then an external source (e.g. gas boiler) will be activated until the minimum temperature is reached again, so that the Ohmpilot only uses surplus energy and does not draw any energy from the grid.

The maximum temperature must be set on the heating element thermostat. If the heating element does not have a thermostat, the Ohmpilot can also carry out this task as an alternative (see chapter **Optional settings** on page **122**).

The heating element is used for the legionella prevention program.

This function can **also be combined with a 3-phase heating element**.

Settings in the menu area



General settings, symbolic representation

1 Open the Ohmpilot user interface
Chapter **Establishing the data connection** on page **113** describes how you can access the Ohmpilot user interface.

2 Activate the "**Temperature sensor present**" field

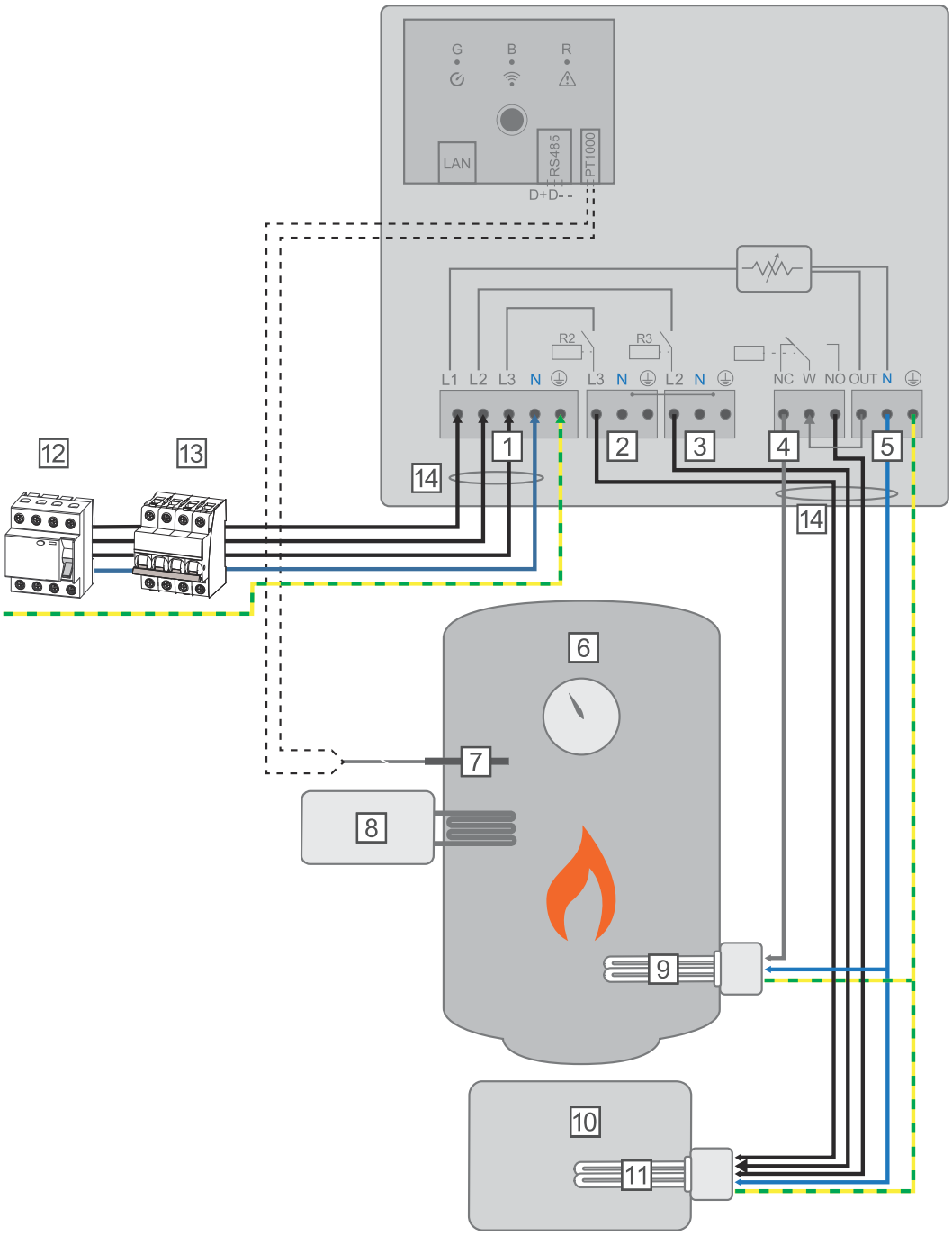
3 Activate the "**Adapt day curve**" field

4 Adjust settings under "**Time from**", "**Time to**" and "**Minimum temperature**" as desired
More information can be found in chapter **Adapting the day curve** on page **123**

5 Under **HEATER 2** for **Consumer**, select "**Activate external source**"

Two heating elements - 3-phase and 1-phase

Application example 5



(1) **INPUT - grid supply** 3x 230 V network, spring-loaded terminal 1.5 - 2.5 mm^2

(2) **OUTPUT - L3 heating element**

(3) **OUTPUT - L2 heating element**

(4) **Multifunctional relay output**

(5) **OUTPUT up to 3 kW** variable, max. 13 A resistive load, spring-loaded terminal 1.5 - 2.5 mm^2

(6) **Hot water boiler**

(7) **Temperature sensor** PT1000

(8) **External source** (e.g. gas boiler)

(9) **Heating element 1** (max. 3 kW)
(10) **Buffer**
(11) **Heating element 2** (max. 9 kW)
(12) **Residual-current circuit breaker**
(13) **Automatic circuit breaker** max. B16A
(14) **Ferrite** (included in scope of supply)

Many heating systems consist of a boiler and a buffer, whereby the central heating supplies the buffer, and a control system feeds the hot water boiler via a pump. As with thermal photovoltaic systems, the Ohmpilot is also capable of heating the hot water boiler first and then the buffer, so that the maximum amount of photovoltaic surplus energy can be stored.

The Fronius Smart Meter records the current power at the feed-in point and transfers the data to the inverter. By controlling the Ohmpilot, the inverter adjusts any surplus energy that is available to zero. In detail, this takes place by continuously adjusting the heating element connected to the Ohmpilot.

For this application, two heating elements are installed, with preference being given to activation of the first heating element (9). Only once the maximum temperature in the boiler (6) has been reached is the second heating element activated in a continuously variable manner, so that the remaining energy can, for example, be stored in a buffer.

If no temperature sensor is connected to the Ohmpilot, after 30 minutes the Ohmpilot attempts to output energy via the first heating element once again. If a temperature sensor is present, the device switches back to the first heating element as soon as a temperature difference of 8°C is reached (compared to the temperature measured prior to switch-over).

This switching can also be used for layering in a boiler/buffer, so that the maximum temperature is reached in the top part of the boiler using minimal energy and the remaining energy is stored in the lower part of the boiler. By using layering in a storage tank, it is also possible to store significantly more energy, as a minimum temperature is normally maintained in the top part of the boiler. This means that the temperature difference and thus the amount of energy is rather small. In the lower part of the boiler, a high temperature difference of, for example, 50 °C can be used.

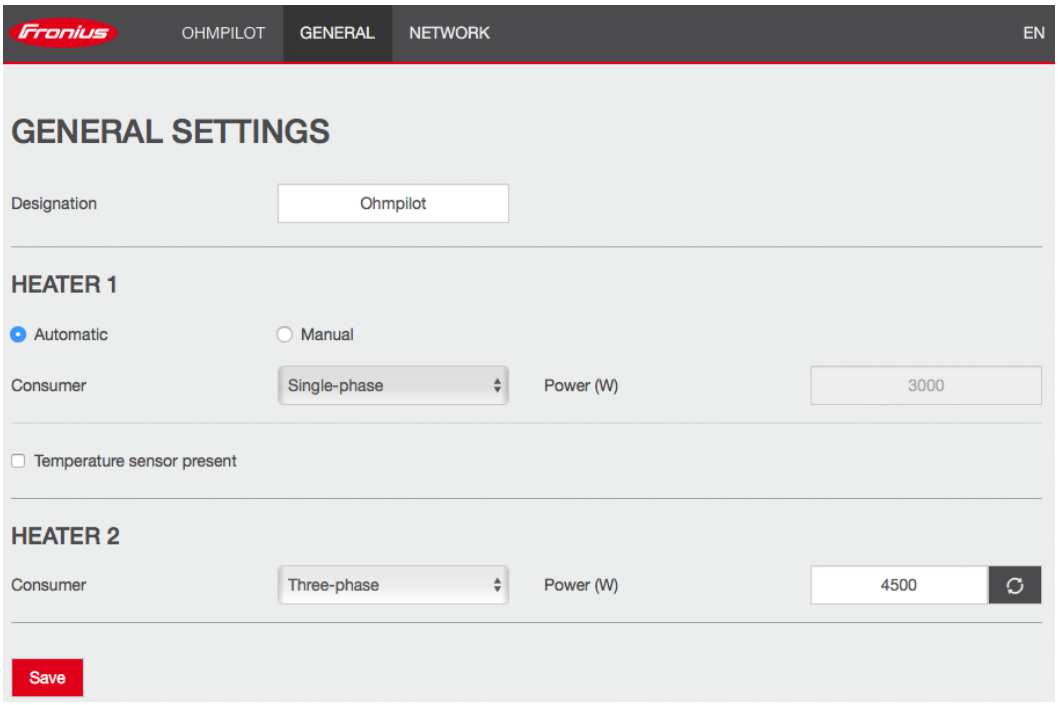
Both the first and the second heating element can be 1-phase or 3-phase. For two 3-phase heating elements, see **Application example 6**. If no temperature sensor is fitted, an external source (e.g. gas boiler) must be used to ensure the minimum temperature is met.

Alternatively, the Ohmpilot can also ensure the minimum temperature. This may result in electricity being sourced from the grid. The maximum temperature must be set on the heating element thermostat. If heating element 1 (9) does not have a thermostat, the Ohmpilot can also carry out this task as an alternative (see chapter **Optional settings** on page **122**). However, heating element 2 (11) must have a thermostat.

NOTE!

Heating at the same time.
At no point can both heating elements be heated simultaneously.

Settings in the menu area



General settings, symbolic representation

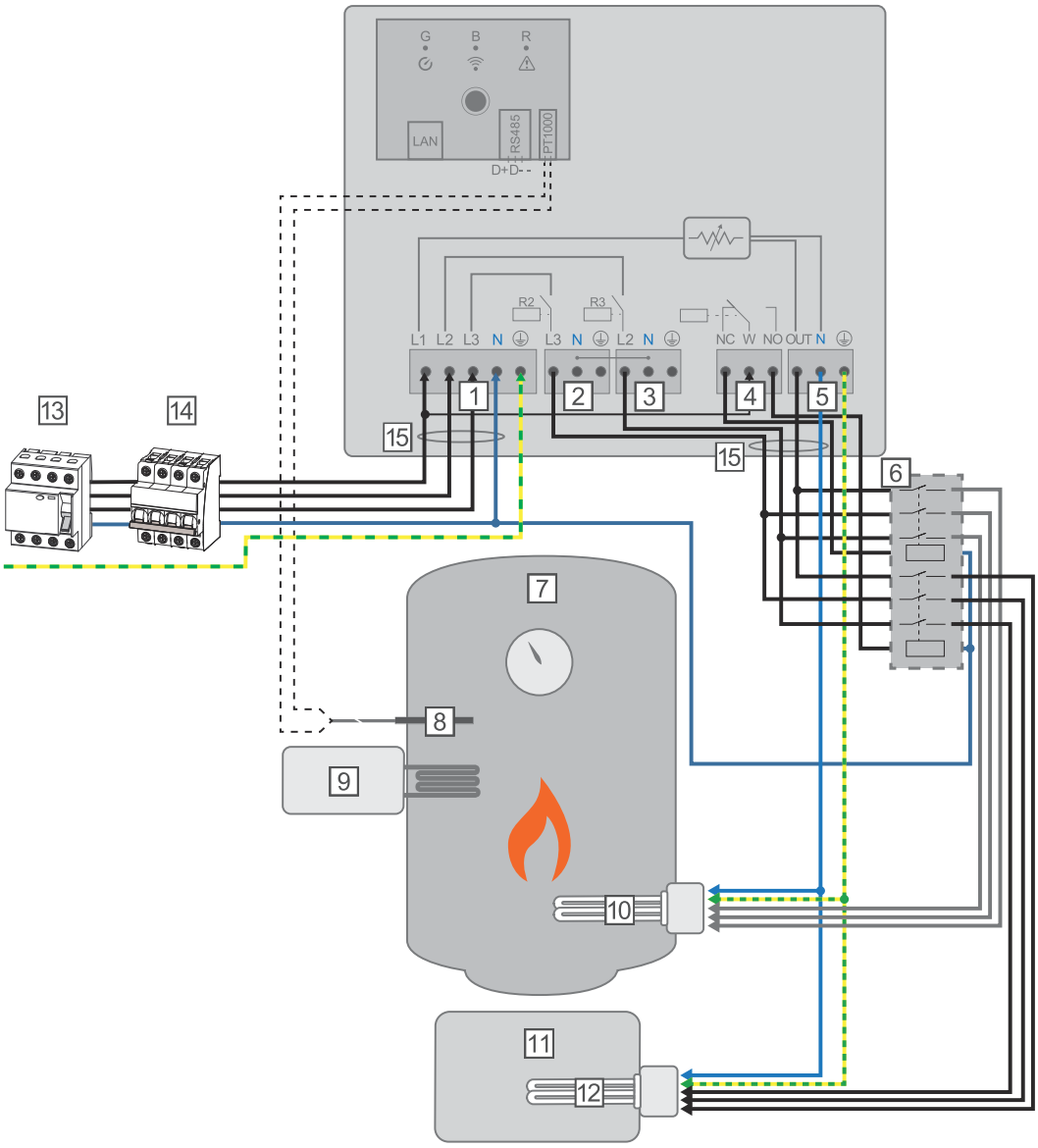
1 Open the Ohmpilot user interface
Chapter **Establishing the data connection** on page **113** describes how you can access the Ohmpilot user interface.

2 Under **HEATER 1**, select "**Manual**" and "**Single-phase or Three-phase**".

3 Under **HEATER 2**, select "**Single-phase or Three-phase**" and enter the output of the load.

Two 3-phase heating elements up to 9 kW

Application example 6



(1) **INPUT - grid supply** 3x 230 V network, spring-loaded terminal 1.5 - 2.5 mm²
(2) **OUTPUT - L3 heating element**
(3) **OUTPUT - L2 heating element**
(4) **Multifunctional relay output**
(5) **OUTPUT up to 3 kW** variable, max. 13 A resistive load, spring-loaded terminal 1.5 - 2.5 mm²
(6) **Contactor switching**
(7) **Hot water boiler**
(8) **Temperature sensor** PT1000
(9) **External source** (e.g. gas-fired heating)
(10) **Heating element 1** (max. 9 kW)
(11) **Buffer**
(12) **Heating element 2** (max. 9 kW)
(13) **Residual-current circuit breaker**

(14) **Automatic circuit breaker** max. B16A
(15) **Ferrite** (included in scope of supply)

Many heating systems consist of a boiler and a buffer, whereby the central heating supplies the buffer, and a control system feeds the hot water boiler via a pump. As with thermal photovoltaic systems, the Ohmpilot is also capable of heating the hot water boiler first and then the buffer, so that the maximum amount of photovoltaic surplus energy can be stored.

The Fronius Smart Meter records the current power at the feed-in point and transfers the data to the inverter. By controlling the Ohmpilot, the inverter adjusts any surplus energy that is available to zero. In detail, this takes place by continuously adjusting the heating element connected to the Ohmpilot.

For this application, two heating elements are installed, with preference being given to activation of the first heating element (10). Only once the maximum temperature in the boiler (7) has been reached is the second heating element (12) activated in a continuously variable manner, so that the remaining energy can, for example, be stored in a buffer.

If no temperature sensor is connected to the Ohmpilot, after 30 minutes the Ohmpilot attempts to output energy via the first heating element once again. If a temperature sensor is present, the device switches back to the first heating element as soon as a temperature difference of 8 °C is reached (compared to the temperature measured prior to switch-over).

This switching can also be used for layering in a boiler/buffer, so that the maximum temperature is reached in the top part of the boiler using minimal energy and the remaining energy is stored in the lower part of the boiler. By using layering in a storage tank, it is also possible to store significantly more energy, as a minimum temperature is normally maintained in the top part of the boiler. This means that the temperature difference and therefore the amount of energy is rather small. In the lower part of the boiler, a high temperature difference of, for example, 50 °C can be used.

The switching must be realised by an external contactor. If no temperature sensor is fitted, an external source (e.g. gas-fired heating) must be used to ensure the minimum temperature is met.

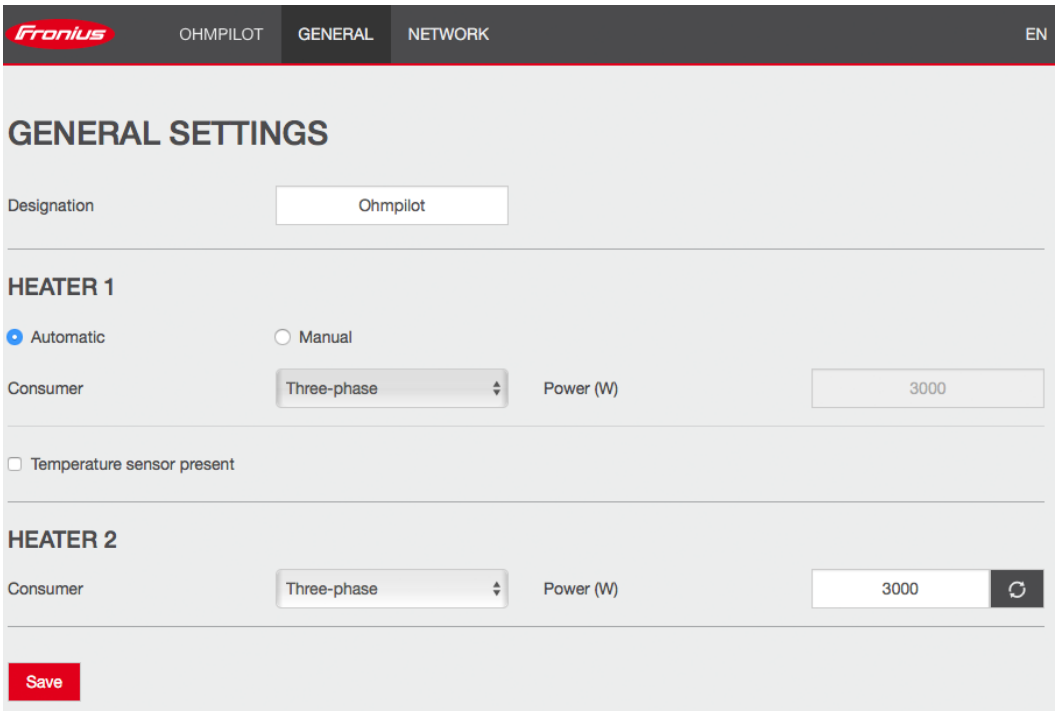
Alternatively, the Ohmpilot can also ensure the minimum temperature. This may result in electricity being sourced from the grid.

The maximum temperature must be set on the heating element thermostat. If heating element 1 (10) does not have a thermostat, the Ohmpilot can also carry out this task as an alternative (see chapter **Optional settings** on page **122**). However, heating element 2 (12) must have a thermostat.

NOTE!

Heating at the same time.
At no point can both heating elements be heated simultaneously.

Settings in the menu area



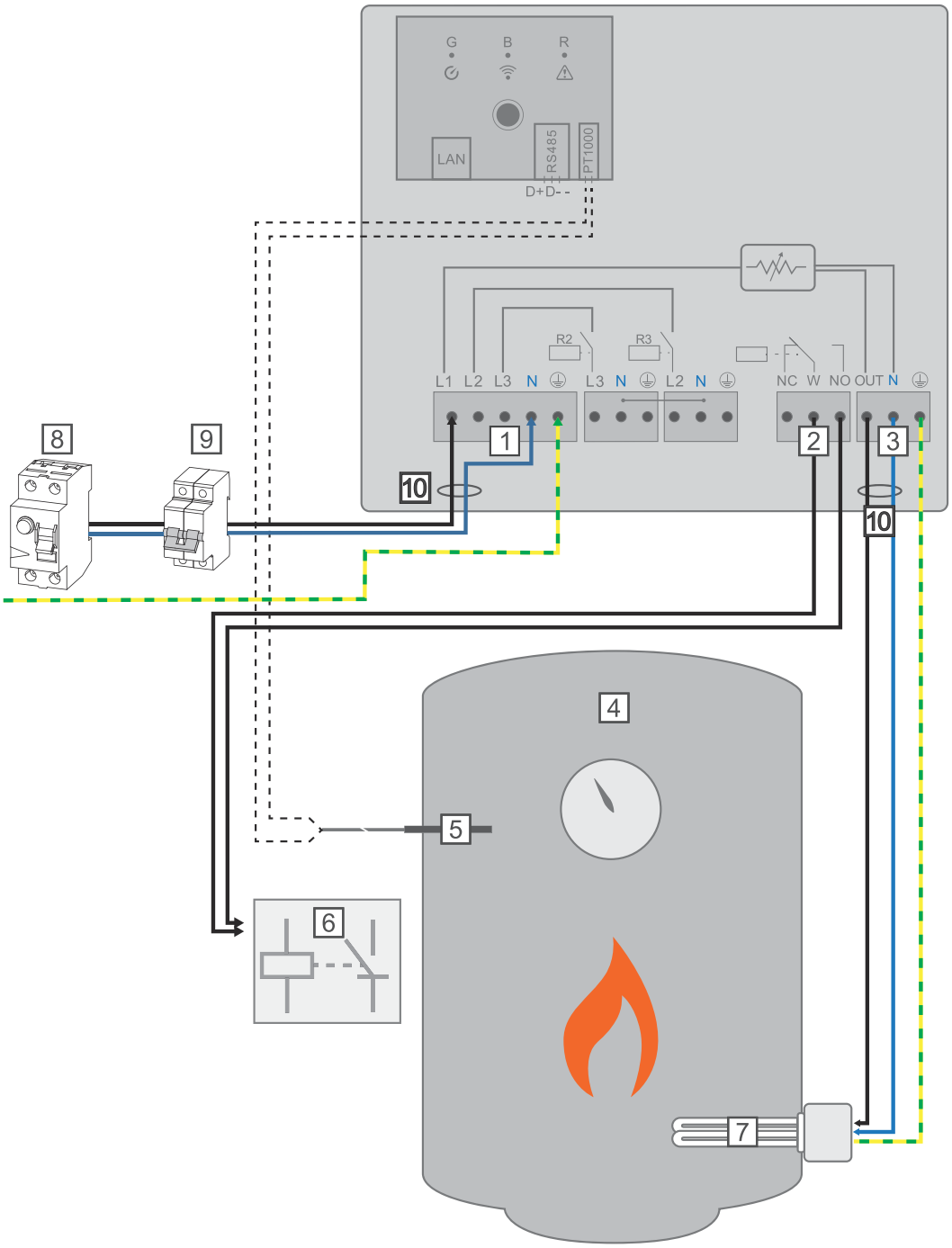
General settings, symbolic representation

1 Open the Ohmpilot user interface
Chapter **Establishing the data connection** on page **113** describes how you can access the Ohmpilot user interface.

2 Under **HEATER 2**, select "**Three-phase**" and enter the output of the load

1-phase heating element up to 3 KW and circulating pump

Application example 7



(1) **INPUT - grid supply** 1x 230 V network, spring-loaded terminal 1.5 - 2.5 mm^2

⚠ WARNING!

Short circuit
If current-carrying stripped wires touch each other, a short circuit is triggered.
- ▶ Carry out all connection work in accordance with the applicable electrotechnical guidelines and regulations.
- ▶ Observe the maximum stripping length of 10 mm.
- ▶ When connecting the phases, tie together the individual wires with a cable tie directly in front of the terminal.

(2) **Multifunctional relay output**
(3) **OUTPUT up to 3 kW** variable, max. 13 A resistive load, spring-loaded terminal 1.5 - 2.5 mm^2
(4) **Hot water boiler**
(5) **Temperature sensor** PT1000
(6) **Circulating pump auxiliary relay**

NOTE!

Relay contacts can oxidise.
The voltage must be at least 15 V and the current at least 2 mA, so that the relay contacts do not oxidise.

(7) **Heating element** (max. 3 kW)
(8) **Residual-current circuit breaker**
(9) **Automatic circuit breaker** max. B16A
(10) **Ferrite** (included in scope of supply)

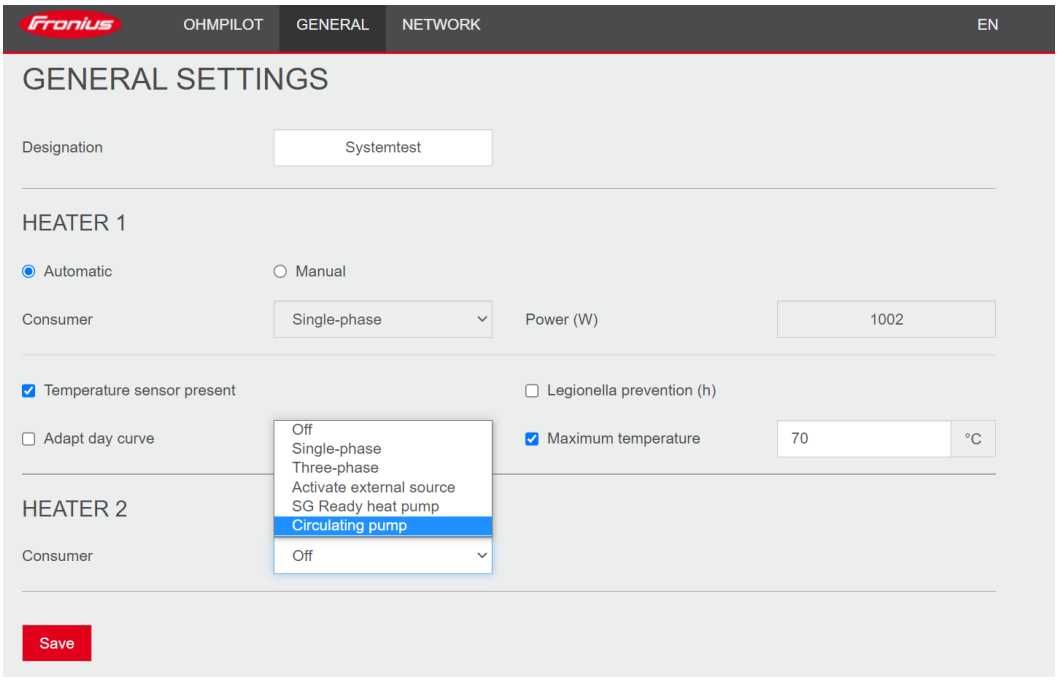
Via the floating contact of the device control, the Ohmpilot can also control a circulating pump in a heating system in parallel to a heating element. This is possible with all circulating pumps that have an auxiliary relay.

The designation of the floating contact on the Ohmpilot is **NC W NO**. The switching rocker (W) switches from the "normally open" (NO) position to "normally closed" (NC) when activated.

In heating mode, this contact is activated and the circulating pump runs as **"Heater 2"** in parallel to the heating element, which is operated via the **"Heater 1"** output.

To prevent the auxiliary relay of the circulating pump from switching on and off continuously in case of low or fluctuating PV power, the Ohmpilot is equipped with a delay. This has a positive effect on the wear and service life of the relay and the pump.

Settings in the menu area



General settings, symbolic representation

1 Open the Ohmpilot user interface
Chapter **Establishing the data connection** on page **113** describes how you can access the Ohmpilot user interface.

2 Under **HEATER 1**, select "Automatic"

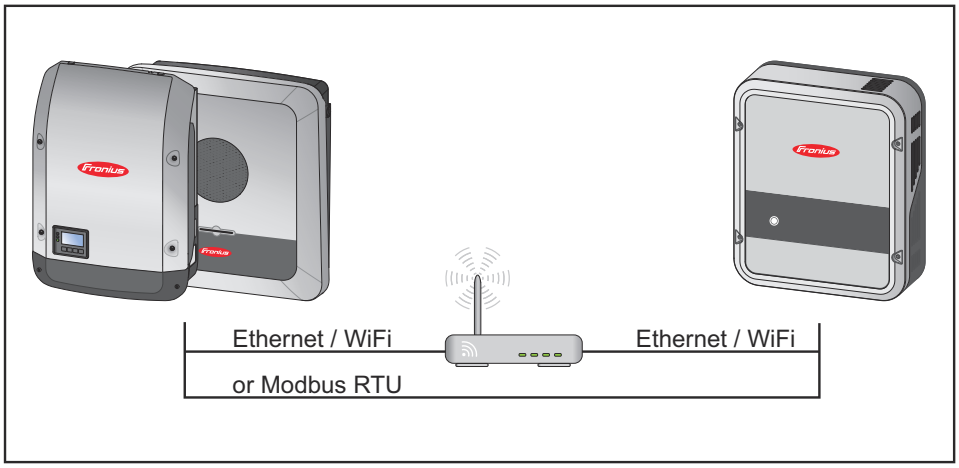
3 Under **HEATER 2**, select "Circulating pump"

IMPORTANT!
If the "Circulating pump" option is selected, no other heater can be controlled by the Ohmpilot. The **"HEATER 1"** output controls the heating element which, in combination with the circulating pump, heats a hot water tank.

Establishing the data connection

Possible communication channels

The data connection is required for communication between the inverter and the Ohmpilot. The inverter mainly sends default values to the Ohmpilot. For some applications, it is necessary to make settings via the Ohmpilot user interface.



There are 3 possible communication channels:
- Modbus RTU (via RS 485)
- LAN (Ethernet)
- WLAN

NOTE!

Compatible software versions
An inverter from the SnapInverter series (Datamanager 2.0) must have at least software version 3.8.1-x.

Connecting the inverter to the Ohmpilot

Each inverter with a Fronius Smart Meter automatically connects itself to the Ohmpilot. However, if there is more than one inverter with a Fronius Smart Meter in the network, the wrong inverter can be connected. In this case, the Ohmpilot can be manually connected under System Information on the user interface of the inverter to be connected.

Information on how to access the user interface of the inverter can be found in the "Fronius Datamanager 2.0" Operating Instructions.

Components

Inverter			
No	Device type	PMC	Serial number
1	Fronius Symo 4.5-3-S	254510007009303l6|4,071,334|0.8D_D|RECERBO|R|	

Meter			
No	Device type	Location of the meter	Serial number
1	Smart Meter 63A	Feed-in point (Primary meter)	15060034

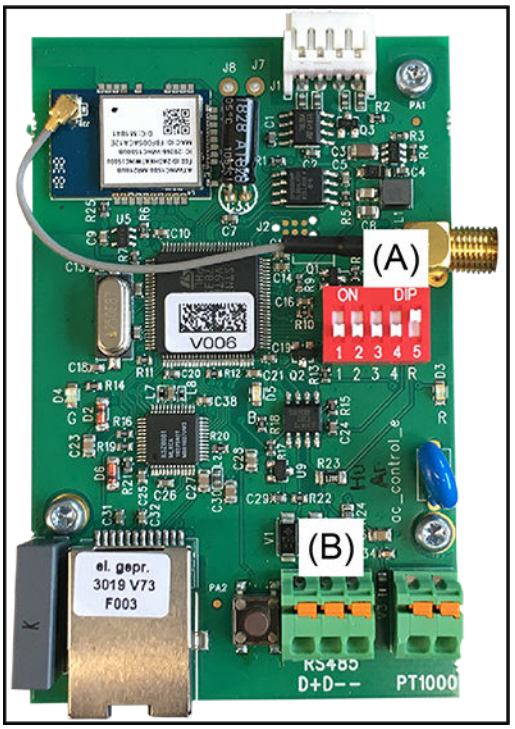
OhmPilot					
No	Serial number	Software version	Hardware version	Paired with	Pairing
1	28136344	61	3	239.3218	Pairing

Establishing a connection via Modbus RTU

1 Connect the bus cabling (B) to the Ohmpilot.
(The bus cabling is carried out in parallel via the TX+, TX- and GND cables with the Fronius Smart Meter and the Fronius inverter or Datamanager 2.0).

2 Terminate the bus cabling with a resistor on the first and last device.
The resistor can be activated on the Ohmpilot using DIP switch number 5.
See (A).

3 Set Modbus address using numbers 1-3.
Default address: 40 (for future applications, the Modbus address can be changed using the DIP switches on the Ohmpilot).



(A) DIP switches

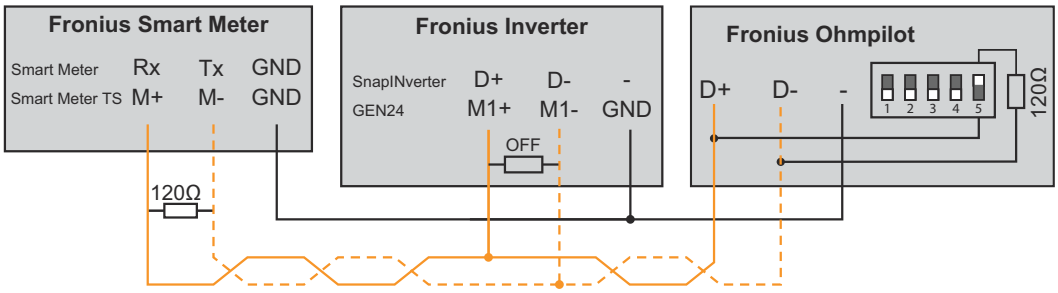
DIP 1-3 = Modbus address BCD
DIP 4 = reserve
DIP 5 = terminating resistor (120 Ohm)

NOTE!

Avoid confusion of cables.
Use a data cable that is clearly distinguishable from the mains cable, so that there is no confusion, and injury and damage to property are avoided.

NOTE!

Faulty cabling.
This is indicated by the red LED indicator flashing 1x.



In order to implement various settings, the WLAN connection must briefly be opened:

1 Press the button on the Ohmpilot 2x.
The blue LED flashes (twice) as long as the WLAN access point is active (30 minutes). Before the access point is opened, it searches for available WLAN networks.

2 Activate the "Ohmpilot" WLAN network on your smart device or PC.

3 In the browser, enter the address http://192.168.250.181 or http://ohmpilotW.local.

NOTE!

Accessing the Ohmpilot via the network.
In networks with a DNS suffix, the Ohmpilot can be accessed at http://ohmpilotW.<DNS-Suffix>, e.g. http://ohmpilotW.fronius.com

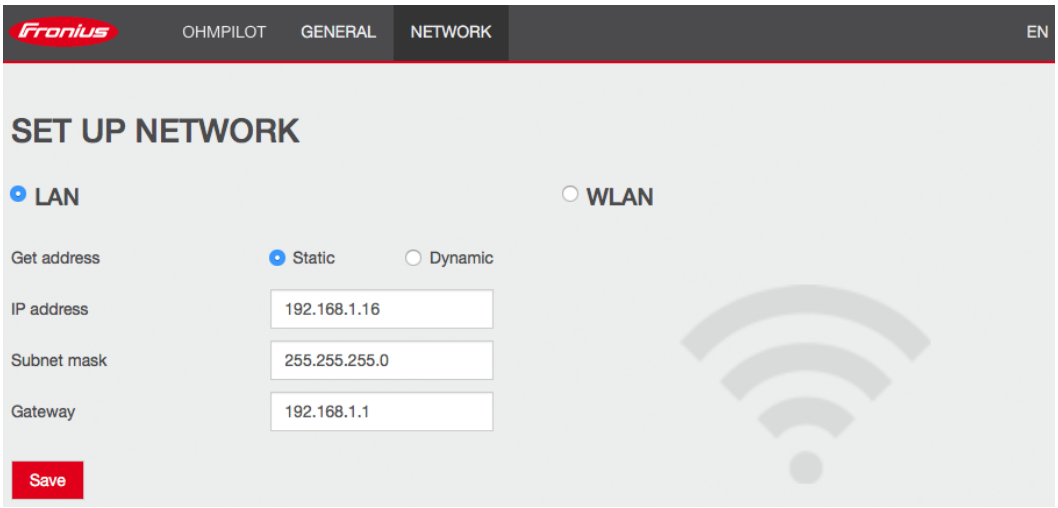
4 Implement the settings.

Establishing a connection via LAN

As standard, the Ohmpilot obtains its IP address automatically from the DHCP server, meaning that no settings are generally necessary.

The inverter automatically searches for the Ohmpilot, and the search process may take up to 5 minutes. If the red LED is not lit and the green LED is flashing, the Ohmpilot is working correctly.

A static IP address can be assigned to the Ohmpilot via the user interface.



Set Up Network, symbolic representation

1 In the web browser, open the address http://ohmpilotL.local.

Alternatively, the IP address assigned by the DHCP server can also be read out. Almost every router displays its connected devices (clients) on its user interface. Apps such as Fing can help you find the automatically assigned IP address. Alternatively, the Ohmpilot can also be searched on the network using the Fronius Solar.web App.

NOTE!

Accessing the Ohmpilot via the network.
In networks with a DNS suffix, the Ohmpilot can be accessed at http://ohmpilotL.<DNS-Suffix>, e.g. http://ohmpilotL.fronius.com

To set the IP address manually, the "Static" option must be selected. Then enter the desired IP address.

The Ohmpilot can then be reached at http://ohmpilotL.local or at the fixed IP address assigned.

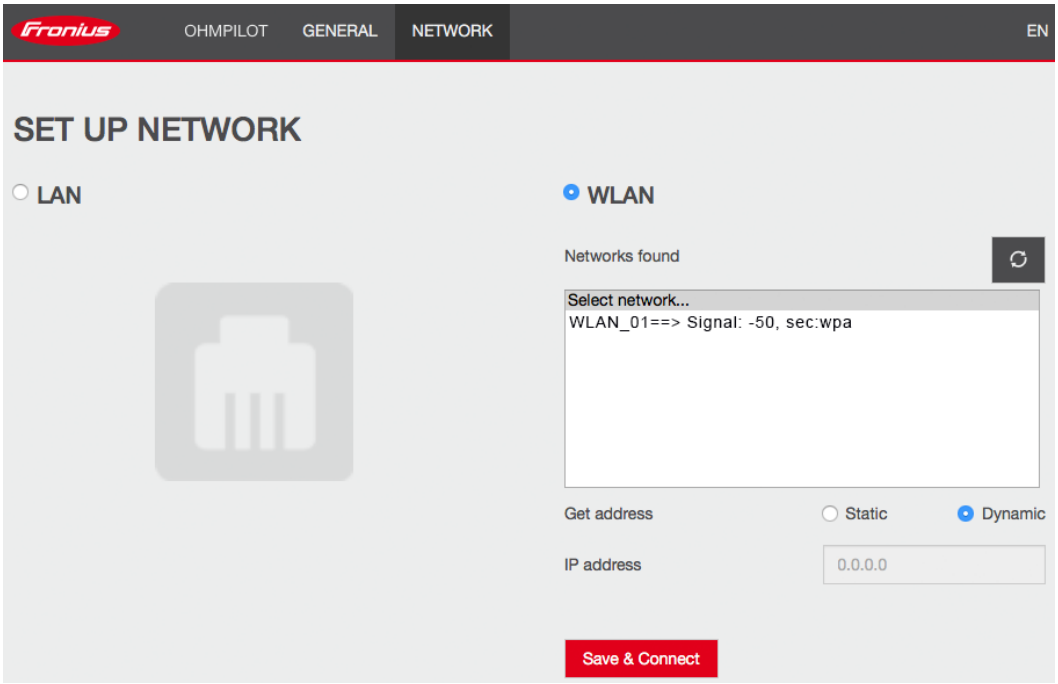
Establishing a connection via WLAN

There are two options for connecting the Ohmpilot to an existing WLAN network:

Connecting via WPS (WiFi Protected Setup)

1 Press the button on the Ohmpilot 1x.
The blue LED flashes (once) as long as WPS is active.

2 Press the WPS button on the router within 2 minutes.
If the blue LED on the Ohmpilot lights up permanently, the connection to the network was successful.
The inverter automatically searches for the Ohmpilot, and the search process can take up to 5 minutes. If the red LED is not lit and the green LED is flashing, the Ohmpilot is working correctly.



Set Up Navigation, symbolic representation

Connecting via access point and manual configuration of the WLAN settings

1 Press the button on the Ohmpilot 2x.
The blue LED flashes (twice) as long as the WLAN access point is active (30 minutes). Before the access point is opened, it searches for available WLAN networks.

2 Activate the "Ohmpilot" WLAN network on your smart device or PC.

3 In the browser, enter the address http://192.168.250.181 or http://ohmpilotW.local. Alternatively, the Ohmpilot can also be searched on the network using the Fronius Solar.web App.

4 Select the desired network in the WLAN network tab.

NOTE!

Desired network not listed.
If the desired WLAN network is not listed, end access point mode by pressing the button again and repeat the process.

5 Click on "Save & Connect", enter WLAN password.
If the blue LED on the Ohmpilot lights up permanently, the connection to the network was successful.
The inverter automatically searches for the Ohmpilot, and the search process can take up to 5 minutes. If the red LED is not lit and the green LED is flashing, the Ohmpilot is working correctly.

NOTE!

WLAN network scan not possible.
When the access point is opened, it is not possible to scan the WLAN networks.

A static IP address can be assigned to the Ohmpilot via the user interface.

The Ohmpilot can then be reached at http://ohmpilotW.local or at the fixed IP address assigned. Alternatively, the Ohmpilot can also be searched on the network using the Fronius Solar.web App.

NOTE!

Device connections.
Only one device can connect to the Ohmpilot.

NOTE!

Accessing the Ohmpilot via the network.
In networks with a DNS suffix, the Ohmpilot can be accessed at http:// ohmpilotW.<DNS-Suffix>, e.g. http://ohmpilotW.fronius.com

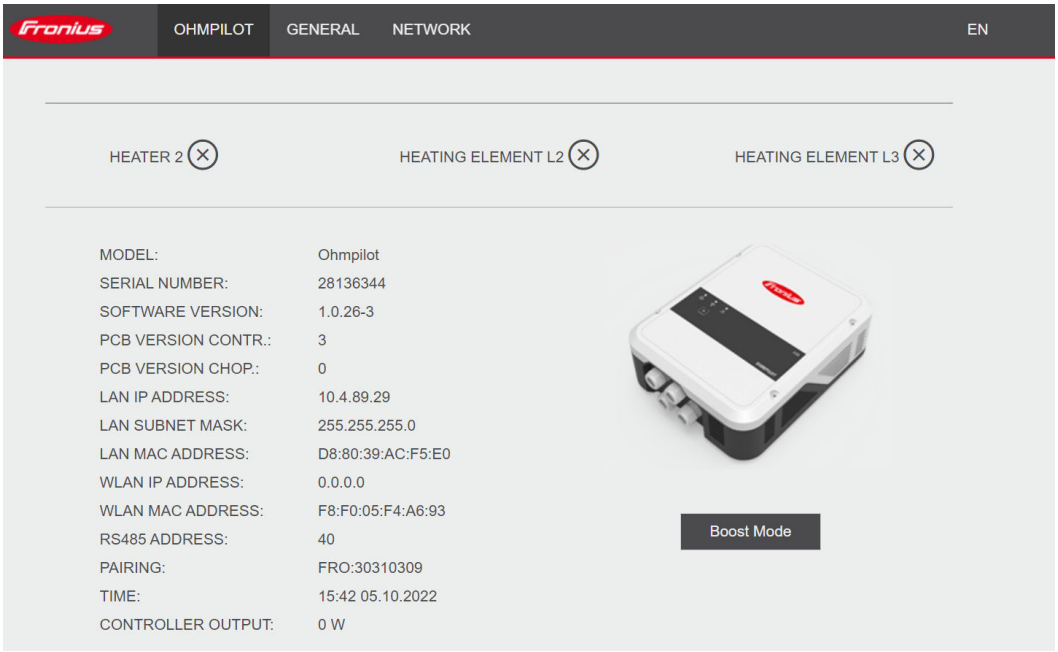
Boost Mode

Boost Mode

Boost Mode is used to supply the load at the "Heater 1" output with 100% of the available power for a short time. Over a maximum period of 4 hours, the dimmer level is activated at 100%, L2 and L3 are switched through. This may result in electricity being sourced from the grid.

Boost Mode can be activated and deactivated by pressing the button on the Ohmpilot (see **Indicators/controls on the device**) or via the user interface.

Settings in the menu area



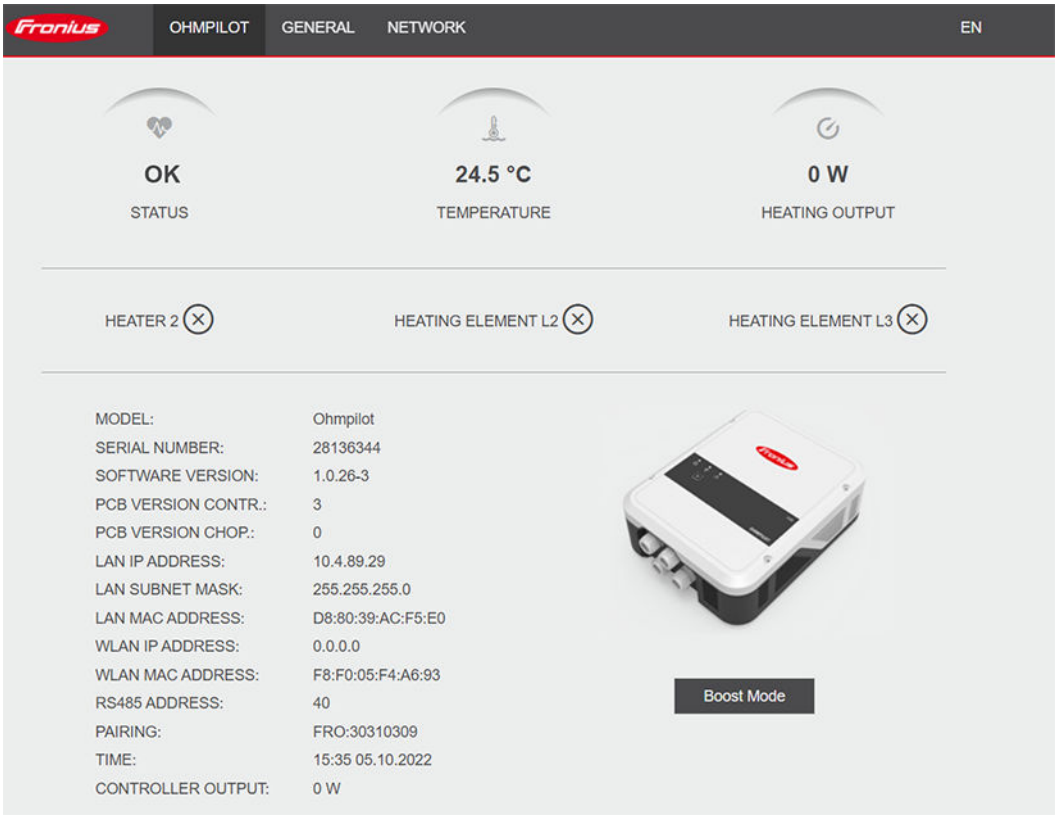
Boost Mode, symbolic representation

1. Open the Ohmpilot user interface
   Chapter **Establishing the data connection** on page **113** describes how you can access the Ohmpilot user interface.
2. Activate Boost Mode by clicking on the button of the same name.
3. Click the button again to deactivate Boost Mode.

Ohmpilot user interface

User interface

Status indicators on the web interface



Status indicators, symbolic representation

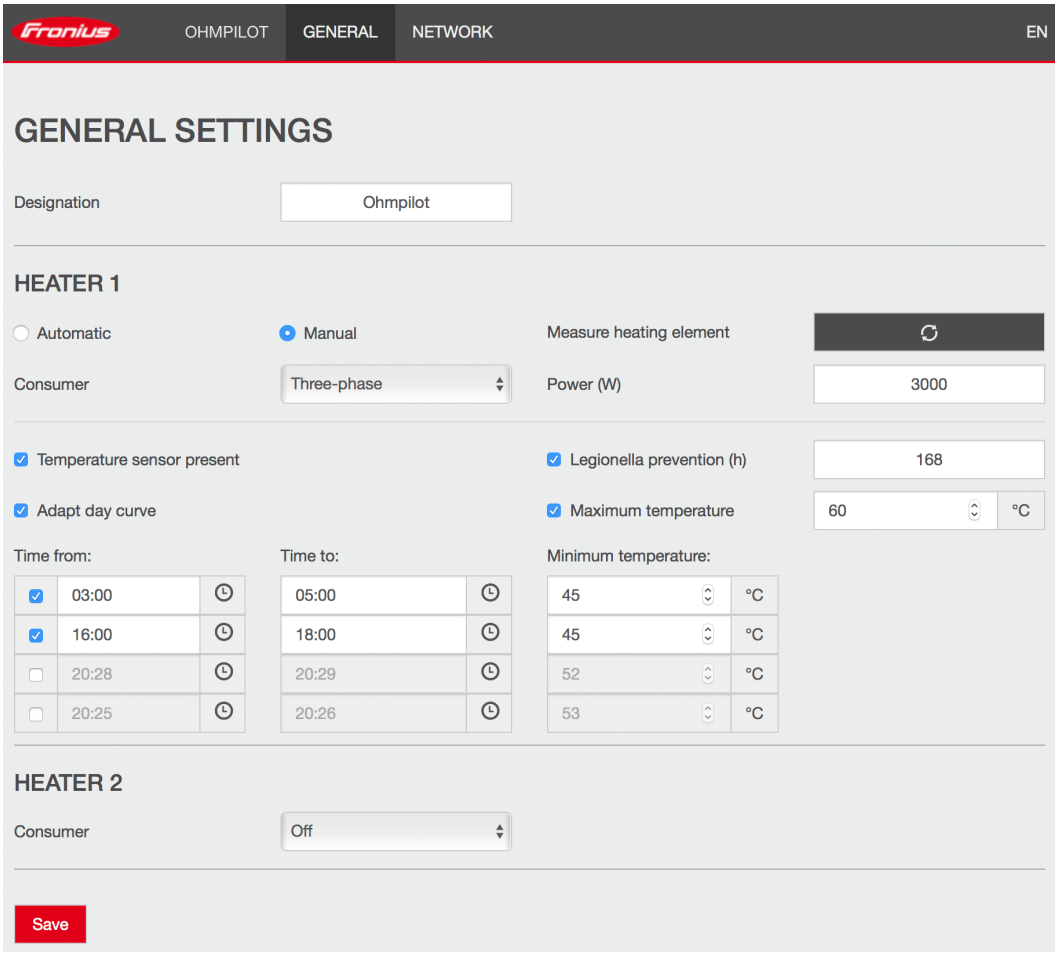
Status	
OK	Ohmpilot is operating in normal mode.
Minimum temperature	The minimum temperature has been exceeded. Heater 1 heats up to 100%.
Legionella prevention	Legionella prevention program is active. Heater 1 heats up to 100%.
Boost Mode	The Ohmpilot has been switched to Boost Mode manually. Heater 1 heats up to 100%.
Error	A fault has been detected. More information can be found on Fronius Solar.web.
Temperature	Currently measured temperature. A valid value is only displayed when a temperature sensor is connected.
Heat output	Current power being used by the Ohmpilot.
Heater 2	Heater 2 is active. Heater 2 may be a second heating element, a heat pump or an external source (e.g. gas-fired heating).
L2 heating element	Phase 2 of 3-phase heating element is active.
L3 heating element	Phase 3 of 3-phase heating element is active.

Optional settings

Manual settings for HEATER 1

NOTE!

Settings not absolutely necessary.
The settings described here can be made for all the application examples shown above. If they are not described for the respective example, they are not absolutely necessary.



General settings, symbolic representation

Setting the output of HEATER 1 manually:

1. Under **HEATER 1**, select "**Manual**"
2. Select "**Single-phase**" or "**Three-phase**" **Consumer**
3. Enter the output of the load

NOTE!

It is not possible to measure heating element 1 automatically.
In the case of applications with a 1-phase and a 3-phase heating element, it is not possible for the Ohmpilot to measure heating element 1 automatically due to the cabling. In this case, the configuration must be carried out manually.

Activating legionella prevention

When the legionella prevention function is activated, the hot water is heated to 60 °C at a set interval.

1 Activate the "**Temperature sensor present**" field
2 Activate the "**Legionella prevention (h)**" field
3 Enter the desired legionella prevention cycle

NOTE!

If no hygienic storage tank is being used, measures must be taken to kill legionella bacteria.
If the boiler is operated at a temperature <60 °C for a relatively long period of time and no hygienic storage tank is being used, measures must be taken to kill the legionella bacteria. For private use, it is recommended to implement legionella prevention at least once a week (168 hours). In the case of a large hot water storage tank or a comparatively low consumption of hot water, legionella prevention should be carried out regularly. A PT1000 temperature sensor is required for this function and can be sourced from Fronius under item number 43,0001,1188.

Despite the setting of the "Legionella prevention" function, contamination of water with legionella **is not completely ruled out**.

Adapting the day curve

This function ensures that the user-specified temperature is not undershot. If there is not sufficient surplus power available, the external source will be started up, if activated, or otherwise electricity will be drawn from the grid in order to ensure a minimum temperature.

Up to four time periods can be defined so that, for example, higher hot water temperatures are only certain to be available at night, but more potential is possible for the surplus during the day due to the fact that a lower target temperature is selected.

Adapting the day curve:

1 Activate the "**Temperature sensor present**" field
2 Activate the "**Adapt day curve**" field
3 Under "**Time from**", enter the time from which the Ohmpilot should start to heat to the new minimum temperature.
4 Under "**Time to**" enter the time until which the Ohmpilot should heat to the minimum temperature.
5 Under "**Minimum temperature**", select the desired end temperature.

NOTE!

Time ranges overlap.
If time ranges overlap, the higher temperature is used, so that, for example, a basic temperature of 40 °C can be set for the whole day and is increased to 50 °C at certain times.

NOTE!

Undefined time ranges.
If time ranges are not defined, then in this time the system is not heated via the grid or the external source, but only using PV surplus.

NOTE!

Primary heat source.
If heater 1 is the primary heat source, the daily cycle must be adjusted to ensure the desired minimum temperature. A PT1000 temperature sensor is required for this function and can be sourced from Fronius under item number 43,0001,1188. The position of the temperature sensor in the boiler should be selected so that sufficient hot water is available. However, it must be mounted above the heating element / external source.

Example 1: 03:00 - 05:00 45 °C => So that in the morning at 06:00 there is hot water available for showering. After showering, the water should only be heated using surplus energy. 16:00 - 18:00 45 °C => If there was not enough surplus energy available, the water is reheated for showering. After showering, reheating should no longer be carried out in order to keep heat losses to a minimum.

Temperature limitation

If heater 1 does not have a configurable thermostat, this function can be used to limit the temperature.

1 Activate the "**Temperature sensor present**" field
2 Activate the "**Temperature limitation**" field
3 Enter maximum temperature (e.g. 60 °C)

NOTE!

This function is only possible for heater 1.
If a second heating element is used as heater 2, it must have a thermostat. A PT1000 temperature sensor is required for this function and can be sourced from Fronius under item number 43,0001,1188. The position of the temperature sensor should be just above the heating element, so that the incoming cold water is immediately heated again and thus the maximum amount of storage is used.

Appendix

Status Codes

Status codes

Sending of errors

- Errors are saved in the Datamanager 2.0 and can be sent via Fronius Solar.web.
- Possible error outputs (as at 07/12/2015):

Code	Description	Cause	Remedy
906	Heating element 1 faulty - short circuit L1	The load on L1 is higher than 3 kW. Short circuit on L1.	Check heating element 1. Check wiring.
907 908	HS 1 - Overload on L2 HE 1 - Overload on L3	Current on L2 greater than 16 A. Current on L3 greater than 16 A.	Check HE 1 and replace if necessary.
909 910 911	HE 1 faulty - L1 highly resistive HE 1 faulty - L2 highly resistive HE 1 faulty - L3 highly resistive	No current is flowing through L1/L2/L3. L1/L2/L3 of HE 1 faulty. Phase L1/L2/L3 interrupted.	Check L1/L2/L3. Check L1/L2/L3 connections.
912	HE 2 faulty - short circuit L1	The load on L1 is higher than 3 kW. Short circuit on L1.	Check HE 2. Check wiring.
913 914	HS 2 - Overload on L2 HE 2 - Overload on L3	Current on L2 greater than 16 A. Current on L3 greater than 16 A.	Check HE2 and replace if necessary.
915 916 917	HE 2 faulty - L1 highly resistive HE 2 faulty - L2 highly resistive HE 2 faulty - L3 highly resistive	No current is flowing through L1/L2/L3. L1/L2/L3 of HE 2 faulty. Phase L1/L2/L3 interrupted.	Check L1/L2/L3. Check L1/L2/L3 connections.
918 919	Relay 2 faulty Relay 3 faulty	Relay R2/R3 does not switch.	Replace Ohmpilot.
920	TS short circuit	TS input resistance less than 200 Ohm. No PT1000 TS connected. TS defective.	Check cable and connections on TS cable. Replace TS.
921	TS not connected or faulty	No TS connected (input resistance greater than 2000 Ohm). TS is activated (should be deactivated). TS cable defective. TS defective. No PT1000 TS connected.	Connect TS to device. Deactivate TS via the user interface (if sensor not needed). Check TS cable. Replace TS.
922 923	60 °C for legionella prevention could not be achieved within 24 hours. Minimum temperature could not be achieved within 5 hours	ES is switched off/faulty (922 only). TS has not been fitted correctly. Heating system has not been dimensioned properly (hot water consumption too high, etc.). HE/TS faulty.	Switch on ES (922 only). Fit TS above the HE (in the protective tube). Legionella prevention via the user interface. Replace HE/TS.

924	ES could not achieve minimum temperature within 5 hours.	ES switched off/defective. ES not connected to Ohmpilot. TS incorrectly mounted. Heating system not dimensioned properly (hot water consumption too high, etc.). TS faulty.	Switch on ES. Connect ES to relay 1. Fit TS above the heater battery of the ES. Check minimum temperature setting. Replace TS.
925	Time not synchronised	Time not synchronised in the last 24 hours. Router has been switched off/ reconfigured.	Check connection between Ohmpilot and inverter. Switch on router. Check network settings.
926	No connection to inverter	No connection between inverter and Ohmpilot. Inverter switched off. The Ohmpilot also needs a connection to the inverter at night. Router switched off/faulty/reconfigured. Night switch-off function enabled on the inverter. Poor WLAN connection between inverter or Ohmpilot and router.	Check connection. Switch on the inverter. Update the software. Switch Ohmpilot and inverter off and on again. The night switch-off function of the inverter must be disabled. On the inverter display, set night mode to ON under "SETUP/Display settings/Night mode" menu. Switch on router. Reposition the WLAN antenna in a better location. Check network settings.
927	Ohmpilot overtemperature	Ambient temperature too high (>40 °C). The output of the heating element is too high Ventilation slots are covered.	Install Ohmpilot in a cooler location. Use a heating element with a permissible output. Uncover the ventilation slots.
928	Ohmpilot undertemperature	Ambient temperature too low (<0 °C).	Install Ohmpilot in a warmer location. Installation outdoors is not permitted.
	Residual current-operated circuit breaker is triggered	N and L mixed up.	Connect N and L correctly.
	Ohmpilot is not using any surplus	Thermostat on heating element has switched off. Safety thermostat (STC) on the heating element has triggered.	Wait until thermostat switches on again. Reset safety thermostat.
	Ohmpilot is using only part of the surplus power	Heating element power is lower than surplus power.	Select a larger heating element where necessary
	Power at the feed-in point is not always adjusted to 0	Load and generation fluctuations require a few seconds to settle down.	
	After switch-on, the green LED makes 2 long flashes	Thermostat on heating element has switched off. Heating element is not connected.	Briefly turn up the thermostat for the power measurement. Connect the heating element.

	After a power failure, the Ohmpilot will no longer work	After a power failure, if it does not receive an IP address after 40 seconds, the Ohmpilot automatically assigns a fixed IP address to 169.254.0.180 (only valid if the Ohmpilot is connected to the router via WLAN).	Restart Ohmpilot so that the WLAN connection is re-established.

HE=heating element TS=temperature sensor WR=inverter ES=external source (e.g. gas-fired heating)

Technical data

Input data	Frequency	50 Hz
	Nominal Voltage	230 V / 400 V
	Max. Input current	1 X 16 A / 3 x 16 A
Interfaces	Modbus RTU	RS 485, max 1000 m, screened and twisted
	LAN	Ethernet min. CAT5, screened
	WLAN	IEEE 802.11 b/g/n
	Temperature sensor	PT1000 (max. 30 m)
Output data	Analogue out 1-phase / 3-phase	Continuously variable 0 - 3 / 0 - 9 kW
	Nominal current analogue per phase	13 A
	Short circuit current analogue out	16 A (max. 5 sec.)
	Max. Current relay out	L2 / L3 16A (max. 5 sec.)
	Multi-function relay out	min. 15V / 2mA; max. 16 A (max. 5 sec.)
	Efficiency in rated operation	min. 98%
	Consumption in standby	type 1.8 W
General data	Dimensions (height x width x depth)	340 mm x 270 mm x 123 mm
	Weight	3.9 kg
	Protection class	IP54
	Installation	Wall
	Ambient temperature range	0 to 40 °C
	Permissible humidity	0-99% (non-condensing)
	Cooling	Convection
	Storage temperature	-40 to 70 °C
	EMC device class	B
	Overvoltage category	3
	Pollution degree	3

Tests/specifications

Tests/specifications

Tests/information according to EN60730 Section 1 Table 7.2

6a	Construction	Electronic RS 2.5.5, independently mounted RS
19	Screwless terminals	2.10.6.1 type X mounting
24	Classification of the RS according to protection against electric shock, Section 6.8	Protection class I 6.8.3
29	Type of shutdown or open circuit for each circuit	Micro interruption according to 2.4.4.
30	PTI value of the insulation materials used for insulation	PTI 175 as per 6.13.2
31a	Type of ground conductor connection	N in accordance with 7.4.3, grounding terminal according to 9.1.1
39	Operating principle	Operating principle TYPE 1 according to 2.6.1
40	Additional properties for operating principle	C in accordance with 6.4.3.3
51	Glow wire test temperatures (Sections 21.2.1, 21.2.2, 21.2.3 and 21.2.4)	Housing 550 °C, cable gland/ strain-relief device 650 °C; category B according to EN 60730-1:2000/A1:2004;
75	Rated surge voltage (Sections 2.1.12, 20.1)	According to EN 61000-6-2:2005, EN 60730-1:2011, EN 301 489-1 (V1.9.2) Wire to wire | Wire(s) to ground Signal and control lines: --- ± | 1 kV DC mains inputs: ± 0.5 kV | ± 0.5 kV AC mains inputs: ± 1 kV |± 2 kV
77	Temperature of the ball pressure test	According to 21.2.1, 21.2.2, 21.2.3 and 21.2.4, case (housing): Ball pressure test 1: 102 °C Cable bushing (cable gland): Ball pressure test 2: 125 °C
80	Rated surge voltage for creepage distance or contact-gap	According to EN 61000-6-2:2005, EN 60730-1:2011, EN 301 489-1 (V1.9.2) Wire to wire | Wire(s) to ground Signal and control lines: --- ± | 1 kV DC mains inputs: ± 0.5 kV | ± 0.5 kV AC mains inputs: ± 1 kV |± 2 kV

Warranty terms and conditions, and disposal

Fronius manufacturer's warranty	Detailed, country-specific warranty conditions are available on the internet www.fronius.com/solar/garantie
Disposal	The manufacturer, Fronius International GmbH, will take back the old device and arrange for it to be recycled in an appropriate manner. Observe the national regulations for the disposal of electronic equipment.
Applicable standards and directives	CE mark The devices conform to all the requisite and relevant standards and guidelines that form part of the relevant EU directive, and are therefore permitted to display the CE mark.

Sommaire