

■ Operating manual

REMKO PV Smart-Grid with REMKO Smart-Control controller





Read these operating instructions carefully before commissioning / using this device!

These instructions are an integral part of the system and must always be kept near or on the device.

Subject to modifications; No liability accepted for errors or misprints!

Translation of the original operating manual

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1 Safety and usage instructions

1.1 General safety notes

Carefully read the operating manual before commissioning the units for the first time. It contains useful tips and notes such as hazard warnings to prevent personal injury and material damage. Failure to follow the directions in this manual not only presents a danger to people, the environment and the system itself, but will void any claims for liability.

Keep this operating manual and the refrigerant data sheet near to the units.

1.2 Identification of notes

This section provides an overview of all important safety aspects for proper protection of people and safe and fault-free operation. The instructions and safety notes contained within this manual must be observed in order to prevent accidents, personal injury and material damage.

Notes attached directly to the units must be observed in their entirety and be kept in a fully legible condition.

Safety notes in this manual are indicated by symbols. Safety notes are introduced with signal words which help to highlight the magnitude of the danger in question.

DANGER!

Contact with live parts poses an immediate danger of death due to electric shock. Damage to the insulation or individual components may pose a danger of death.

DANGER!

This combination of symbol and signal word warns of a situation in which there is immediate danger, which if not avoided may be fatal or cause serious injury.

WARNING!

This combination of symbol and signal word warns of a potentially hazardous situation, which if not avoided may be fatal or cause serious injury.

CAUTION!

This combination of symbol and signal word warns of a potentially hazardous situation, which if not avoided may cause injury or material and environmental damage.

NOTICE!

This combination of symbol and signal word warns of a potentially hazardous situation, which if not avoided may cause material and environmental damage.



This symbol highlights useful tips and recommendations as well as information for efficient and fault-free operation.

1.3 Personnel qualifications

Personnel responsible for commissioning, operation, maintenance, inspection and installation must be able to demonstrate that they hold a qualification which proves their ability to undertake the work.

1.4 Safety-conscious working

The safety notes contained in this manual, the existing national regulations concerning accident prevention as well as any internal company working, operating and safety regulations must be observed.

1.5 Safety notes for the operator

The operational safety of the units and components is only assured providing they are used as intended and in a fully assembled state.

- The units and components may only be set up, installed and maintained by qualified personnel.
- Protective covers (grille) over moving parts must not be removed from units that are in operation.
- Do not operate units or components with obvious defects or signs of damage.
- Contact with certain unit parts or components may lead to burns or injury.
- The units and components must not be exposed to any mechanical load, extreme levels of humidity or extreme temperature.

- Spaces in which refrigerant can leak sufficient to load and vent. Otherwise there is danger of suffocation.
- All housing parts and device openings, e.g. air inlets and outlets, must be free from foreign objects, fluids or gases.
- The units must be inspected by a service technician at least once annually. Visual inspections and cleaning may be performed by the operator when the units are disconnected from the mains.

1.6 Safety notes for installation, maintenance and inspection

- Appropriate hazard prevention measures must be taken to prevent risks to people when performing installation, repair, maintenance or cleaning work on the units.
- The setup, connection and operation of the units and its components must be undertaken in accordance with the usage and operating conditions stipulated in this manual and comply with all applicable regional regulations.
- Local regulations and laws such as Water Ecology Act must be observed.
- The power supply should be adapted to the requirements of the units.
- Units may only be mounted at the points provided for this purpose at the factory. The units may only be secured or mounted on stable structures, walls or floors.
- Mobile units must be set up securely on suitable surfaces and in an upright position. Stationary units must be permanently installed for operation.
- The units and components should not be operated in areas where there is a heightened risk of damage. Observe the minimum clearances.
- The units and components must be kept at an adequate distance from flammable, explosive, combustible, abrasive and dirty areas or atmospheres.
- Safety devices must not be altered or bypassed.

1.7 Dangers of failure to observe the safety notes

Failure to observe the safety notes may pose a risk to people, the environment and the units. Failure to observe the safety notes may void any claims for damages.

In particular, failure to observe the safety notes may pose the following risks:

- The failure of important unit functions.
- The failure of prescribed methods of maintenance and repair.
- Danger to people on account of electrical and mechanical effects.

1.8 Unauthorised modification and changes

Modifications or changes to units and components are not permitted and may cause malfunctions. Safety devices may not be modified or bypassed. Original replacement parts and accessories authorised by the manufacturer ensure safety. The use of other parts may invalidate liability for resulting consequences.

1.9 Intended use

Function for use via corresponding switch contacts.

Any different or additional use is a non-intended use. The manufacturer/supplier assumes no liability for damages arising from non-intended use. The user bears the sole risk in such cases. Intended use also includes working in accordance with the operating and installation instructions and complying with the maintenance requirements.

The threshold values specified in the technical data must not be exceeded.

1.10 Warranty

For warranty claims to be considered, it is essential that the ordering party or its representative complete and return the "certificate of warranty" to REMKO GmbH & Co. KG at the time when the units are purchased and commissioned.

The warranty conditions are detailed in the "General business and delivery conditions". Furthermore, only the parties to a contract can conclude special agreements beyond these conditions. In this case, contact your contractual partner in the first instance.

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1.11 Transport and packaging

The devices are supplied in a sturdy shipping container. Please check the equipment immediately upon delivery and note any damage or missing parts on the delivery and inform the shipper and your contractual partner. For later complaints can not be guaranteed.



WARNING!

Plastic films and bags etc. are dangerous toys for children!

Why:

- Leave packaging material are not around.
- Packaging material may not be accessible to children!

1.12 Environmental protection and recycling

Disposal of packaging

All products are packed for transport in environmentally friendly materials. Make a valuable contribution to reducing waste and sustaining raw materials. Only dispose of packaging at approved collection points.



Disposal of equipment and components

Only recyclable materials are used in the manufacture of the devices and components. Help protect the environment by ensuring that the devices or components (for example batteries) are not disposed in household waste, but only in accordance with local regulations and in an environmentally safe manner, e.g. using certified firms and recycling specialists or at collection points.



2 General notes

2.1 Use of photovoltaic power

In order to increase the proportion of renewable energies, the heat pump can be combined with a photovoltaic system. The controller uses as much of the self-generated solar power as possible for heat generation. By storing the solar power in the form of heat, the energy consumption and therefore the cost-effectiveness of the photovoltaic system are increased.



Fig. 1: Integration of photovoltaics

2.2 Use of graduated tariffs

Even if the heat pump is connected via a separate power meter (heat pump tariff) with time-based power tariffs, the REMKO Smart Control can make meaningful use of these tariffs.

To obtain information on the individual meter readings, the REMKO Smart Count heat meter must be activated. Without the heat meter, individual meter readings cannot be determined.

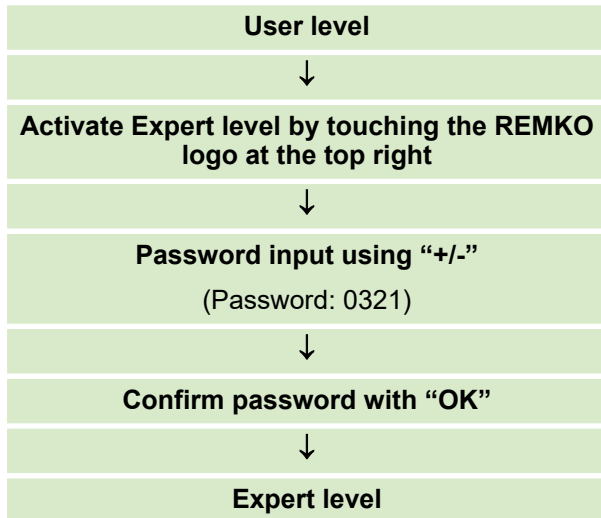


The two controller functions 'PV power utilisation' and 'Graduated tariffs' cannot be combined with one another!

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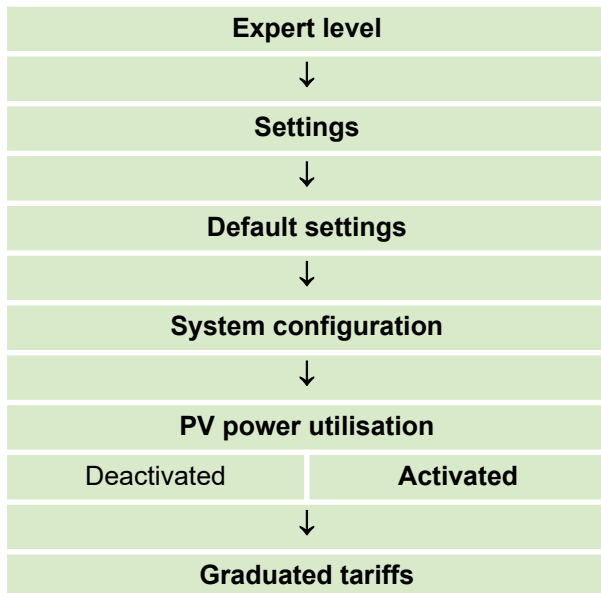
3 Configuring the Smart PV function

The settings for the Smart PV function can be made in the Expert level. To do so, touch the REMKO logo in the upper right corner of the display.

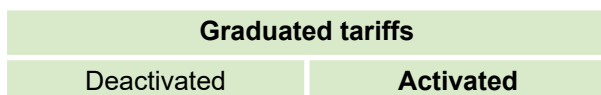


Enabling and programming

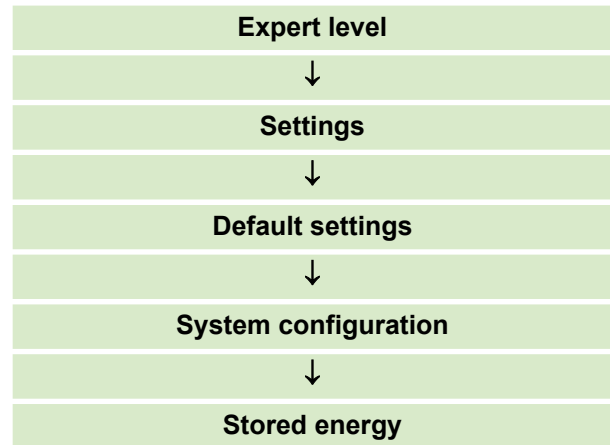
This function is not activated ex works. You must set the following parameters to activate this function:



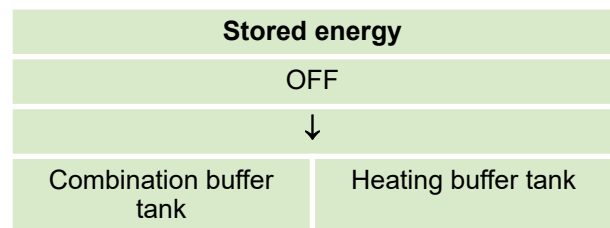
If you use a graduated tariff from your energy supplier to operate your heat pump, you still have to activate this function.



If the heat pump is installed in conjunction with a buffer tank, this storage tank must also be activated in the configuration.

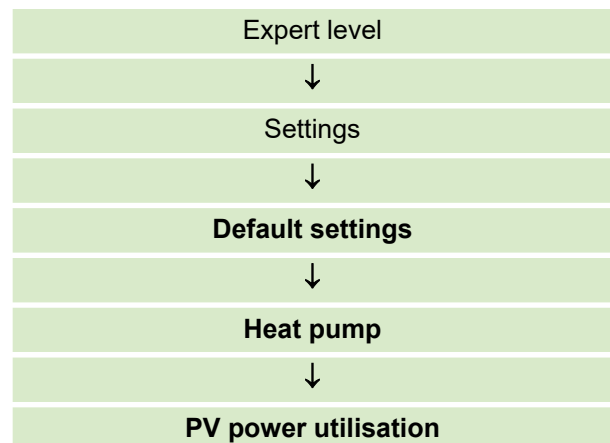


To activate a storage tank, select the appropriate storage tank type. You can select between a combination buffer tank (e.g. REMKO MPS storage tank) or a heating buffer tank (e.g. REMKO HPS or KPS storage tank).



The parameters are now enabled for PV power utilisation.

Press “Back” several times to return to the “Basic settings” display. The PV power utilisation can be accessed via the “Heat pump” parameter.



After pressing “OK”, the following variants can be adjusted:

PV power utilisation	
↓	
PV personal use Variant 1	PV personal use Variant 2

Adjust the variants according to the energy meter that is installed.



For more information on the two possible variants, see Chapter 5.2 ‘Possible variants of current meters’ on page 14

Adjusting the variant correctly is the prerequisite for functioning correctly!

After setting the suitable variant, the following parameters can be adjusted:

Designation	Value range	Factory setting	Customer setting
PV personal use	Variant 1 or 2	Variant 1	
Power tariff 1	10 ct - 100 ct/kWh	24 ct/kWh	
Feed-in tariff	0 ct - 100 ct/kWh	17 ct/kWh	
Personal use tariff	0 ct - 100 ct/kWh	0 ct/kWh	
Factor for PV surplus	0.3 - 2.0 W	0.3 W	
Damping electrical power	0 - 60 min	5 min	
Hot water setpoint	40 - 85 °C	48 °C	
Setpoint heating ¹⁾	40 - 85 °C	48 °C	
Continuous HTG adjustment ²⁾	0 - 10 K	1.0 K	
Difference from cooling limit	0 - 10 K	2.0 K	
Minimum running time for cooling (PV)	0 - 300 min	60 min	
Target feed-in	0 - 5 kW	0.5 kW	
Hysteresis	0.5 - 5 kW	0.5 kW	

¹⁾ If the “Stored energy” function is activated, i.e. with buffer tank (S09)

²⁾ If the “Stored energy” function is deactivated, i.e. without buffer tank

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4 Commissioning the "Graduated tariffs" function

4.1 Description of the "Graduated tariffs" function

The "Graduated tariffs" function utilises time variable power tariffs.

In order to make more heavy use of the lower-cost time-based power tariffs, operation of the heat pump is increased for these times - i.e. the setpoint for hot water/heating is raised. There are two types of setpoint adjustment:

1. ➤ Short-term setpoint adjustment

Just before the switch to a higher power tariff, the setpoint is increased, thus triggering a start-up of the heat pump.

Just before the switch to a lower power tariff, the setpoint is reduced, thus preventing potential start-up of the heat pump. The size of the setpoint adjustment is dependent on the size of the jump in tariff.

2. ➤ Continuous setpoint adjustment

The setpoint is adjusted to the current tariff and is calculated from an average of the tariff levels. If the current tariff is above the average, the setpoints are lowered, if it is below the average, they are raised. The size of the adjustment is dependent on the difference between the current tariff and the average.

NOTE: The graduated tariffs cannot be combined with a PV function!

The following example shows a graduated tariff with a total of 4 tariffs (1 night tariff and 3 peak tariffs):

Day of the week	Tariff	Energy rate		Time
		Gross ct/kWh	Net ct/kWh	
Weekdays	Night tariff	17.46	14.67	22:15 - 06:15
	Peak tariff 1	24.67	20.67	06:15 - 12:30
	Peak tariff 2	28.36	23.83	12:30 - 19:00
	Peak tariff 3	21.81	18.33	19:00 - 22:15
Sat - Sun	Night tariff	17.46	14.67	22:15 - 06:15
	Peak tariff 3	21.81	18.33	06:15 - 22:15

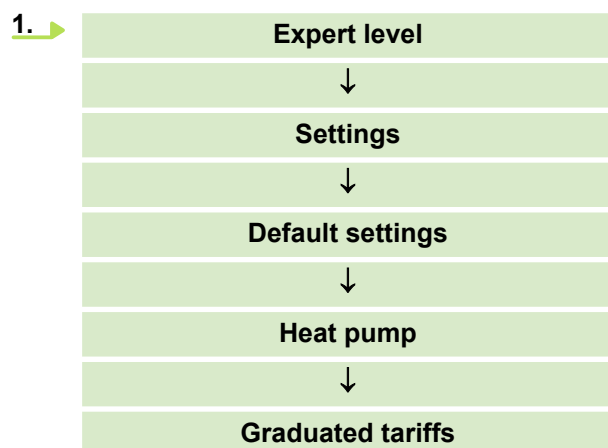
The parameters for the graduated tariffs are available in: "Expert level/Settings/Heat pump/Graduated tariffs"

Designation	Value range	Factory setting	Customer setting
Number of graduate tariffs	2 - 9 graduated tariffs	Graduated tariff 1 & 2	
Tariff 1 time field	Mo - Su / 0h - 24h 10 -100 ct/kWh	Peak tariff 24h	
Tariff 2 time field	Mo - Su / 0h - 24h 10 -100 ct/kWh	Low tariff 24h	
Tariff 3 time field	Mo - Su / 0h - 24h 10 -100 ct/kWh	Low tariff 24h	
Tariff 4 time field	Mo - Su / 0h - 24h 10 -100 ct/kWh	Low tariff 24h	
Tariff 5 time field	Mo - Su / 0h - 24h 10 -100 ct/kWh	Low tariff 24h	
Tariff 6 time field	Mo - Su / 0h - 24h 10 -100 ct/kWh	Low tariff 24h	
Tariff 7 time field	Mo - Su / 0h - 24h 10 -100 ct/kWh	Low tariff 24h	
Tariff 8 time field	Mo - Su / 0h - 24h 10 -100 ct/kWh	Low tariff 24h	
Tariff 9 time field	Mo - Su / 0h - 24h 10 -100 ct/kWh	Low tariff 24h	
Power tariff 1	10 - 100 ct/kWh	24.0 ct/kWh	
Power tariff 2	10 - 100 ct/kWh	24.0 ct/kWh	
Power tariff 3	10 - 100 ct/kWh	24.0 ct/kWh	
Power tariff 4	10 - 100 ct/kWh	24.0 ct/kWh	
Power tariff 5	10 - 100 ct/kWh	24.0 ct/kWh	
Power tariff 6	10 - 100 ct/kWh	24.0 ct/kWh	
Power tariff 7	10 - 100 ct/kWh	24.0 ct/kWh	
Power tariff 8	10 - 100 ct/kWh	24.0 ct/kWh	
Power tariff 9	10 - 100 ct/kWh	24.0 ct/kWh	
Continuous HW adjustment	0.0 K - 10 K	3.0 K	
Short-term HW adjustment	0.0 K - 10 K	0.0 K	
Continuous HTG adjustment	0.0 K - 10 K	2.0 K	
Short-term HTG adjustment	0.0 K - 10 K	1.0 K	

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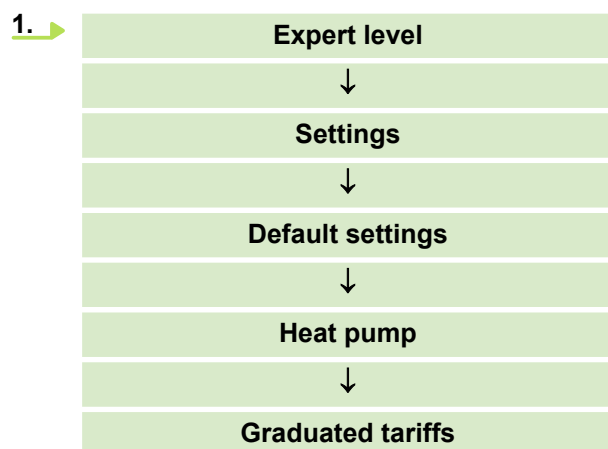
4.2 Configuration of the "Graduated tariffs" function

To set the tariffs, proceed as follows:



2. ➤ Set the number of power tariffs.
3. ➤ Enter the tariff level for each power tariff.
4. ➤ Enter the tariff duration for each tariff. Navigate to the "Time field" parameter, select "Change" and change the settings.

To set the setpoint adjustment, proceed as follows:



2. ➤ Set the temperature difference for the short-term or long-term setpoint adjustment for hot water and heating.
3. ➤ Set the time offset. The time offset is used to specify the period in which the short-term setpoint adjustment will occur before a jump in tariff. The pre-set default is 30 minutes in advance.

4.3 Tariff time field setting

Set the individual time fields in the "Graduated tariffs" section of the expert level.

You can set these as follows:

1. ➤ Use the "+/-" key to set the corresponding number of power tariffs (maximum of nine power tariffs possible).
2. ➤ After setting the suitable number of power tariffs, go to the "Tariff 1 time field" parameter and the setting can be changed using "+/-".
3. ➤ The window to set the corresponding time field opens. The setting can be changed using "+/-". Then confirm the entry with "OK".
4. ➤ The window to select the corresponding week day or block programming for several days opens. After selecting, confirm with "OK".

5 Commissioning the "PV power utilisation" function

5.1 Description of the "PV power utilisation" function

PV local use is activated when:

1. ➤ the heating and hot water have reached the setpoints
2. ➤ There is an adequate surplus of electrical PV power: $[PV \text{ power}] - [Household] - [Factor \text{ for PV excess}] * [forecast \text{ power consumption of the heat pump}] > 0.0 \text{ kW}$ or $[Feed-in \text{ power}] - [Factor \text{ for PV excess}] * [forecast \text{ power consumption of the heat pump}] > 0.0 \text{ kW}$.

After starting up the HP, the output is electrically regulated in relation to the surplus. The goal of this is to fully use the surplus PV power, and not draw any power from the grid.

The parameter "Continuous setpoint adjustment" is set for the increase in temperatures.

After starting up the HP, the output may change, e.g. due to a cloud, shadow, etc. The heat pump will not switch off immediately, but rather continues to run for 15min (value is adjustable (damping of the measured values)). During this period, the system draws its electricity from the grid. If the power is still coming from the grid after 15 min, then the heat pump is switched off. If the supply of PV power is reestablished with these 15 minutes, then the heat pump continues to operate.

The behaviour of the heat pump for the cooling setting is similar to in heating; the setpoints are corrected downwards according to the settings. Humidity monitoring still has the highest priority for setpoint specification. If the values for the condensation point have been lowered, then will not be lowered any further. In spite of the PV surplus.

The impulse rate of the energy meter should be at least 500 Imp/kWh, in order to display the current output. The power measurement can also be performed at a lower impulse rate.

If an inverter has an impulse output, then there is the option of using this. The connection requirements for the SMT I/O unit must be taken into account.

The impulse input of the controller supplies the transistor (open collector) of the impulse transducer (energy meter) with 3.3V (S2x/GND).

General requirements for the connection of the impulse transducer:

Minimum cable section = 0.5mm²

Max. cable length = 50m

Max. frequency = 5000 Hz

Minimum impulse rate = 500Imp/kWh

Tested power meters

Tested current meters with compatible impulse outputs:

REMKO:

- Bidirectional meter, energy meter 259065

Karlo Gavazzi:

- EM24DINAV23X02P

Finder:

- 7E.46.8.400.0002, 7E.56.8.400.0000 and

- 7E.23.8.230.0000

Saia Burgess:

- ALE3D5F10KB2A00 and ALD1D5F10KB2A00

Müller+Ziegler:

- EZD series and EZW series

Variant 2: Layout with a bidirectional meter (from the energy supplier) with display on the Smart Control

All power is fed via the bidirectional household meter. In this case, the household meter is either a bidirectional meter, or it consists of two meters connected in opposite directions. The PV-excess (feed-in) is measured through the meter S29.

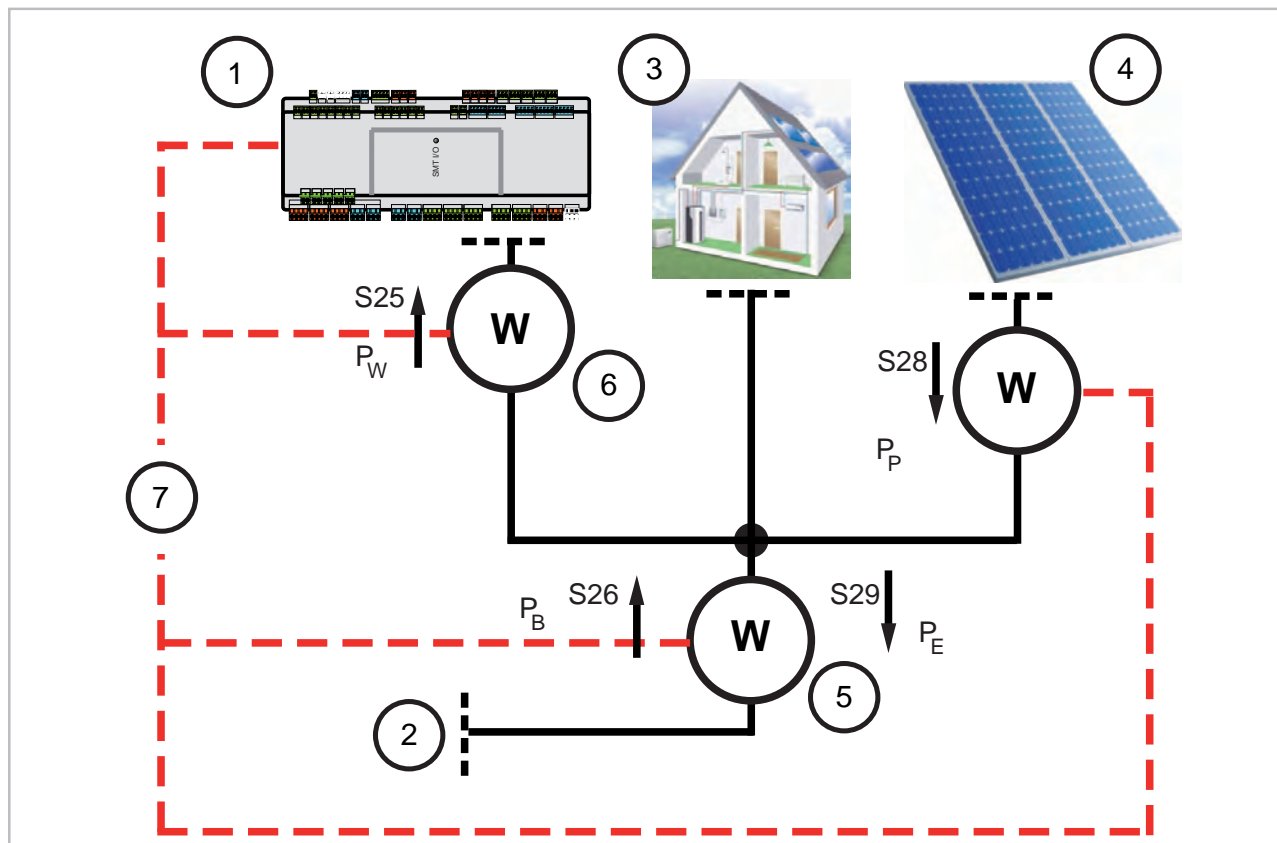


Fig. 3: Layout with a bidirectional meter (from the energy supplier) with display on the Smart Control. Heat pump using normal tariff

- | | |
|---|---|
| W: Power meters | 6: Heat pump meter |
| 1: Heat pump I/O module | 7: Connection to controller |
| 2: Energy supplier | P_B : P-reference (household meter) |
| 3: Household | P_E : P-feed-in (photovoltaic feed-in) |
| 4: Photovoltaic | P_P : P-Photovoltaic (Photovoltaic yield) |
| 5: Energy supply company bidirectional meter or additional bidirectional energy meter with impulse output | P_W : P-heat pump |

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5.3 Connection of signalling to the controller

Shielded cables with a cable cross section of at least 0.5 mm² must be used for the connection between the power meters and the controller. A separate cable must be used for each power meter, in order to avoid interaction between the signals. The meters must generate an impulse rate of at least 500 Imp/kWh.

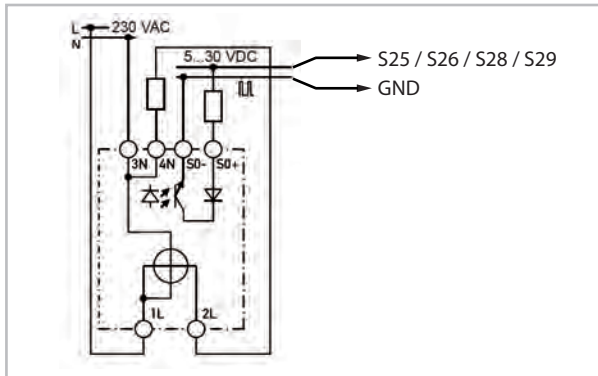


Fig. 4: Meter with impulse input

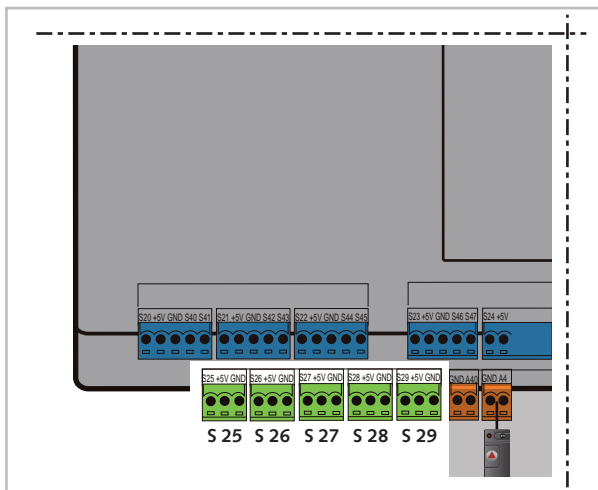
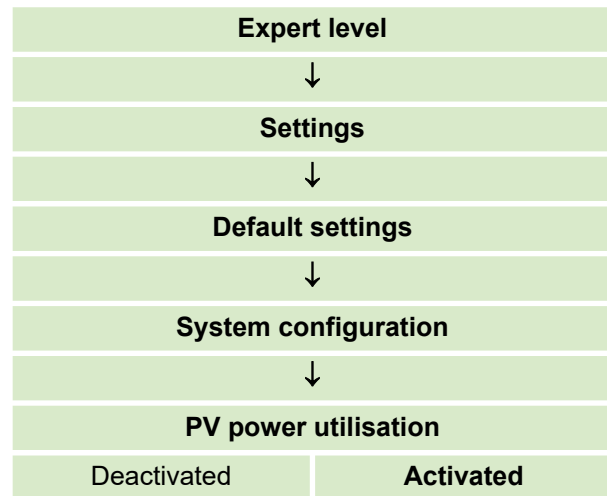


Fig. 5: Connection to the I/O module

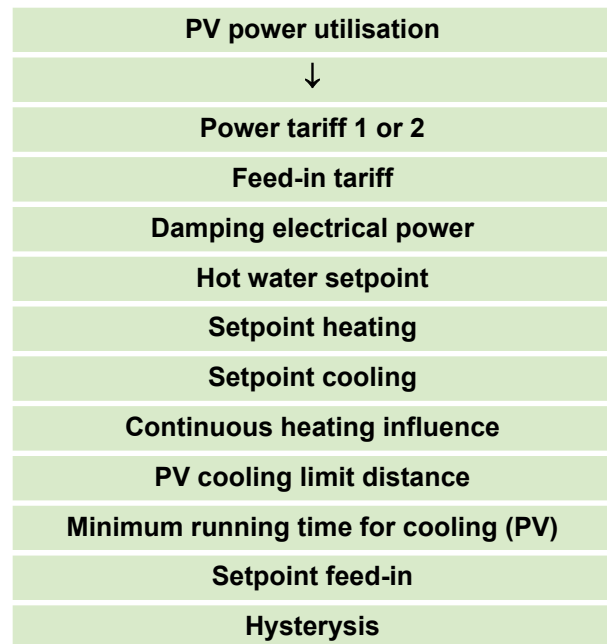
S25 / GND: Heat pump
S26 / GND: Domestic electricity
S28 / GND: PV output
S29 / GND: PV feed-in

5.4 Configuration of the "PV power utilisation" function

First, activate the function 'PV power utilisation'.



Then you have access to the following parameters:



Depending on the settings, the electrical heating rod is switched on automatically to provide support.

! NOTICE!

Please note the maximum inlet temperature of the REMKO heat pump used!

Setting for the meter constants (impulse rates):

The impulse rate settings for all energy meters installed can be implemented in the Expert menu Settings > Energy meters. Then the following settings must be adapted in the Expert menu Settings > Heat pump > PV power utilisation:

1. ➤ The appropriate variant is selected for the correct balancing of the power in accordance with the meter assignment.
2. ➤ The tariffs for network reference, feed-in and if necessary the remuneration for local use must be set.
3. ➤ Set the temperature difference for the long-term setpoint adjustment for hot water and heating.
4. ➤ Set the factor for HP nominal output. The parameter specifies by what factor the surplus must exceed the forecast power consumption of the heat pump. At 1.0, the setpoints are increased when the surplus is equal to the forecast power consumption, at 2.0 the surplus must be twice as big. The factor serves to avoid cycling of the heat pump's power. The default setting is 1.2.
5. ➤ In the comparison of the surplus with the HP nominal output, the average PV output over a certain period of time is used instead of the current value. This period can be determined with this parameter. Damping also serves to avoid cycling of the heat pump's power in the case of short-term changes in output (e.g. due to shadows caused by clouds). The default setting is 15 minutes.



Please pay attention to the possible pulse rates of the electricity meters used. A pulse rate of at least 500 imp/kWh is required to achieve maximum personal use of the self-generated electricity.

The following pulse rates can be set on the Smart Control:

1, 60, 75, 96, 100, 120, 150, 200, 250, 375, 450, 480, 500, 600, 750, 1000, 2000, 5000, 10000.

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