Operating Instructions

Fronius Verto

15.0 Plus / 17.5 Plus
20.0 Plus / 25.0 Plus
30.0 Plus / 33.3 Plus

EN-US | Operating instructions

42,0426,0552,EA 010-11072025

Table of contents

General information

Safety information

Explanation of warnings and safety instructions

The warnings and safety instructions in these instructions are intended to protect people from possible injury and the product from damage.

⚠ DANGER!

Indicates an immediately dangerous situation
Serious injury or death will result if appropriate precautions are not taken.
▶ Action step to escape the situation

⚠ WARNING!

Indicates a potentially dangerous situation
Death or serious injury may result if appropriate precautions are not taken.
▶ Action step to escape the situation

⚠ CAUTION!

Indicates a potentially dangerous situation
Minor or moderate injury may result if appropriate precautions are not taken.
▶ Action step to escape the situation

NOTE!

Indicates impaired work results and/or damage to the device and components

The warnings and safety instructions are an integral part of these instructions and must always be observed to ensure the safe and proper use of the product.

Safety instructions and important information

The device has been manufactured in line with the state of the art and according to recognized safety standards.

⚠ WARNING!

Incorrect operation or misuse
Serious to fatal injuries to the operator or third parties as well as damage to the device and other property of the operator may result.
▶ All persons involved in the commissioning, maintenance, and servicing of the device must be appropriately qualified and have knowledge of working with electrical installations.
▶ Read these operating instructions in full and follow them carefully and precisely.
▶ The operating instructions must always be kept to hand wherever the device is being used.

IMPORTANT!
In addition to the operating instructions, all applicable local rules and regulations regarding accident prevention and environmental protection must also be followed.

IMPORTANT!
Labels, warning notices, and safety symbols are located on the device. A description can be found in these operating instructions.

IMPORTANT!

All safety and danger notices on the device:
- Must be kept in a legible state
- Must not be damaged/marked
- Must not be removed
- Must not be covered, have anything stuck on them, or painted over

⚠ WARNING!

Tampered-with and non-functioning protection devices
Serious to fatal injuries as well as damage to the device and other property of the operator may result.
- ▶ Never bypass or disable protection devices.
- ▶ Any protection devices that are not fully functional must be repaired by an authorized specialist before the device is switched on.

⚠ WARNING!

Loose, damaged, or under-dimensioned cables
An electric shock can be fatal.
- ▶ Use undamaged, insulated, and adequately dimensioned cables.
- ▶ Fasten the cables according to the specifications in the operating instructions.
- ▶ Loose, damaged, or under-dimensioned cables must be repaired or replaced immediately by an authorized specialist.

NOTE!

Installations or modifications to the device
The device may be damaged
- ▶ Do not carry out any alterations, installations, or modifications to the device without first obtaining the manufacturer's permission.
- ▶ Damaged components must be replaced.
- ▶ Only use original spare parts.

Environmental conditions

Operation or storage of the device outside the stipulated area will be deemed as not in accordance with the intended purpose.

Electromagnetic fields

During operation, due to the high electrical voltages and currents, local electromagnetic fields (EMF) occur in the environment around the inverter and the Fronius system components as well as in the area of the PV modules including the supply lines.

In the case of exposure to humans, the required limit values are observed when the products are used in line with the intended use and the recommended distance of at least 20 cm is observed.

If these limit values are complied with, according to current scientific knowledge, no health-endangering effects from EMF exposure are to be expected. If wearers

of prostheses (implants, metal parts in and on the body) as well as active physical aids (pacemakers, insulin pumps, hearing aids, etc.) are in the vicinity of components of the PV system, they must consult with the responsible doctor regarding possible health risks.

Data on noise emission values

The sound pressure level of the inverter is indicated in the Technical data.

The cooling of the device takes place via an electronic temperature control system at the lowest possible noise level and depends on the power used, ambient temperature, and the soiling level 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, the operator is obliged to take action to rectify the situation.

Backup power

This system has backup power functions, which enable a replacement power supply to be established in the event of a failure of the public grid.

Where an automatic backup power supply is installed, a backup power warning notice (https://www.fronius.com/en/search-page, item number: 42,0409,0275) must be fitted on the electrical distributor.

Maintenance and installation work in the home network requires both disconnection on the utility side and deactivation of the replacement power mode by opening the integrated DC disconnector on the inverter.

The function of the residual current devices for the backup power supply must be checked at regular intervals (according to the manufacturer's instructions), but at least twice a year.
A description on how to perform the test operation can be found in the backup power checklist (https://www.fronius.com/en/search-page, item number: 42,0426,0365).

Depending on the insolation conditions and the battery state of charge, the backup power supply is automatically deactivated and activated. This can cause the backup power supply to unexpectedly return from standby mode. Therefore, installation work can only be performed on the home network when the backup power supply is deactivated.

Influencing factors on the total power in backup power mode:

Reactive power
Electrical loads with a power factor not equal to 1 also require reactive power in addition to effective power. The reactive power also loads the inverter. Therefore, to correctly calculate the actual total power, it is not the rated power of the load that is relevant, but the current caused by effective and reactive power.

Devices with a high reactive power are mainly electric motors such as:

- Water pumps
- Circular saws
- Blowers and fans

High starting current
Electrical loads that need to accelerate a large mass usually require a high starting current. This can be up to 10 times higher than the nominal current. The maximum current of the inverter is available for the starting current. Loads with starting currents that are too high therefore cannot be started/operated, even though the nominal output of the inverter suggests that they can. When dimensioning the backup power circuit, the connected load power and any starting current must also be taken into account.

Devices with high starting currents are, for example:
- Devices with electric motors (e.g., lifting platform, circular saws, planing bench)
- Devices with large transmission ratio and flywheel mass
- Devices with compressors (e.g., compressed air compressors, air conditioning systems)

IMPORTANT!
Very high starting currents can cause short-term distortion or a drop in output voltage. Operating electronic devices simultaneously in the same backup power supply system should be avoided.

Load imbalance
When dimensioning three-phase backup power networks, the total output power and the power output per phase of the inverter must be taken into account.

IMPORTANT!
The inverter may only be operated within the limits of its technical capabilities. Operation outside of its technical capabilities can cause the inverter to shut down.

Ground conductor

Connection of a point in the device, system, or installation to ground to protect against electric shock in the event of a fault. When installing an inverter from safety class 1 (see Technical data), a ground conductor connection is required.

When connecting the ground conductor, ensure that it is secured to prevent unintentional disconnection. All of the points listed in the chapter headed Connecting the inverter to the public grid (AC side) on page 67 must be observed. When using cable glands, ensure that the ground conductor is last to be subjected to a load in the event of a failure of the cable gland. The respective national standards and regulations and requirements for minimum cross-section must be observed when connecting the ground conductor.

Protection of people and equipment

Central grid and system protection

The inverter offers the option to use the integrated AC relays as section switches in conjunction with a central grid and system protection unit (in accordance with VDE-AR-N 4105:2018:11 §6.4.1). For this purpose, the central trigger device (switch) must be integrated into the WSD chain as described in chapter WSD (wired shutdown) on page 15.

WSD (wired shutdown)

The wired shutdown (WSD) interrupts the inverter's grid power feed if the trigger device (switch, e.g., Emergency Stop or fire alarm contact) has been activated.

If an inverter (slave) fails, it is bypassed and the other inverters continue operating. If a second inverter (slave) or the inverter (master) fails, the operation of the entire WSD chain is interrupted.

For installation, see Installing the WSD (wired shutdown) on page 83.

RCMU

The inverter is equipped with an RCMU (RCMU = residual current monitoring unit) according to IEC 62109-2 and IEC63112.
It monitors residual currents from the PV module up to the AC output and disconnects the inverter from the grid when an improper residual current is detected.

Insulation monitoring

In the case of photovoltaic systems with ungrounded PV modules, the inverter checks the resistance between the positive or negative pole of the photovoltaic system and the ground potential before starting grid power feed operation. In the event of a short circuit between the DC+ or DC- cable and ground (e.g., due to inadequately insulated DC cables or defective PV modules), feeding into the public grid is prevented.

AFCI - Arc Fault Circuit Interrupter (Arc Guard)

An AFCI (Arc Fault Circuit Interrupter) protects against arc faults and, in the narrower sense, is a protection device in the event of contact errors. The AFCI evaluates faults that occur in the current and voltage flow on the DC side using an electronic circuit and shuts down the circuit if a contact error is detected. This prevents overheating at poor contact points and, ideally, possible fires.

⚠ CAUTION!

Danger from faulty or incorrect DC installation.
This may result in a risk of damage and, as a consequence, risk of fire in the PV system due to prohibited thermal loads that occur during an arc.

- ▶ Check the plug connections to ensure that they are correct.
- ▶ Repair faulty insulation correctly.
- ▶ Perform connection work in line with the instructions.

IMPORTANT!
Fronius will not bear any costs that may arise due to a detected electric arc and its consequences. Fronius accepts no liability for damage which may occur des-

pite the integrated Arc Fault Circuit Interrupter/interruption (e.g., due to a parallel arc).

IMPORTANT!
Active PV module electronics (e.g., power optimizers) can impair the function of the Arc Fault Circuit Interrupter. Fronius cannot guarantee the correct function of the Arc Fault Circuit Interrupter in combination with active PV module electronics.

Reconnection behavior
Grid power feed operation is interrupted for at least 5 minutes after an arc has been detected. Depending on the configuration, grid power feed operation is then automatically resumed. If several arcs are detected within a period of 24 hours, grid power feed operation can also be permanently interrupted until a manual reconnection has been performed.

Safe state

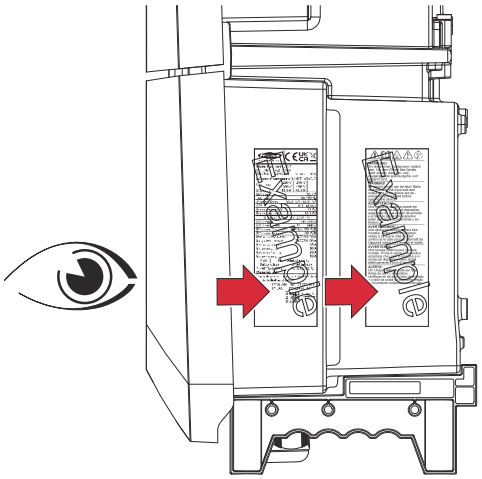
If one of the following safety devices is triggered, the inverter switches to a safe state:
- WSD
- Insulation monitoring
- RCMU
- AFCI

In the safe state, the inverter no longer feeds energy in and is disconnected from the grid by the AC relay opening.

General

Information on the device

Technical data, warning notices, labels, and safety symbols are located on and in the inverter. This information must be kept in a legible condition and must not be removed, covered, pasted over, or painted over. They warn against incorrect operation, which may result in serious injury and property damage.



Symbols on the rating plate:

CE label – confirms compliance with applicable EU directives and regulations.

WEEE marking – waste electrical and electronic equipment must be collected separately and recycled in an environmentally sound manner in accordance with the European Directive and national law.

Safety symbols:

Integrated switch disconnector on the input side of the inverter with switch-on, switch-off, and isolating function according to IEC 60947-3 and AS 60947.3. The values required by the applicable standard for Ithe solar +60°C are given.

General warning sign
Observe the danger shown on the additional sign(s).

Observe instructions
Do not use the functions described here until you have fully read and understood the following documents:
- These operating instructions, especially the safety rules.
- Read and understand all operating instructions for the system components of the photovoltaic system, especially the safety rules.

Warning of hot surface
Take care not to come into contact with hot surfaces.

Warning of electrical voltage
Take care not to come into contact with electrical voltage.

Allow the capacitors of the inverter to discharge (2 minutes).

Warning notice text:

WARNING!
An electric shock can be fatal. Before opening the device, ensure that the input and output sides are de-energized and disconnected.

How information is presented in the document

The conventions regarding how information is presented in the document, which are set out below, have been defined in order to increase the readability and comprehensibility of the document.

Application notes

IMPORTANT! Indicates application notes and other useful information. It does not indicate a harmful or dangerous situation.

Software

Software functions and elements of a graphical user interface (e.g., buttons, menu items) are highlighted in the text with this **mark up**.

Example: Click **Save**.

Instructions for action

1 Action steps are displayed with consecutive numbering.

✓ *This symbol indicates the result of the action step or the entire instruction.*

Target group

This document provides detailed information and instructions to ensure that all users can use the device safely and efficiently.

- The information is intended for the following groups of people:
  - **Technical specialists:** People with appropriate qualifications and fundamental electronic and mechanical knowledge, who are responsible for the installation, operation, and maintenance of the device.
  - **End users:** People that use the device in daily operation and want to understand its basic functions.
- Regardless of any qualifications, only perform the activities listed in this document.
- All persons involved in the commissioning, maintenance, and servicing of the device must be appropriately qualified and have knowledge of working with electrical installations.
- The definition of professional qualifications and their applicability are subject to national law.

Data security

With regard to data security, the user is responsible for:

- Backing up any changes made to the factory settings
- Saving and storing personal settings

NOTE!

Data security for network and Internet connection
Unsecured networks and lack of safeguards can result in data loss and unauthorized access. Observe the following points for safe operation:

- Operate inverters and system components on a private, secure network.
- Keep the network devices (e.g., WiFi routers) up to date with the latest technology.
- Keep the software and/or firmware updated.
- Use a wired network to ensure a stable data connection.
- For security reasons, do not make inverters and system components accessible from the Internet via port forwarding or Port Address Translation (PAT).
- Use the cloud services provided by Fronius for monitoring and configuration.
- The optional communication protocol Modbus TCP/IP[1)] is an unsecured interface. Only use Modbus TCP/IP if no other secured data communication protocol (MQTT[2)]) is possible (e.g., compatibility with older Smart Meters).

[1)] TCP/IP - Transmission Control Protocol/Internet Protocol
[2)] MQTT - Message Queuing Telemetry Protocol

Copyright

Text and illustrations were accurate at the time of printing, subject to change.
We are grateful for suggestions for improvement and information on any discrepancies in the operating instructions.

Fronius Verto

Device concept

The inverter transforms the direct current generated by the PV modules into alternating current. This alternating current is fed into the public grid and synchronized with the mains voltage in use. Moreover, the solar energy can also be stored in a connected battery for later use.

The inverter is intended for use in grid-connected photovoltaic systems. The inverter has backup power functions and switches to backup power mode if it has been wired accordingly*.

The inverter automatically monitors the public grid. Whenever conditions in the electric grid are inconsistent with standard conditions (e.g., grid switch-off, interruption), the inverter will immediately stop producing power and interrupt the supply of power into the grid.
The grid is monitored by monitoring the voltage, frequency, and islanding conditions.

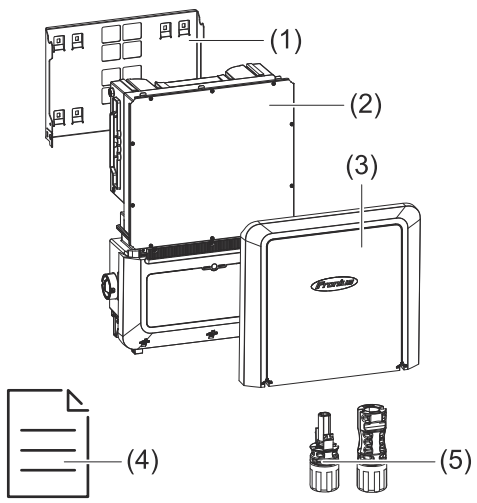
After installation and commissioning, the inverter's operation is fully automatic; the inverter draws the maximum possible power from the solar modules. Depending on the operating point, this power is used in the home, stored in a battery*, or fed into the grid.

As soon as the energy provided by the solar modules is no longer sufficient, the power from the battery is fed into the home network. Depending on the setting, power may also be obtained from the public grid in order to charge the battery*.

When its temperature gets too high, the inverter automatically reduces the output or charging power, or switches off completely, in order to protect itself. Reasons for the temperature being too high include a high ambient temperature or insufficient heat dissipation (for example, inadequate heat dissipation when installed in switch cabinets).

* Depending on the device variant, suitable battery, corresponding cabling, settings, and local standards and regulations.

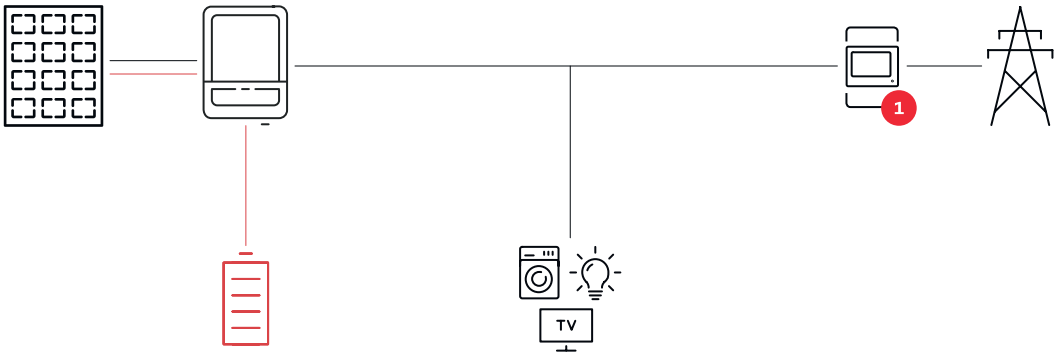
Scope of supply



(1) Mounting bracket (is mounted on the inverter on delivery)
(2) Inverter
(3) Housing cover
(4) Quick Start Guide
(5) Plug set MC4 EVO Store 10 mm² / 4-6 mm²

Enhanced Power Harvest

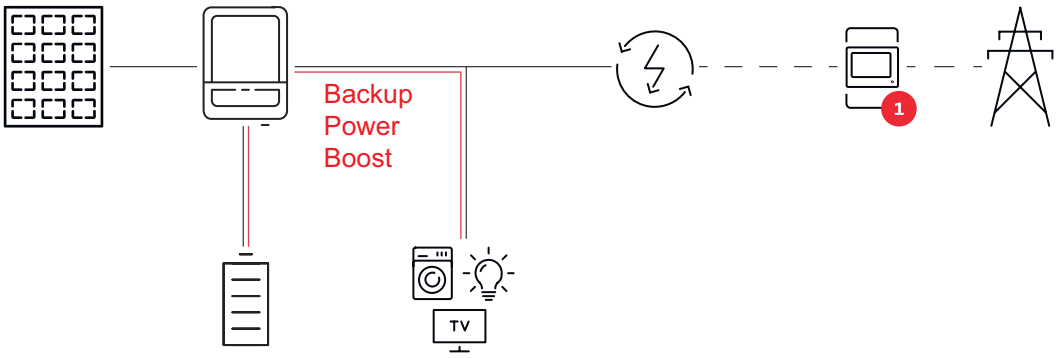
With the “Enhanced Power Harvest” function, surplus energy from the PV modules that exceeds the rated power of the inverter can also be stored in the battery.



Power category	Surplus energy	Maximum DC power utilization
15.0	150%	22.5 kW
17.5	150%	26.25 kW
20.0	150%	30 kW
25.0	130%	32.5 kW
30.0	130%	39 kW
33.3	117%	39 kW

Backup Power Boost

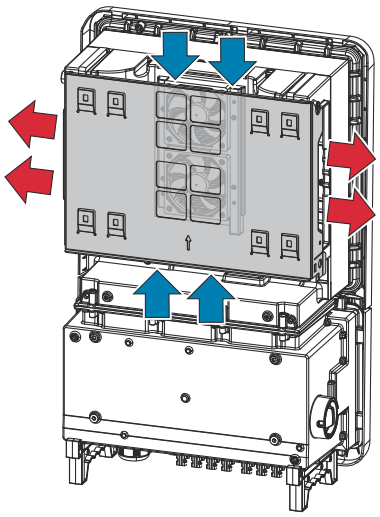
With the “Backup Power Boost” function, the inverter can provide increased power for a short time in backup power mode in order to reliably supply even power-intensive loads.



Power category	Max. DC power *	Max. output current / phase *
15.0	30 kVA	43.5 A (3 phases) / 32 A (1 phase)
17.5	30 kVA	43.5 A (3 phases) / 32 A (1 phase)
20.0	30 kVA	43.5 A (3 phases) / 32 A (1 phase)
25.0	50 kVA	72.5 A (3 phases) / 72.5 A (1 phase)
30.0	50 kVA	72.5 A (3 phases) / 72.5 A (1 phase)
33.3	50 kVA	72.5 A (3 phases) / 72.5 A (1 phase)

* Sufficient PV and battery power required. Duration max. 5–10 seconds, 400 V AC symmetrical, depending on the environmental conditions.

Thermal concept



Ambient air is drawn in by the fan on the top and bottom and blown out at the device sides. The even heat dissipation allows several inverters to be installed next to each other.

NOTE!

Risk due to insufficient cooling of the inverter.
This may result in a loss of power in the inverter.

- ▶ Do not block the fan (for example, with objects that protrude through the touch guard).
- ▶ Do not cover the ventilation slots, even partially.
- ▶ Make sure that the ambient air can always flow through the inverter's ventilation slots unimpeded.

Fronius Solar.web

System owners and installers can easily monitor and analyze the PV system using Fronius Solar.web or Fronius Solar.web Premium. With the appropriate configuration, the inverter transmits data such as power, yield, load, and energy balance to Fronius Solar.web. More detailed information can be found at Solar.web - Monitoring & analysis.

Configuration is carried out using the Setup wizard; see the chapter headed Installation with the app on page 86 or Installation with the browser on page 86.

Requirements for configuration:

- Internet connection (download: min. 512 kbit/s, upload: min. 256 kbit/s)*.
- User account at solarweb.com.
- Completed configuration using the Setup wizard.

* These specifications do not provide an absolute guarantee of flawless operation. High error rates in the transmission, fluctuating receptions or misfires can have an adverse effect on data transfer. Fronius recommends on-site testing to ensure that the connections meet the minimum requirements.

Local communication

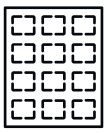
The inverter can be found via the Multicast DNS (mDNS) protocol. We recommend searching for the inverter using the assigned host name.

The following data can be called up via mDNS:

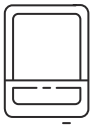
- NominalPower
- Systemname
- DeviceSerialNumber
- SoftwareBundleVersion

Different operating modes

Operating modes – Explanation of symbols



PV module
generates direct current



Fronius Verto inverter
converts the direct current into alternating current and charges the battery. The integrated system monitoring enables the inverter to be integrated into a network by means of WLAN.

Additional inverter in the system
converts the direct current into alternating current. However, it cannot charge a battery and is not available in backup power mode.

Battery
is coupled to the inverter on the direct current side and stores electrical energy.

Fronius Ohmpilot
for using excess energy to heat water.

Primary meter
records the load curve of the system and makes the measured data available for energy profiling in Fronius Solar.web. The primary meter also regulates the dynamic feed-in control.

Secondary meter
records the load curve of individual loads (e.g., washing machine, lights, television, heat pump, etc.) in the load branch and makes the measured data available for energy profiling in Fronius Solar.web.

Loads in the system
are the loads connected in the system.

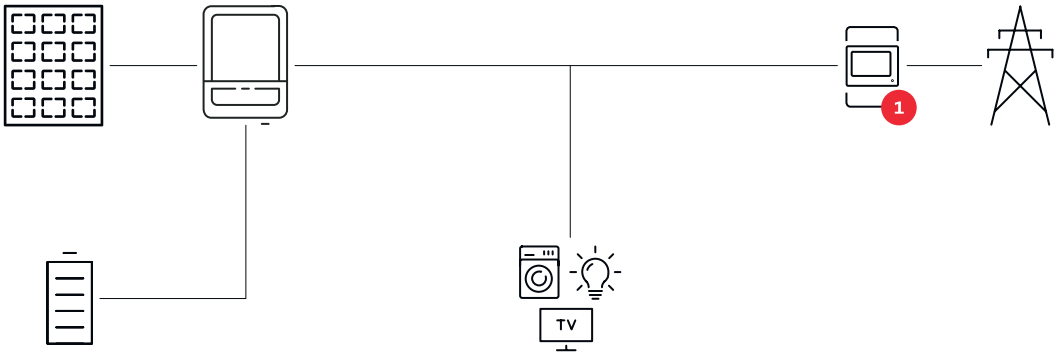
Additional loads and producers in the system
which are connected to the system by means of a Smart Meter.

Full Backup
the inverter is prepared for backup power mode. The backup power function must be implemented in the switch cabinet by the electrician performing the installation. The PV system operates in a stand-alone manner in backup power mode.

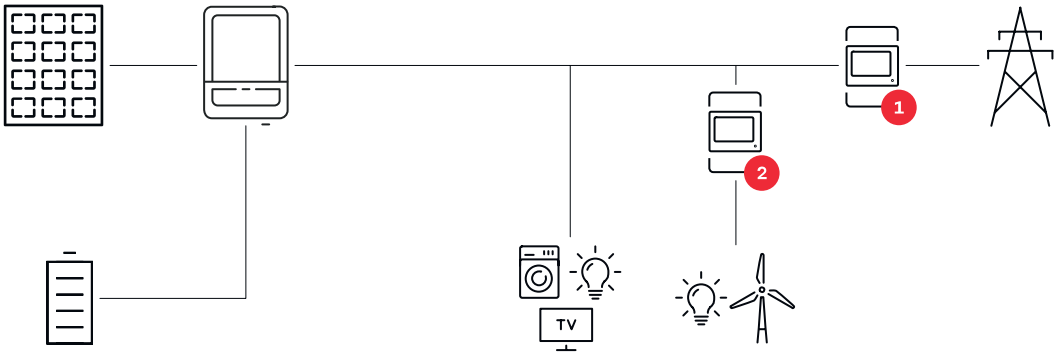
Grid
supplies the loads in the system if insufficient power is being generated by the PV modules or supplied by the battery.

Operating mode – Inverter with battery

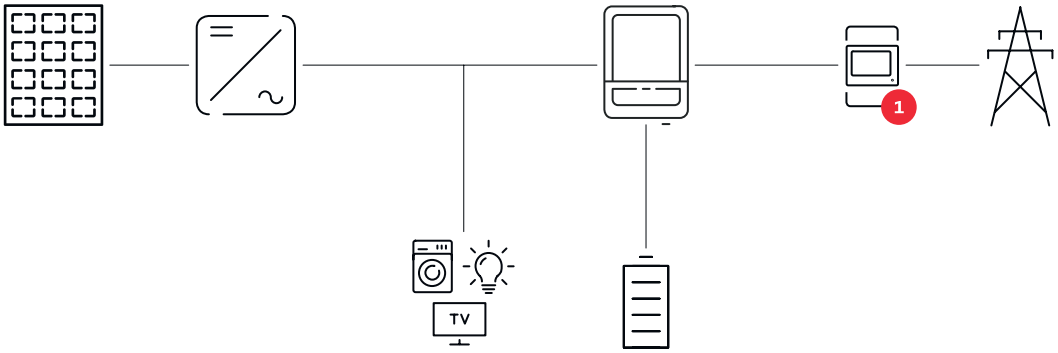
In order to be able to obtain the highest rate of self-consumption with your photovoltaic system, a battery can be used to store excess energy. The battery is coupled to the inverter on the direct current side. Multiple current conversion is therefore not required, and the efficiency is increased.



Operating mode – Inverter with battery and several Smart Meters



Operating mode – Inverter with battery, AC-coupled to another inverter

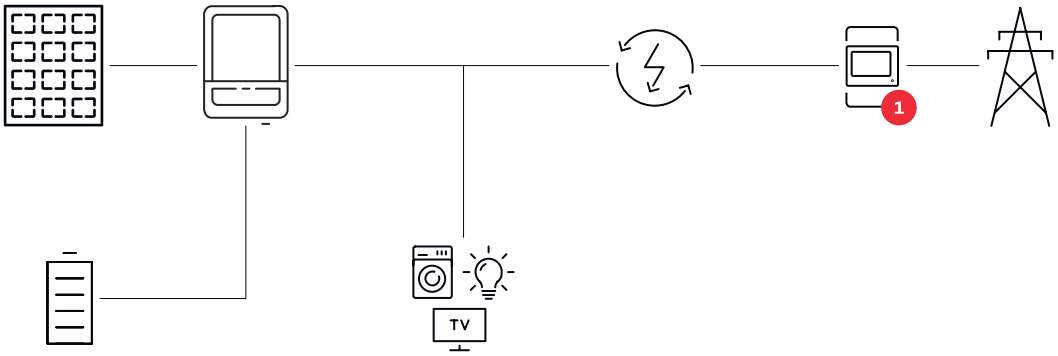


Operating mode – Inverter with battery and backup power function

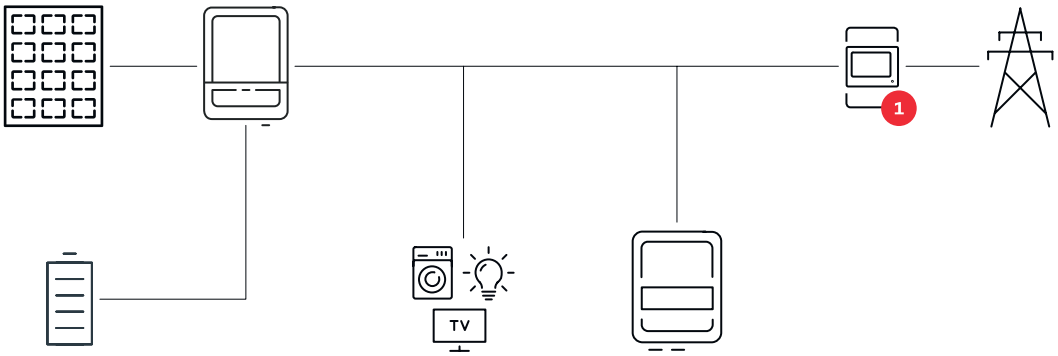
IMPORTANT!
In backup power mode, an increased nominal frequency is used in order to prevent undesired parallel operation with other power generators.

When the hybrid PV system is equipped with all the available features, the inverter can:

- Supply loads in the house
- Store excess energy in the battery and/or feed it into the grid
- Supply connected loads in the event of a power failure

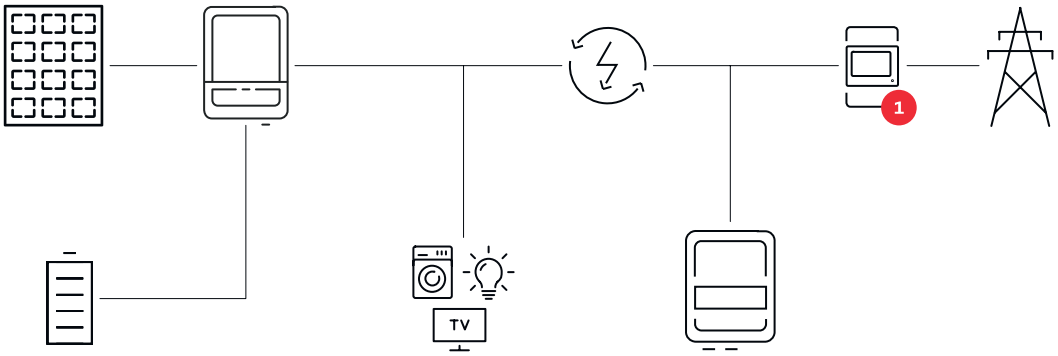


Operating mode – Inverter with battery and Ohmpilot



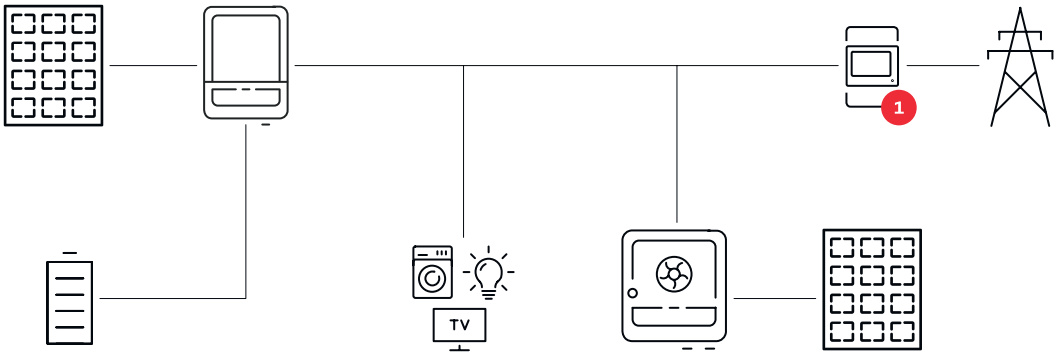
Operating mode – Inverter with battery, Ohmpilot, and backup power function

IMPORTANT!
In the fully equipped hybrid PV system with a Fronius Ohmpilot, the Ohmpilot cannot be operated in the event of a power failure for regulatory reasons. It is therefore sensible to install the Ohmpilot outside of the backup power branch.



Operating mode – Inverter with battery and another inverter

In the hybrid PV system, batteries may only be connected to an inverter with battery support. Batteries cannot be split between multiple inverters with battery support. Depending on the battery manufacturer, however, several batteries can be combined on one inverter.



Operating mode – Inverter with battery, another inverter, and backup power function

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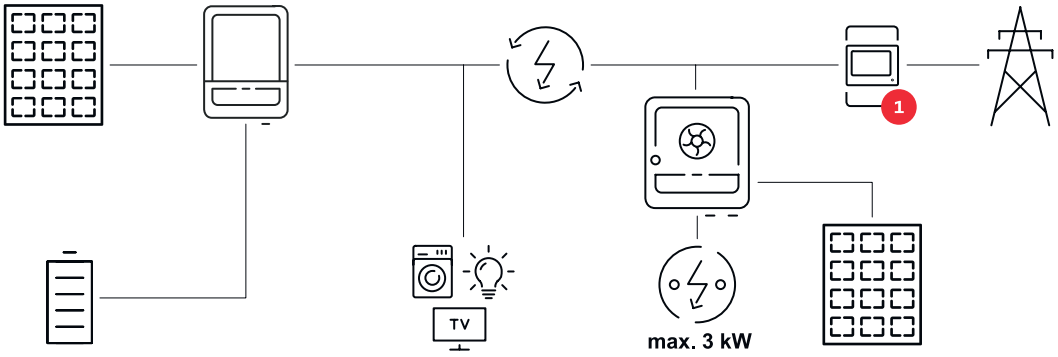
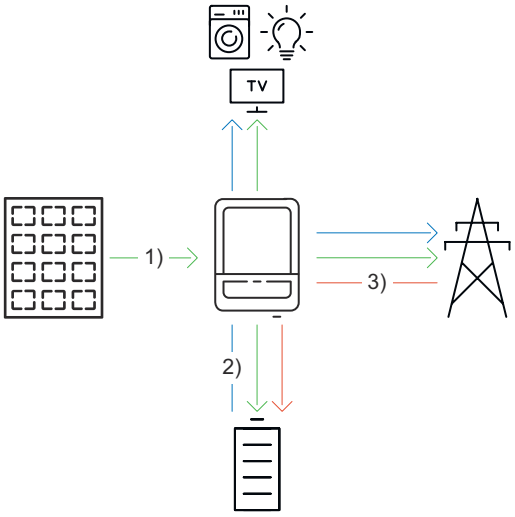


Energy flow direction of the inverter



(1) PV module – inverter – load/grid/battery
(2) Battery – inverter – load/grid*
(3) Grid – inverter – battery*

* Depending on the settings and local standards and regulations.

Operating states (only for battery systems)

Battery systems distinguish between different operating states. In each case, the relevant current operating state is displayed on the user interface of the inverter or in Fronius Solar.web.

Operating state	Description
Normal operation	The energy is stored or drawn, as required.
Min. state of charge (SoC) reached	The battery has reached the minimum SoC specified by the manufacturer or the set minimum SoC. The battery cannot be discharged further.
Energy saving mode (standby)	The system has been put into energy-saving mode. Energy saving mode is automatically ended as soon as sufficient surplus power is available again.
Start	The battery system starts from energy-saving mode (standby).
Forced re-charging	The inverter recharges the battery, in order to maintain the SoC specified by the manufacturer or the set minimum SoC (protection against deep discharge).
Calibration charging	The battery system is charged to the SoC of 100% and then discharged to the SoC of 0%. After 1 hour of waiting time at SoC 0%, the calibration charge is stopped and the battery switches to normal operation.
Service mode	The battery system is charged or discharged to the SoC of 30% and the SoC of 30% is maintained until the end of the service mode.
Deactivated	The battery is not active. It has either been deactivated, switched off, or the communication between the battery and the inverter has been interrupted.

Energy-saving mode

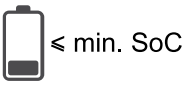
General

Energy saving mode (standby mode) is used to reduce the self-consumption of the system. Both the inverter and the battery automatically switch to energy saving mode under certain conditions.

The inverter switches to energy saving mode if the battery is flat and no PV power is available. Only the inverter's communication with the Fronius Smart Meter and Fronius Solar.web is maintained.

Switch-off conditions

If all the switch-off conditions are met, the battery switches into energy saving mode within ten minutes. This time delay ensures that the inverter can at least be restarted.



The battery state of charge is less than or equal to the input minimum state of charge.

The current charging or discharging power of the battery is less than 100 W.

Less than 50 W is available for charging the battery. The power of feeding into the public grid is at least 50 W less than the power currently required in the home network.

The inverter automatically switches into energy saving mode, following the battery.

Switch-on conditions

If one of the following conditions is met for at least 30 seconds, energy saving mode is ended:

- Energy saving mode is no longer permissible owing to a changed setting on the user interface of the inverter.
- If dynamic power reduction of 0 is set, or if the system is operating in backup power mode, the power of feeding into the public grid is always less than the required power in the home network.
  There is a separate condition for this case (dynamic power reduction < 300 W or active backup power mode):
  - If the PV power is above a specified threshold, energy saving mode is ended.
- Battery charging from the public grid is requested via the user interface of the inverter.
- The battery is being recharged in order to restore the minimum state of charge or perform calibration.

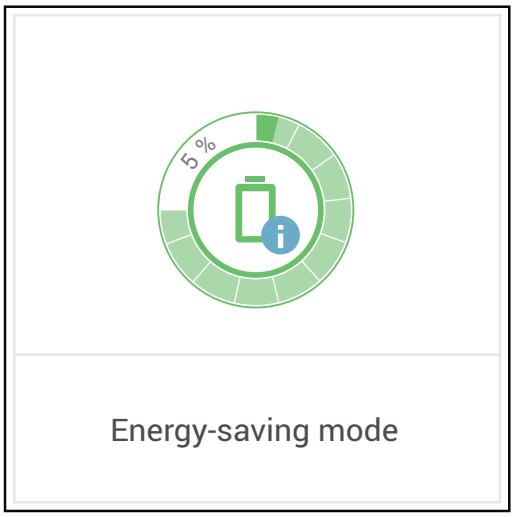
Special case

If the inverter does not operate for 12 minutes (e.g., fault), or there is an interruption in the electrical connection between the inverter and the battery and there is no backup power mode, the battery switches to energy-saving mode in any case. This reduces self discharge of the battery.

Indication of energy saving mode

During energy saving mode:

- Operating LED for the inverter lights up orange (see Button functions and LED status indicator on page 40).
- The user interface of the inverter can be reached.
- All the available data are saved and transmitted to Solar.web.
- The real-time data can be seen on Solar.web.



Energy saving mode is shown on the user interface of the inverter and in Solar.web by an "i" beside the battery symbol in the system overview.

Suitable batteries

General

Fronius explicitly points out that the third-party batteries are not Fronius products. Fronius is not the manufacturer, distributor, or retailer of these batteries. Fronius accepts no liability and offers no service or guarantees for these batteries.

Obsolete firmware/software states may lead to incompatibilities between the inverter and the battery. In this case, the following steps are to be performed:

1 Update battery software—see the battery documentation.

2 Update inverter firmware—see Update on page 107.

Read this document and the Installation Instructions before installing and commissioning the external battery. The documentation is either enclosed with the external battery or can be obtained from the battery manufacturer or their service partners

All documents associated with the inverter can be found at the following address:

https://www.fronius.com/en/solar-energy/installers-partners/service-support/tech-support

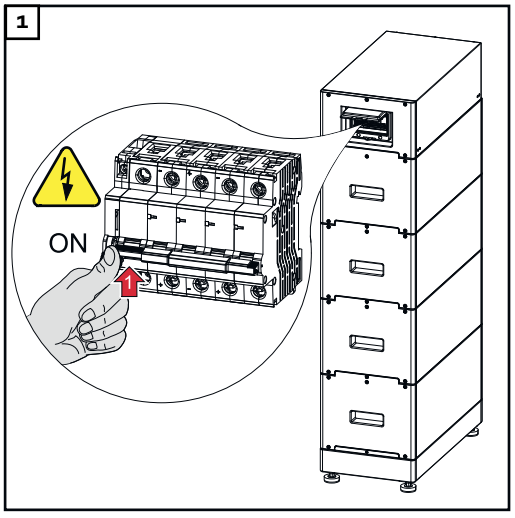
BYD Battery-Box Premium

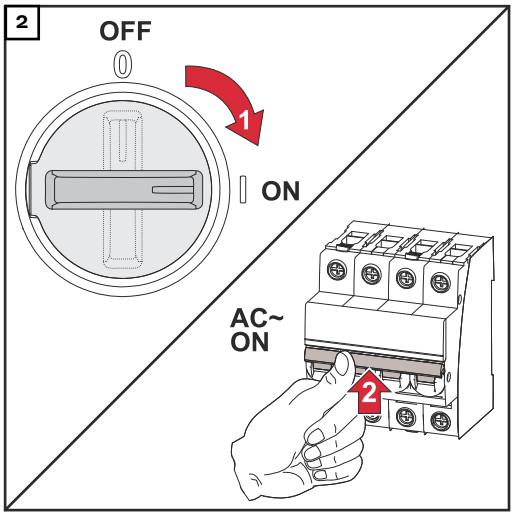
BYD Battery-Box Premium HVM	8.3	11.0	13.8	16.6	19.3	22.1
Number of battery modules	3	4	5	6	7	8
Fronius Verto Plus	✗	✓	✓	✓	✓	✓
Battery parallel operation*	✗	✓	✓	✓	✓	✓

* Max. 3 batteries with the same capacity can be combined. With BYD Battery-Box Premium HVM 22.1 max. 2 batteries can be combined.

IMPORTANT! The following switch-on sequence for the system must always be followed to ensure reliable operation with a BYD Battery-Box Premium.

1 Switch on the battery.





Set the DC disconnector to the "on" switch position. Turn on the automatic circuit breaker.

Manual system start

Requirements	There is no energy available from the PV modules or from the public grid. If backup power operation or battery operation are not possible (e.g., deep discharge protection of the battery), the inverter and battery switch off.
Notification of system shutdown	Status codes about the inactive state of the battery are displayed on the user interface of the inverter. A notification via e-mail can be activated in Fronius Solar.web.
Manual battery start after system shutdown	As soon as energy is available again, the inverter starts operation automatically; however, the battery must be started manually. The switch-on sequence must be observed for this, see chapter Suitable batteries on page 31.
Starting backup power operation after a system shutdown	The inverter requires energy from the battery to start backup power operation. This is done manually on the battery; further information on the power supply for restarting the inverter via the battery can be found in the battery manufacturer's Operating Instructions.

Utilization in accordance with "intended purpose"

Intended use

The inverter is designed to convert direct current from PV modules into alternating current and feed this power into the public grid. A backup power mode* is possible if the wiring is set up accordingly.

Intended use also means:
- Carefully reading and following all the instructions as well as complying with the safety and danger notices in the operating instructions
- Installation in accordance with the chapter headed Installation, from page 55

Follow all grid operator regulations regarding energy fed into the grid and connection methods.

The inverter is a grid-connected inverter with backup power function and is not a stand-alone inverter. The following restrictions in backup power mode must therefore be observed:
- The inverter may be operated for max. 2000 operating hours in backup power mode
- The inverter may be operated for more than 2000 operating hours in backup power mode provided 20% of the grid power feed operating time of the inverter is not exceeded at the time in question

* Depending on the device variant, suitable battery, corresponding cabling, settings, and local standards and regulations.

Foreseeable misuse

The following circumstances are considered to be reasonably foreseeable misuse:
- Any use that is not the intended use or goes beyond the intended use.
- Alterations to the inverter that are not expressly recommended by Fronius.
- Installation of components that are not expressly recommended or sold by Fronius.

Provisions for the photovoltaic system

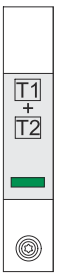
The inverter is designed exclusively to be connected and used with PV modules. Use with other DC generators (e.g., wind generators) is not permitted.

When configuring the photovoltaic system, make sure that all photovoltaic system components are operating exclusively within their permitted operating range.

All measures recommended by the PV module manufacturer for maintaining the PV module properties must be followed.

Surge protection device (SPD)

Surge protection device (SPD)



The surge protection device (SPD) protects against temporary overvoltages and dissipates surge currents (e.g., lightning strike). Building on an overall lightning protection concept, the SPD helps to protect your PV system components.

If the surge protection device is triggered, the color of the indicator changes from green to red (mechanical display).

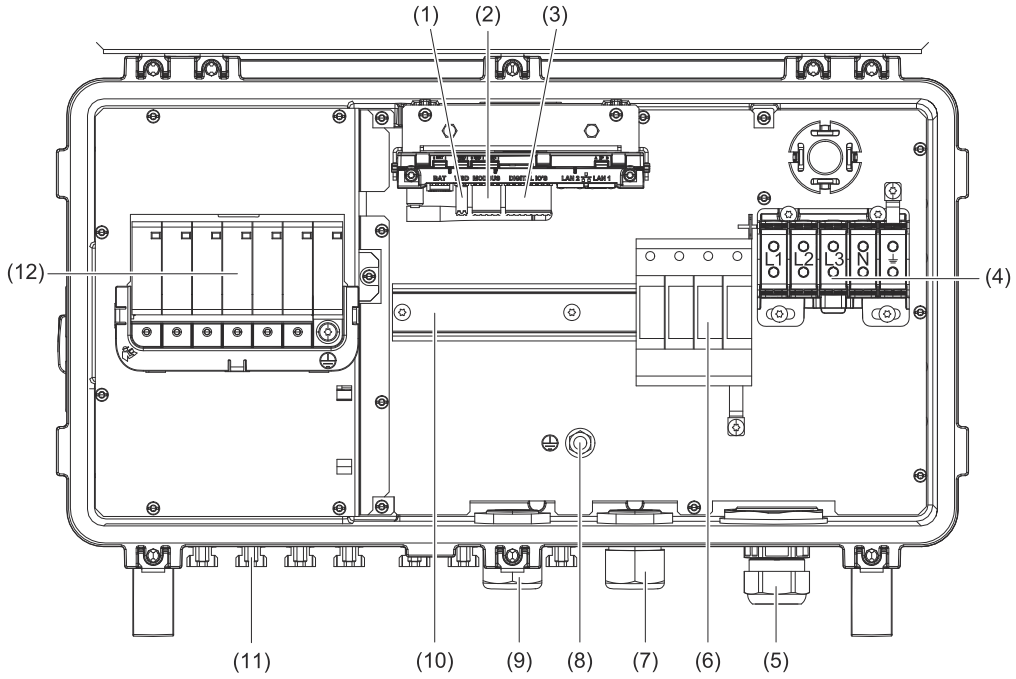
A tripped SPD must be replaced immediately by an authorized specialist company with a functioning SPD in order to maintain the full protective function of the unit.

There is the option of a digital indication when an SPD has tripped. For setting this function, see PDF "Temporary SPD Triggering" in the Service & Support area at www.fronius.com

IMPORTANT!
After setting the function described above, the inverter will also respond if the 2-pole signal cable of the surge protection device is interrupted or damaged.

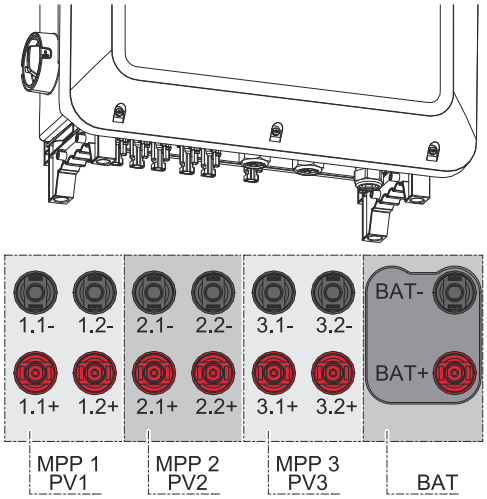
Operating controls and connections

Connection area

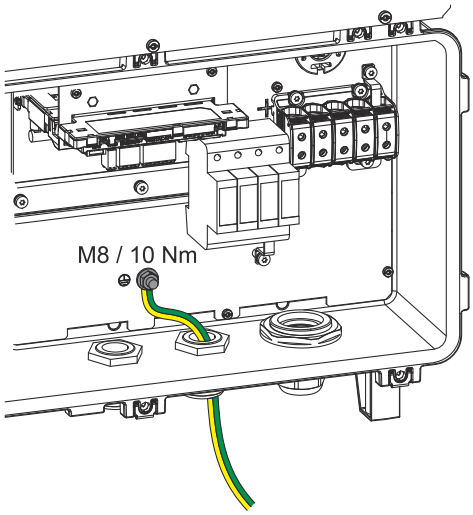


(1) Push-in WSD (wired shutdown) terminal
(2) Push-in terminals in the data communication area (Modbus)
(3) Push-in terminals in the data communication area (Modbus, digital inputs and outputs)
(4) 5-pin AC terminal
⏚ = ⏚
(5) Cable gland/cable connection AC
(6) Surge protection device AC SPD
(7) Optional cable gland
(8) Grounding clamping bolts
(9) Data communication area cable gland/cable connection
(10) DIN rail (installation option for third-party components)
(11) DC connections MC4 and battery connections MC4-Evo stor
(12) Surge protection device DC SPD

Photovoltaic and battery connections



Ground electrode bolt

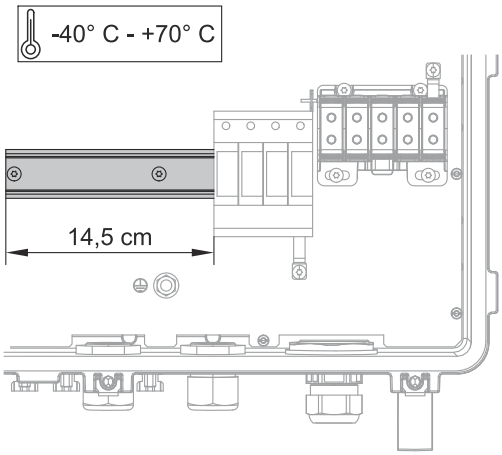


The ground electrode bolt ⏚ allows additional components to be grounded, such as:

- AC cable
- Module mounting system
- Ground rod

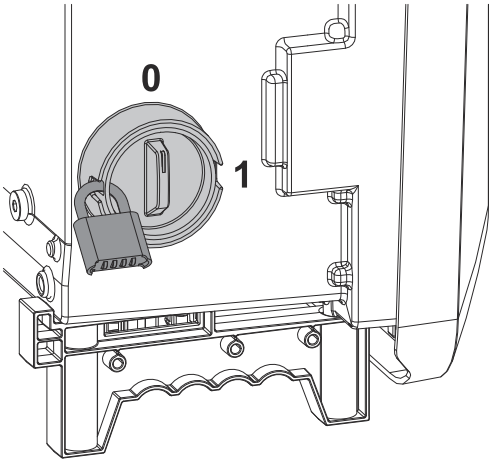
If further grounding options are required, suitable terminals can be fitted to the DIN rail.

Mounting option for third-party components



In the connection area there is space for mounting third-party components. Components up to a maximum width of 14.5 cm (8 DU) can be mounted on the DIN rail. The components must have a temperature resistance of -40 °C to +70 °C.

DC disconnector

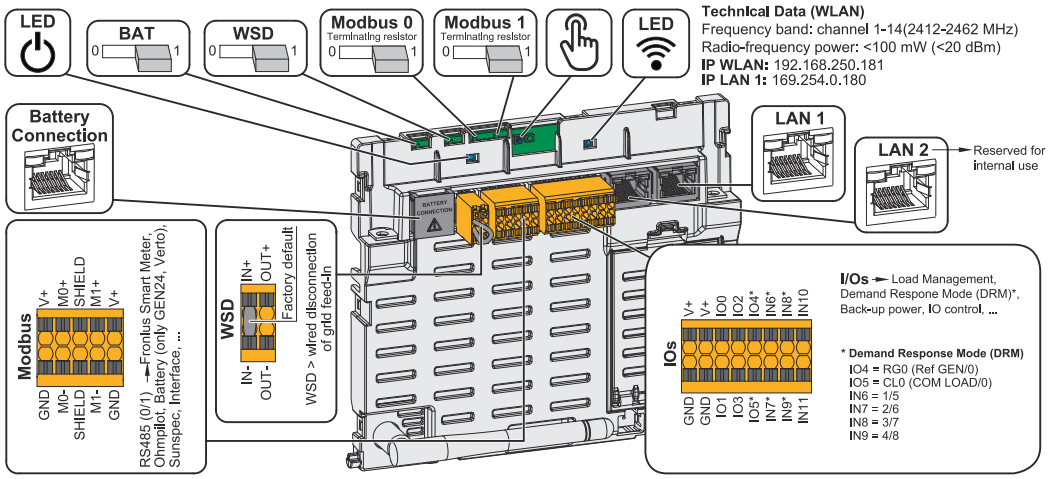


The DC disconnector has 2 switch settings: On / Off.

IMPORTANT!
When the switch is in the 'Off' position, a conventional padlock can be used to secure the inverter against being switched on. The national guidelines must be complied with in this respect.

Padlock minimum requirement:
- Shackle diameter min. 6 mm
- Housing size min. 40 mm

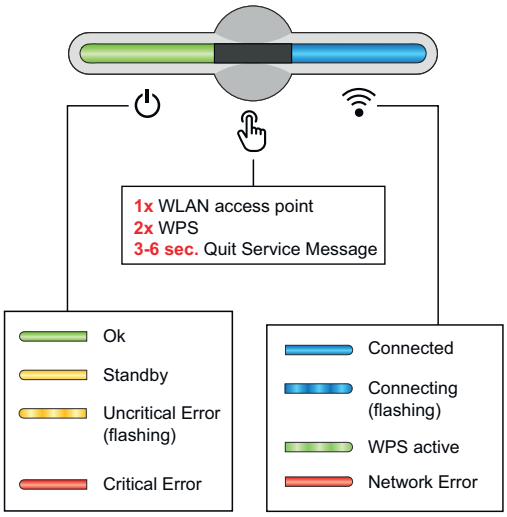
Data communication area



⏻ Operating LED	Indicates the inverter operating status.
BAT switch	**Position 1:** Setting for the connection of compatible batteries (factory setting) **Position 0:** not in use
WSD (wired shutdown) switch	Defines the inverter as the WSD primary device or WSD secondary device. **Position 1:** WSD primary device **Position 0:** WSD secondary device
Modbus 0 (MB0) switch	Switches the terminating resistor for Modbus 0 (MB0) on/off. **Position 1:** Terminating resistor on (factory setting) **Position 0:** Terminating resistor off

Modbus 1 (MB1) switch	Switches the terminating resistor for Modbus 1 (MB1) on/off. **Position 1:** Terminating resistor on (factory setting) **Position 0:** Terminating resistor off
Optical sensor	For operating the inverter. See the chapter headed Button functions and LED status indicator on page 40.
Communications LED	Indicates the inverter connection status.
Battery Connection (Modbus RJ45)	Modbus connector for connecting a compatible battery. **IMPORTANT!** Do not connect any network components (e.g., WiFi routers) to this connection.
LAN 1	Ethernet connection for data communication (e.g., WiFi router, home network) or for commissioning with a laptop, see the chapter headed Installation with the browser on page 86).
LAN 2	Reserved for future functions. To avoid malfunctions, only use LAN 1.
I/O terminal	Push-in terminal for digital inputs/outputs. See chapter Permitted cables for the data communication connection on page 65. The designations (RG0, CL0, 1/5, 2/6, 3/7, 4/8) relate to the Demand Response Mode function, see chapter Demand Response Modes (DRM) on page 94.
WSD terminal	Push-in terminal for the WSD installation. See the chapter headed Installing the WSD (wired shutdown) on page 83.
Modbus terminal	Push-in terminal for the installation of Modbus 0, Modbus 1, 12 V, and GND (ground). The inverter establishes the data connection to the connected components via the Modbus terminal. **The inputs M0 and M1 can be freely selected.** Max. 4 Modbus participants per input; see the chapter headed Modbus participants on page 79.

Button functions and LED status indicator

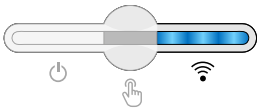


The operating status LED displays the status of the inverter. In case of faults, follow the individual steps in the Fronius Solar.start app.

The optical sensor is actuated by touching it with a finger.

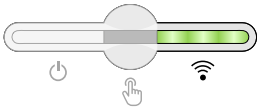
The communications LED displays the connection status. To establish a connection, follow the individual steps in the Fronius Solar.start app.

Sensor functions



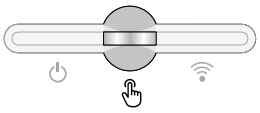
1x = WLAN access point (AP) is opened.

Flashes blue



2x = WLAN protected setup (WPS) is activated.

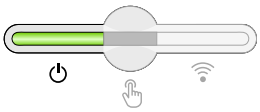
Flashes green



3 seconds (max. 6 seconds) = The service message disappears.

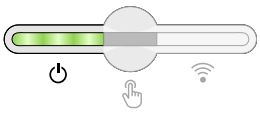
Flashes white (quickly)

LED status indicator



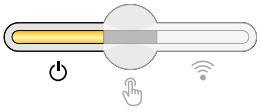
The inverter is operating correctly.

Lights up green



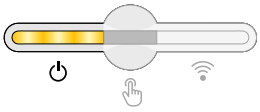
The inverter is performing the grid checks required by the applicable standards for grid power feed operation.

Flashes green



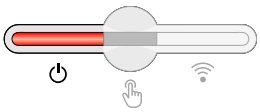
The inverter is on standby, is not operating (e.g., no energy fed into the grid at night), or is not configured.

Lights up yellow



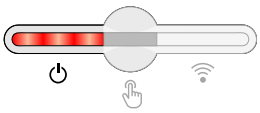
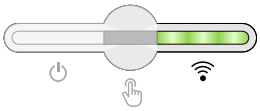
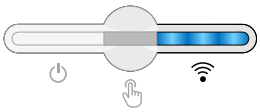
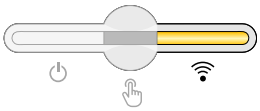
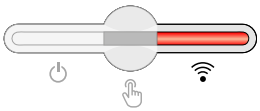
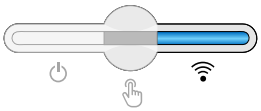
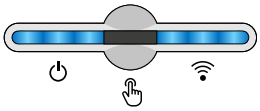
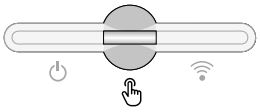
The inverter displays a non-critical status.

Flashes yellow



The inverter displays a critical status and no energy is fed into the grid.

Lights up red

LED status indicator	
	The inverter displays a backup power overload. ⏻ Flashes red
	The network connection is being established via WPS. 2x 👆 = WPS search mode. Flashes green
	The network connection is being established via WLAN AP. 1x 👆 = WLAN AP search mode (active for 30 minutes). Flashes blue
	The network connection is not configured. Lights up yellow
	A network error is displayed, the inverter is operating correctly. Lights up red
	The network connection is active. Lights up blue
	The inverter is performing an update. ⏻ / Flash blue
	There is a service message. 👆 Lights up white

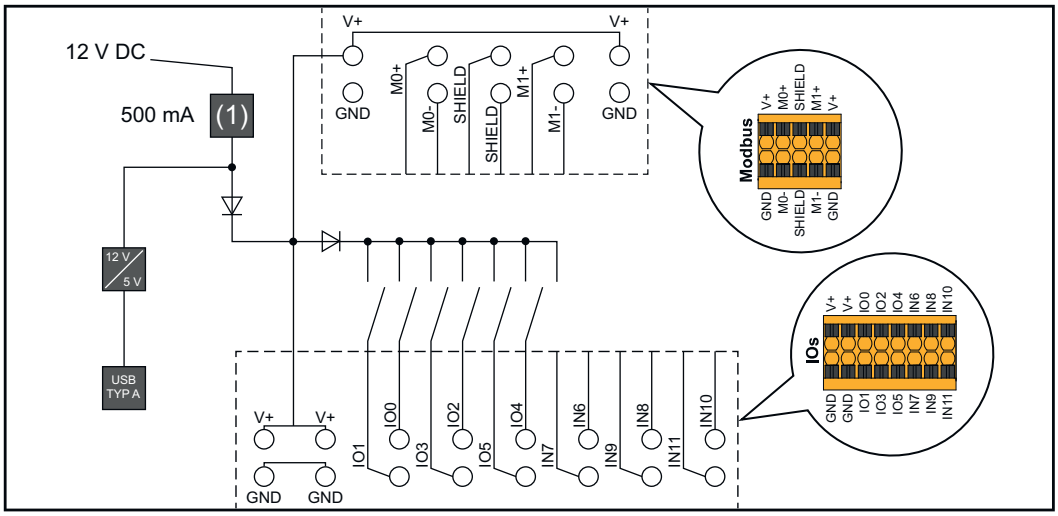
Schematic internal wiring of IOs

The V+/GND pin provides the possibility of feeding in a voltage in the range of 12.5 to 24 V (+ max. 20%) using an external power supply unit. Outputs IO 0 - 5 can then be operated using the external voltage that has been fed in. A maximum of 1 A may be drawn per output, whereby a total of max. 3 A is permitted. The fuse protection must take place externally.

⚠ CAUTION!

Danger from polarity reversal at the terminals due to improper connection of external power supply units.
This may result in severe damage to the inverter.
- ▶ Check the polarity of the external power supply unit with a suitable measuring device before connecting it.
- ▶ Connect the cables to the V+/GND outputs while ensuring the correct polarity.

IMPORTANT!
If the total output (6W) is exceeded, the inverter switches off the entire external power supply.



(1) Current limitation

Backup power variant - Full Backup

General

Prerequisites for backup power mode

The following prerequisites must be met in order to use the inverter's backup power function:

- The inverter must support the backup power variant "Full Backup."
- A battery suitable for backup power use must be installed and configured.
- Correct cabling of the backup power system in the electrical installation or usage of a switchover box from Enwitec (see chapter Components for switching to backup power on page 138 or Circuit Diagrams on page 157).
- An installation with connected neutral conductor.
- Install and configure the Fronius Smart Meter at the feed-in point.
- Attach a backup power supply warning (https://www.fronius.com/en/search-page, item number: 42.0409.0275) to the electrical distributor.
- Apply the necessary settings in the **Devices and system components** > **Functions and pins** > **Backup Power** menu item and activate backup power.
- Go through the checklist – Backup power (https://www.fronius.com/en/search-page, item number: 42.0426.0365) step by step and confirm.

Transitioning from grid power feed operation to backup power mode

1. The public grid is monitored by the inverter's internal grid and system protection unit and by the Fronius Smart Meter connected to it.
2. **The public grid fails or specific grid parameters are undershot or exceeded.**
3. The inverter carries out the measures necessary according to the country standard and then switches off.
4. The inverter starts backup power mode after a checking period.
5. All loads in the household that are in the backup power circuit are supplied by the battery and the PV modules. The remaining loads are not supplied with power and are safely isolated.

Transitioning from backup power mode to grid power feed operation

1. The inverter is operating in backup power mode.
2. **The public grid is functioning correctly again.**
3. The Fronius Smart Meter monitors the grid parameters on the public grid and passes this information to the inverter.
4. The stability of the restored public grid is determined by checking the measured values of the Fronius Smart Meter.
5. Backup power mode is terminated automatically or manually depending on the design of the backup power switchover facility.
6. All circuits are reconnected to the public grid and are supplied by the grid.
7. The inverter can start grid power feed operation again after performing the grid checks required by the relevant standard.

Backup power and energy saving mode

Under the following conditions, the battery and the inverter are switched to energy saving mode after a waiting time of 8-12 minutes and backup power mode is ended:

- The battery is discharged to the minimum state of charge and no energy is coming from the PV modules.
- The inverter is set to energy saving mode (standby mode).

If the battery and inverter are in energy saving mode, the system is reactivated by the following:

- Enough energy is available from the PV modules.
- The public grid is functioning again.
- The battery is switched off and on.

Automatic switch to backup power including backup power circuits and 3-pin separation, e.g., Austria or Australia

Functions

- Measuring and transferring the required parameters for energy management and Solar.web by the Fronius Smart Meter.
- Disconnecting from the public grid to enable operation in backup power mode if the grid parameters are outside the country-specific standards.
- Reconnecting to the public grid when the grid parameters are within the limits specified by the country-specific standards.
- Option of having a separate backup power circuit or several backup power circuits that are supplied even during failure of the public grid. The total load of the backup power circuits must not exceed the nominal output of the inverter. Furthermore, the performance of the connected battery must also be considered.

Transitioning from grid power feed operation to backup power mode

1. The public grid is monitored by the inverter's internal grid and system protection unit and by the Fronius Smart Meter connected to it.
2. **Failure of the public grid**.
3. The inverter carries out the measures necessary according to the country standard and then switches off.
   Contactor K1 drops out. This disconnects the backup power circuits and the inverter from the rest of the home network and from the public grid, as the main contacts of contactor K1 open. The inverter activates relay K3, which interrupts the supply to contactor K1. This prevents unintentional activation of contactor K1 and thus a grid connection when voltage is restored in the grid. The NC auxiliary contacts of contactor K1 send feedback to the inverter that the contactor is open (a condition for starting backup power mode).
4. The NO contact of relay K3 gives additional feedback to the inverter on whether the locking was successfully performed by relay K3.
5. The inverter decides based on the contactor's feedback as well as the measurements on the inverter terminals that the backup power mode can be activated.
6. After all the required activation tests have been carried out, the inverter starts backup power mode.
7. All loads in the backup power circuits are supplied with power. The remaining loads are not supplied with power and are safely isolated.

Transitioning from backup power mode to grid power feed operation

1. The inverter is operating in backup power mode. Contactor K1 to the public grid is open.
2. **Public grid available again.**
3. The Fronius Smart Meter monitors the grid parameters on the public grid and passes this information to the inverter.
4. The stability of the restored public grid is determined by checking the measured values of the Fronius Smart Meter.
5. The inverter ends backup power mode and disconnects the outputs.
6. The inverter deactivates K3. Contactor K1 is reactivated.
7. All circuits are reconnected to the public grid and are supplied by the grid. The inverter does not feed anything into the grid at this time.
8. The inverter can start grid power feed operation again after performing the grid checks required by the relevant standard.

Automatic switch to backup power all-pin separation, e.g., Germany, France, Spain

Functions

- Measuring and transferring the required parameters for energy management and Solar.web by the Fronius Smart Meter.
- Disconnecting from the public grid to enable operation in backup power mode if the grid parameters are outside the country-specific standards.
- Reconnecting to the public grid when the grid parameters are within the limits specified by the country-specific standards.
- Establishing a proper ground connection for backup power mode to ensure the protection devices function correctly.
- Option of having a separate backup power circuit or several backup power circuits that are supplied even during failure of the public grid. The total load of the backup power circuits must not exceed the rated power of the inverter. Furthermore, the performance of the connected battery must also be considered.

Transitioning from grid power feed operation to backup power mode

1. The public grid is monitored by the inverter's internal grid and system protection unit and by the Fronius Smart Meter connected to it.
2. **Failure of the public grid**.
3. The inverter carries out the necessary measures according to the country standard and then switches off.
   Contactors K1, K4, and K5 drop out. This disconnects the backup power circuits and the inverter from the rest of the home network and from the public grid, as the main contacts of contactor K1 open (all-pin). The NC auxiliary contacts of contactor K1 send feedback to the inverter that the contactor is open (a condition for starting backup power mode).
4. The NC main contacts of contactors K4 and K5 are closed, establishing a connection between the neutral conductor and the ground conductor. The two other NC main contacts of contactors K4 and K5 give feedback to the inverter that the ground connection has been established correctly (a condition for starting backup power mode).
5. The inverter activates relay K3, which interrupts the supply to contactors K1, K4, and K5. This prevents unintentional activation of contactors K1, K4, and K5 and thus a grid connection when voltage is restored in the grid.
6. The NO contact of relay K3 gives additional feedback to the inverter on whether the locking was successfully performed by relay K3.
7. The inverter decides based on the contactors' feedback as well as the measurements on the inverter terminals that the backup power mode can be started.
8. After all the required activation tests have been carried out, the inverter starts backup power mode.
9. All loads in the backup power circuits are supplied with power. The remaining loads are not supplied with power and are safely isolated.

Transitioning from backup power mode to grid power feed operation

1. The inverter is operating in backup power mode. Contactor K1 to the public grid is open.
2. **Public grid available again.**
3. The Fronius Smart Meter monitors the grid parameters on the public grid and passes this information to the inverter.
4. The stability of the restored public grid is determined by checking the measured values of the Fronius Smart Meter.
5. The inverter ends backup power mode and disconnects the outputs.
6. The inverter deactivates K3. Power is restored to contactors K1, K4, and K5.
7. All circuits are reconnected to the public grid and are supplied by the grid. The inverter does not feed anything into the grid at this time.
8. The inverter can start grid power feed operation again after performing the grid checks required by the relevant standard.

Automatic switch to backup power all-pin separation, Italy

Functions

- Measuring and transferring the required parameters for energy management and Solar.web by the Fronius Smart Meter.
- Monitoring of the voltage and frequency grid parameters by the inverter.
- Disconnecting from the public grid to enable operation in backup power mode if the grid parameters are outside the country-specific standards.
- Reconnecting to the public grid when the grid parameters are within the limits specified by the country-specific standards.
- Establishing a correct ground connection for backup power mode.
- Option of having a separate backup power circuit or several backup power circuits that are supplied even during failure of the public grid. The total load of the backup power circuits must not exceed the nominal output of the inverter. Furthermore, the performance of the connected battery must also be considered.

Transitioning from grid power feed operation to backup power mode

1. The public grid is monitored by the inverter's internal grid and system protection unit and by an external grid and system protection unit.
2. **Failure of the public grid**
3. The inverter carries out the measures necessary according to the country standard and then switches off.
4. The external grid and system protection unit opens contactors K1 and K2 for grid monitoring. This disconnects the backup power circuits and the inverter from the rest of the home network and from the public grid, as the main contacts of contactors K1 and K2 open (all-pin). To ensure that the public grid has definitely been disconnected, the NC auxiliary contacts of contactor K1 give feedback to the external grid and system protection unit.
5. The NC main contacts of contactors K4 and K5 are closed, establishing a connection between the neutral conductor and the ground conductor. The two other NC main contacts of contactors K4 and K5 give feedback to the inverter that the ground connection has been established correctly.
6. The inverter activates relay K3, which activates the remote input of the external grid and system protection unit via an NC contact. This prevents a connection to the public grid when voltage is restored in the grid.
7. The NO contact of relay K3 gives additional feedback to the inverter on whether the locking was successfully performed by relay K3.
8. The inverter decides based on the contactor's feedback as well as the measurement on the inverter terminals that the backup power mode can be activated.
9. The inverter starts backup power mode after a defined checking period.
10. All loads in the backup power circuits are supplied with power. The remaining loads are not supplied with power and are safely isolated.

Transitioning from backup power mode to grid power feed operation

1. The inverter is operating in backup power mode. The contactors K1 and K2 to the public grid are open.
2. **Public grid available again.**
3. The Fronius Smart Meter monitors the grid parameters on the public grid and passes this information to the inverter.
4. The stability of the restored public grid is determined by checking the measured values of the Fronius Smart Meter.
5. On the basis of adjustments that have been carried out, the inverter ends backup power mode and disconnects the outputs.
6. The inverter deactivates K3. Power is restored to contactors K1, K2, K4, and K5.
7. All circuits are reconnected to the public grid and are supplied by the grid. The inverter does not feed anything into the grid at this time.
8. The inverter can start grid power feed operation again after performing the grid checks required by the relevant standard.

Manual switch to backup power 3-pin separation, e.g., Austria / all-pin separation, e.g., Germany

Functions

- Measuring and transferring the required parameters for energy management and Solar.web by the Fronius Smart Meter.
- Monitoring of the grid parameters by the inverter.
- Possibility of manual separation from the public grid if it fails or is deemed unstable.
- Option of having a separate backup power circuit or several backup power circuits that are supplied even during failure of the public grid. The total load of the backup power circuits must not exceed the rated power of the inverter. Furthermore, the performance of the connected battery must also be considered.
- If, in the event of a public grid failure, there is no manual switch to backup power mode within the first 10 minutes, this may cause the inverter and the battery to shut down. In order to then start backup power mode, manual switching must take place and a manual system start must be performed, if necessary (see chapter Manual system start on page 33).
- It is possible to manually reconnect the inverter and loads in the backup power circuit to the public grid once it is deemed to be stable again. The inverter only starts feed-in mode once the required grid monitoring time has passed.

Transition from grid power feed operation to backup power mode

1. The public grid is monitored by the inverter's internal grid and system protection and by the connected Fronius Smart Meter.
2. **Failure of the public grid**.
3. The inverter takes the necessary measures according to the country standard and then switches off.
4. The user switches changeover switch Q1 from switch position 1 (grid operation) via switch position 0 to switch position 2 (backup power mode). This disconnects the backup power circuits and the inverter from the rest of the home network and from the public grid. In the case of all-pole disconnection, the connection of ground conductor and neutral conductor is also made via the main contacts of the switch. Switch position 2 (backup power mode) is fed back to the inverter via a contact of changeover switch Q1. In addition, when changeover switch Q1 switches via switch position 0, the WSD line is interrupted. This causes the inverter to switch off immediately. This behavior is ensured via 2 contacts. The communication between the inverter and the Fronius Smart Meter is optionally interrupted via a contact. The suspended communication prevents automatic termination of backup power mode when power returns to the public grid. The inverter then remains in backup power mode until it is manually switched back again.
5. Based on the feedback for switch position 2 and the measurements at the inverter terminals, the inverter decides that backup power mode can be started.
6. After all required connection tests have been carried out, the inverter starts in backup power mode.
7. All loads that are in the backup power circuits are supplied. The remaining loads are not supplied and are safely disconnected.

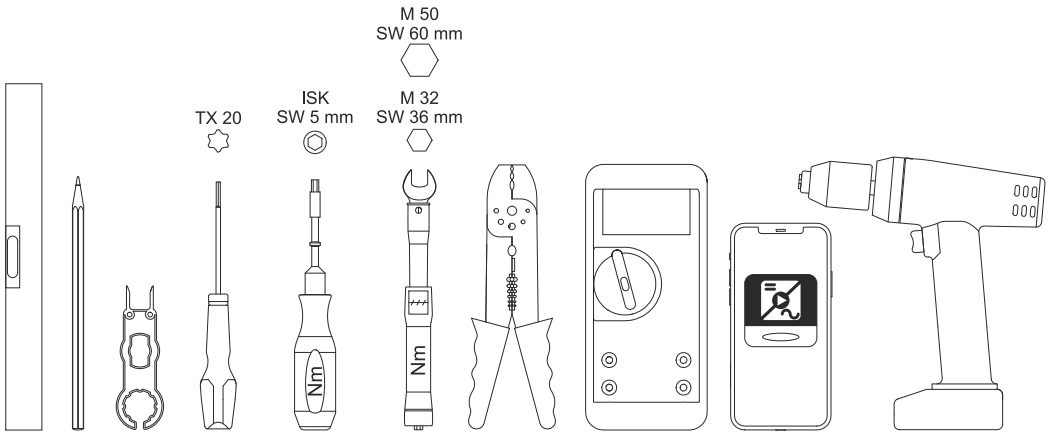
Transition from backup power mode to grid power feed operation

1. The inverter is operating in backup power mode. Changeover switch Q1 is in switch position 2 (backup power mode).
2. **Public grid available again.**
3. The user switches changeover switch Q1 from switch position 2 (backup power mode) via switch position 0 to switch position 1 (grid operation). When switching via switch position 0, the inverter switches off immediately. This is ensured by the contacts of changeover switch Q1. In order to protect sensitive loads, it is recommended to remain in the zero position for at least 1 second during the switchover process from backup power mode to the public grid.
4. The inverter is connected to the entire home network and to the public grid again.
5. Communication between the inverter and the Fronius Smart Meter is restored.
6. Once the grid checks required by the applicable standards have been performed, the inverter can start feeding power into the grid again.

Installation

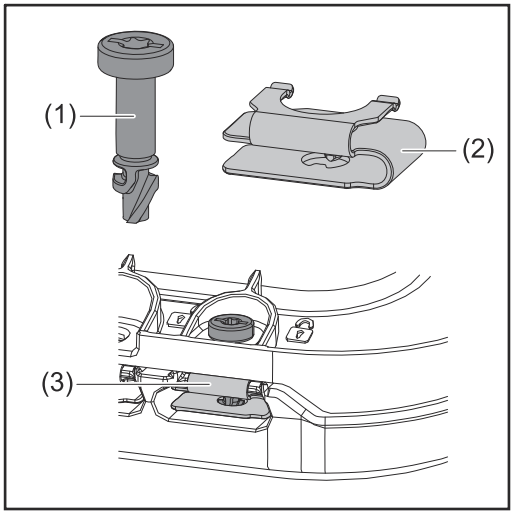
General

Tools required



- Spirit level
- Pencil
- TX20 screwdriver
- Hex socket torque wrench 5 mm
- Torque wrench M32, M50
- Wire stripper for cables and wires
- Multimeter for measuring voltage
- Smartphone, tablet, or PC for setting up the inverter
- Drill driver

Quick-fastener system



A quick-fastener system (3) is used to mount the connection area cover and front cover. The system is opened and closed with a half-rotation (180°) of the captive screw (1) into the quick-fastener spring (2).

The system is independent of torque.

NOTE!

Danger when using a drill driver.
This may result in the destruction of the quick-fastener system due to over-torque.

- ▶ Use a screwdriver (TX20).
- ▶ Do not turn the screws more than 180°.

System component compatibility

All installed components in the PV system must be compatible with each other and have the necessary configuration options. The installed components must not restrict or negatively affect the functioning of the PV system.

NOTE!

Risk due to components in the PV system that are not and/or only partially compatible.

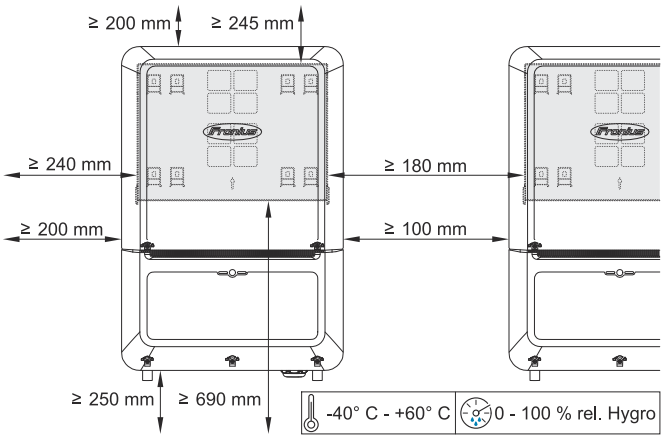
Incompatible components can restrict and/or negatively affect the operation and/or functioning of the PV system.

- ▶ Only install components recommended by the manufacturer in the PV system.
- ▶ Before installation, check the compatibility of components that have not been expressly recommended with the manufacturer.

Installation location and position

Choosing the location of the inverter

Please observe the following criteria when choosing a location for the inverter:



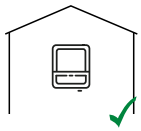
Only install on a solid, non-flammable surface.

When installing the inverter in a switch cabinet or similar closed environment, ensure adequate heat dissipation by forced-air ventilation.

When installing the inverter on the outer walls of cattle sheds, it is important to maintain a minimum clearance of 2 m between all sides of the inverter and the ventilation and building openings.

The following substrates are allowed:

- Wall installation: Corrugated sheet metal (mounting rails), brick, concrete, or other non-flammable surfaces sufficiently capable of bearing loads
- Mast or beam: Mounting rails, behind the PV modules directly on the PV mounting system
- Flat roof (if this is for a film roof, make sure that the films comply with the fire protection requirements and are not highly flammable. Ensure compliance with the national provisions.)
- Covered parking lot roof (no overhead installation)

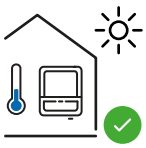


The inverter is suitable for indoor installation.

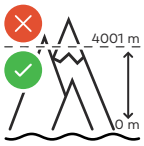
The inverter is suitable for outdoor installation.

Due to its IP 66 protection class, the inverter is not susceptible to water spray from any direction.

Do not expose the inverter to direct sunlight in order to keep inverter heating as low as possible.



The inverter should be installed in a protected location, e.g., near the PV modules or under an overhanging roof.



The inverter must not be installed or operated at more than 4 000 m above sea level.

The voltage U_{DCmax} must not exceed the following values:

- **Verto 15.0 - 20.0 Plus**
  - between 0 and 3000 m: 1000 V
  - between 3001 and 3500 m: 959 V
  - between 3501 and 4000 m: 909 V
  - over 4001: not allowed
- **Verto 25.0 - 33.3 Plus**
  - between 0 and 2700 m: 1000 V
  - between 2701 and 3500 m: 922 V
  - between 3501 and 4000 m: 873 V
  - over 4001: not allowed

Do not install the inverter:

- Where it may be exposed to ammonia, corrosive gases, acids or salts (e.g., fertilizer storage areas, vent openings for livestock stables, chemical plants, tanneries, etc.)

During certain operating phases the inverter may produce a slight noise. For this reason it should not be installed in an occupied living area.

Do not install the inverter in:

- Areas where there is an increased risk of accidents from farm animals (horses, cattle, sheep, pigs, etc.)
- Stables or adjoining areas
- Storage areas for hay, straw, chaff, animal feed, fertilizers, etc.

The inverter is designed to be dust-proof (IP 66). In areas of high dust accumulation, dust deposits may collect on the cooling surfaces, and thus impair the thermal performance. In this case, cleaning is required regularly. We therefore recommend not installing the inverter in areas and environments with high dust accumulation.

Do not install the inverter in:

- Greenhouses
- Storage or processing areas for fruit, vegetables, or viticulture products
- Areas used in the preparation of grain, green fodder, or animal feeds

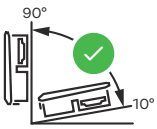
Choosing the location of third-party batteries

IMPORTANT!
Refer to the manufacturer's documents for the suitable location for third-party batteries.
Adverse environmental conditions, such as low temperatures, may result in an automatic reduction in the charging and discharging capacity of the battery.

Installation position of inverter

The inverter is suitable for vertical installation on a vertical wall or column.

Do not install the inverter:
- At an angle
- In the horizontal position
- With the connection sockets facing upwards
- On a base



The inverter is suitable for a horizontal installation position or for installation on a sloping surface.

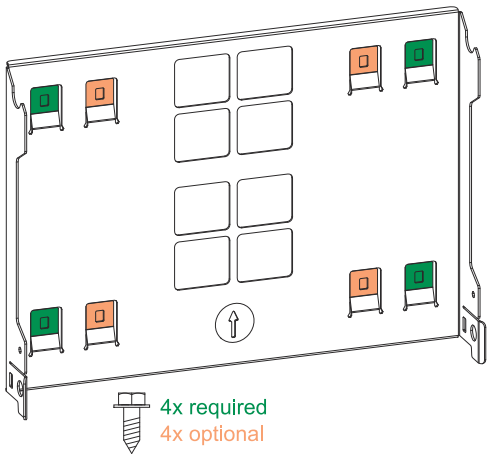
Do not install the inverter:
- On a sloping surface with the connection sockets facing upwards
- Overhanging with the connection sockets facing down
- On the ceiling

Installing the mounting bracket and attaching the inverter

Selecting the mounting material

Use the corresponding fixing materials depending on the subsurface and observe the screw dimension recommendations for the mounting bracket.
The installer is responsible for selecting the right type of fixing.

Properties of the mounting bracket



The mounting bracket (illustration) can also be used as a guide.

The pre-drilled holes on the mounting bracket are intended for screws with a thread diameter of 6-8 mm (0.24-0.32 inches).

Unevenness on the installation surface (for example, coarse-grained plaster) is largely counterbalanced by the mounting bracket.

The mounting bracket must be fixed to the four outer tabs (marked in green). The four inner tabs (marked in orange) can be used in addition if required.

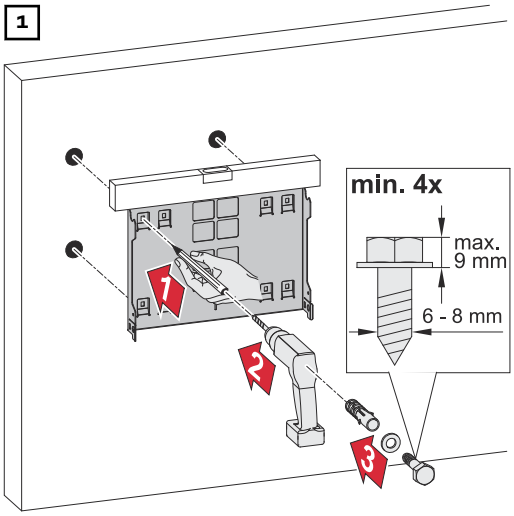
Do not deform the mounting bracket

NOTE!

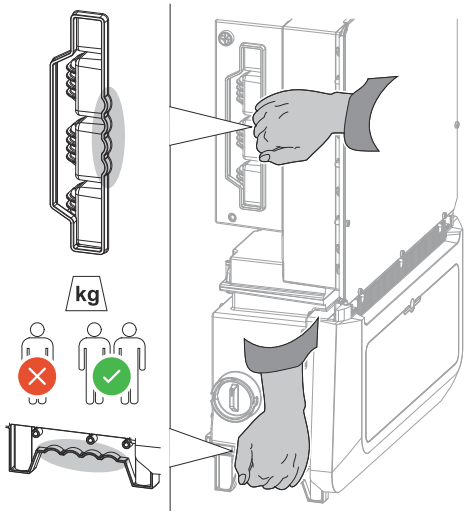
When attaching the mounting bracket to the wall or to a column, make sure that the mounting bracket is not deformed.
A deformed mounting bracket may make it difficult to clip/swivel the inverter into position.

Fitting the mounting bracket to a wall

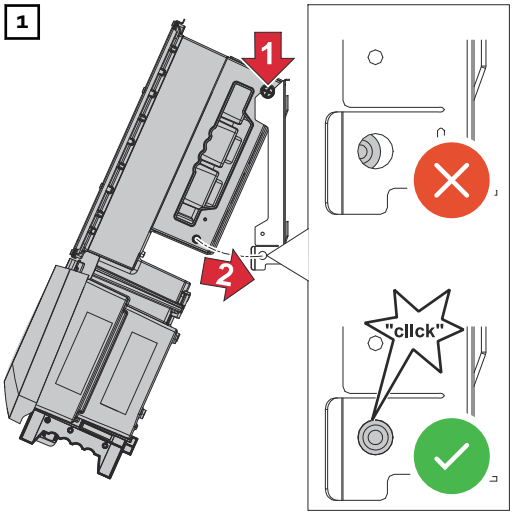
IMPORTANT!
When installing the mounting bracket, make sure that it is installed with the arrow pointing upwards.



Attaching the inverter to the mounting bracket



There are integrated grips on the side of the inverter which facilitate lifting/attaching.



Clip the inverter into the mounting bracket from above. The connections must point downwards.

Push the lower part of the inverter into the snap-in tabs of the mounting bracket until the inverter audibly clicks into place on both sides.

Check that the inverter is correctly positioned on both sides.

Requirements for connecting the inverter

Connecting aluminum cables

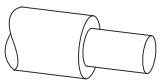
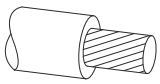
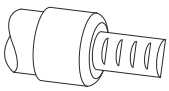
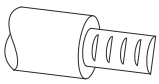
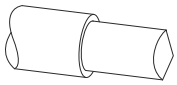
Aluminum cables can also be connected to the AC connections.

NOTE!

When using aluminum cables:

- ▶ Follow all national and international guidelines regarding the connection of aluminum cables.
- ▶ Grease aluminum wires with appropriate grease to protect them from oxidation.
- ▶ Follow the instructions of the cable manufacturer.

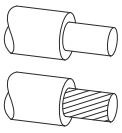
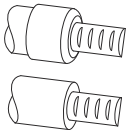
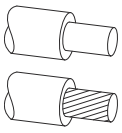
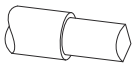
Different cable types

Solid	Fine-stranded	Fine-stranded with ferrule and collar	Fine-stranded with ferrule without collar	Sectoral
				

Permitted cables for the electrical grid connection

Round copper or aluminum conductors with a cross-section of 4 to 35 mm² can be connected to the terminals of the inverter as described below.

The torques according to the following table must be observed:

Cross-section	Copper		Aluminum	
				
35 mm²	10 Nm	10 Nm	14 Nm	14 Nm
25 mm²	8 Nm	8 Nm	12 Nm	10 Nm
16 mm²			10 Nm	
10 mm²	6 Nm	6 Nm	⊗	⊗
6 mm²				
4 mm²	⊗			

The grounding must be established with a 6 mm² copper or 16 mm² aluminum cable as a minimum requirement.

Permitted cables for the electrical DC connection

Round copper conductors with a cross section of **4-10 mm²** can be connected to the MC4 plugs of the inverter.

Select a sufficiently large cable cross-section based on the actual device output and the installation situation! Observe the data sheet for the plug!

Permitted cables for the electrical BAT connection

The inverter is provided with 2 MC4-Evo stor plugs for the electrical BAT connection:
- Plug set MC4 EVO STO 6 mm² - 44.0240.4466,IK
- Plug set MC4 EVO STO 10 mm² - 44.0240.6688,IK

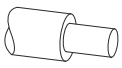
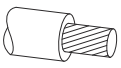
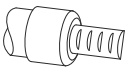
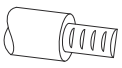
Copper conductors with a cross-section of **6 mm²** or **10 mm²** are to be used for these plugs. Only connecting cables with a flexible stranded wire structure of classes 5 or 6 may be connected. Use only tin-plated copper cables.

Permitted cables for the data communication connection

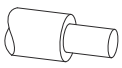
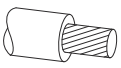
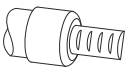
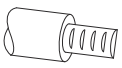
Cables with the following design can be connected to the terminals of the inverter:
- Copper: round, solid
- Copper: round, fine-stranded

IMPORTANT!
If several single conductors are connected to an input of the push-in terminals, connect the single conductors with a corresponding ferrule.

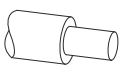
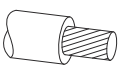
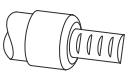
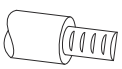
WSD connections with push-in terminal

Distance	Stripping length					Cable recommendation
100 m 109 yd	10 mm 0.39 inch	0.14 - 1.5 mm² AWG 26 - 16	0.14 - 1.5 mm² AWG 26 - 16	0.14 - 1 mm² AWG 26 - 18	0.14 - 1.5 mm² AWG 26 - 16	min. CAT 5 UTP (unshielded twisted pair)

Modbus connections with push-in terminal

Distance	Stripping length					Cable recommendation
300 m 328 yd	10 mm 0.39 inch	0.14 - 1.5 mm² AWG 26 - 16	0.14 - 1.5 mm² AWG 26 - 16	0.14 - 1 mm² AWG 26 - 18	0.14 - 1.5 mm² AWG 26 - 16	min. CAT 5 STP (shielded twisted pair)

IO connections with push-in terminal

Distance	Stripping length					Cable recommendation
30 m 32 yd	10 mm 0.39 inch	0.14 - 1.5 mm² AWG 26 - 16	0.14 - 1.5 mm² AWG 26 - 16	0.14 - 1 mm² AWG 26 - 18	0.14 - 1.5 mm² AWG 26 - 16	Single conductors possible

LAN connections

Fronius recommends using at least CAT 5 STP (shielded twisted pair) cables and a maximum distance of 100 m (109 yd).

Cable diameter of the AC cable

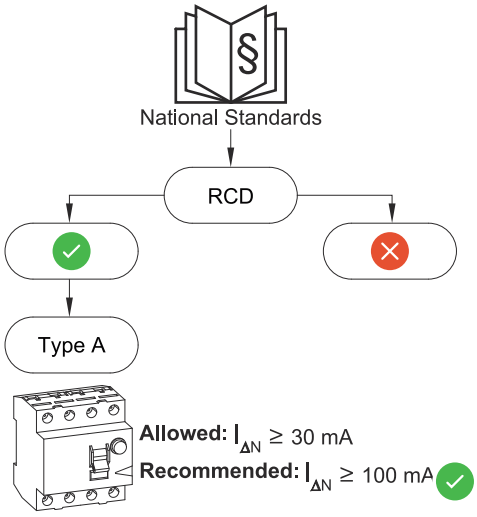
For a standard M32 cable gland **with a large reducer (green)**:
Cable diameter from **12-14 mm**

For a standard M32 cable gland **with a small reducer (red)**:
Cable diameter from **17-19 mm**

For a standard M32 cable gland **without a reducer**:
Cable diameter from **20.5-24.5 mm**

For an M50 cable gland:
Cable diameter from **≤35 mm**

Maximum alternating current fuse protection



NOTE!

A residual current circuit breaker for the AC connecting cable may be required depending on national regulations, the grid operator, and other conditions.
A type A residual current circuit breaker is generally sufficient in this case. Nevertheless, false alarms can be triggered for the type A residual current circuit breaker in individual cases and depending on local conditions. For this reason, Fronius recommends using a residual current circuit breaker suitable for frequency inverters with a release current of at least 100 mA, taking into account national provisions.

Verto	AC power	Recommended fuse protection	Max. fuse protection
15.0	15 kW	63 A	63 A
17.5	17.5 kW	63 A	63 A
20.0	20 kW	63 A	63 A
25.0	25 kW	63 A	63 A
30.0	30 kW	63 A	63 A
33.3	33.3 kW	63 A	63 A

Connecting the inverter to the public grid (AC side)

Safety

⚠ WARNING!

Danger from incorrect operation and work that is not carried out properly.
This can result in severe personal injury and damage to property.
- ▶ Read the Installation Instructions and Operating Instructions before installing and commissioning the equipment.
- ▶ Only qualified personnel are authorized to commission the inverter and only within the scope of the respective technical regulations.

⚠ WARNING!

Danger from grid voltage and DC voltage from PV modules that are exposed to light.
An electric shock can be fatal.
- ▶ Prior to any connection work, ensure that the inverter is de-energized on the AC side and the DC side.
- ▶ Only an authorized electrical engineer is permitted to connect this equipment to the public grid.

⚠ WARNING!

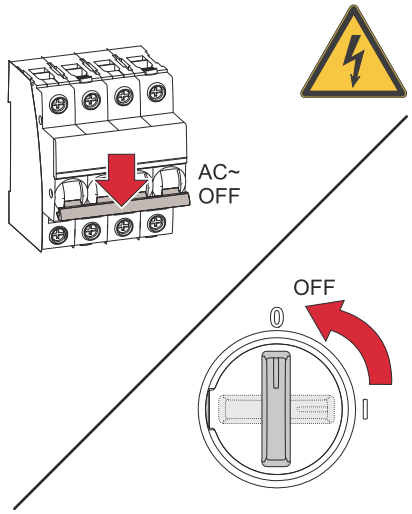
Danger from damaged and/or contaminated terminals.
This can result in severe personal injury and damage to property.
- ▶ Prior to connection work, check the terminals for damage and contamination.
- ▶ Remove any contamination while the equipment is de-energized.
- ▶ Have defective terminals replaced by an authorized specialist.

Connecting the inverter to the public grid (AC side)

It is not possible to operate the inverter in ungrounded grids, e.g., IT grids (insulated grids without ground conductor).

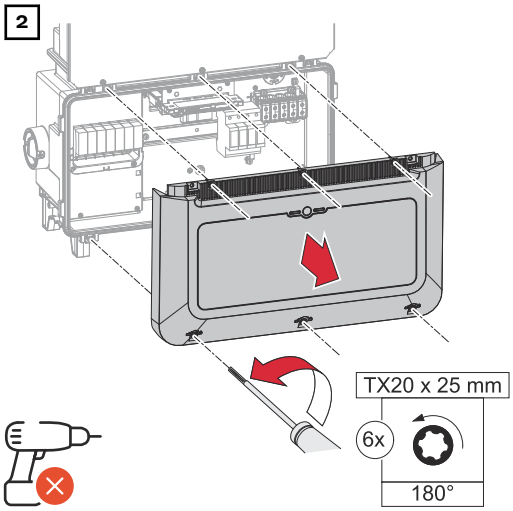
In certain system configurations, it is not necessary to connect the neutral conductor. In this system configuration, the **neutral conductor status** parameter must be set to **Not connected** on the web interface of the inverter in the **Device configuration** > **Inverter** > **AC grid** menu.

1



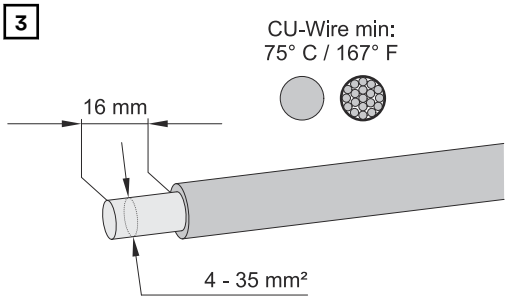
Turn off the automatic circuit breaker. Make sure that the DC disconnector is set to the “Off” switch setting.

2



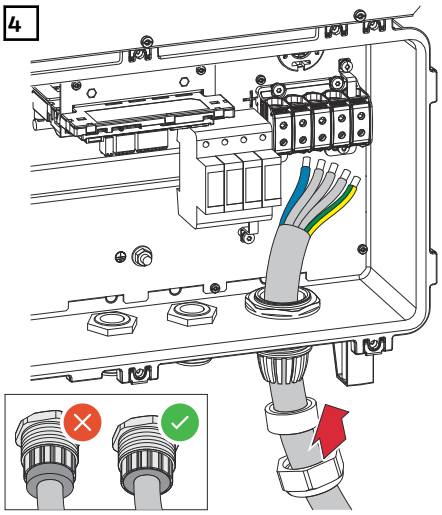
Loosen the 6 screws of the connection area cover by rotating them 180° to the left using a screwdriver (TX20). Remove the connection area cover from the device.

3

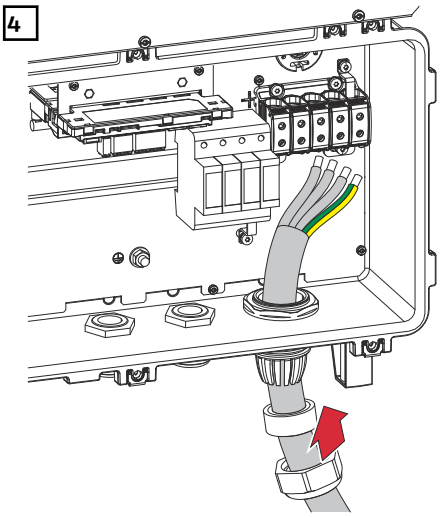


Strip the insulation of the single conductors by 16 mm.
Select the cable cross-section in accordance with the instructions in Permitted cables for the electrical grid connection from page 64.

IMPORTANT!
Only one conductor may be connected to each pin. With a twin ferrule, two conductors can be connected to one pin.

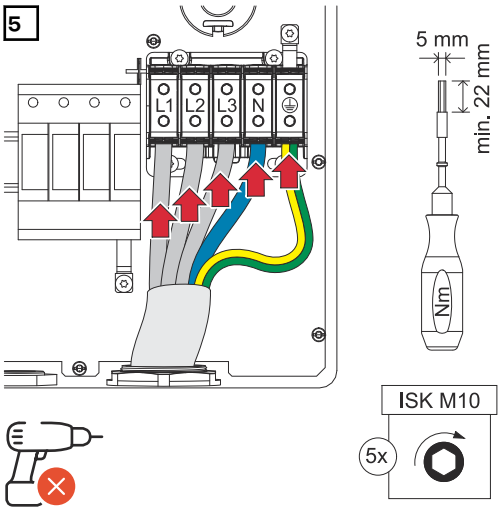


Connection with neutral conductor

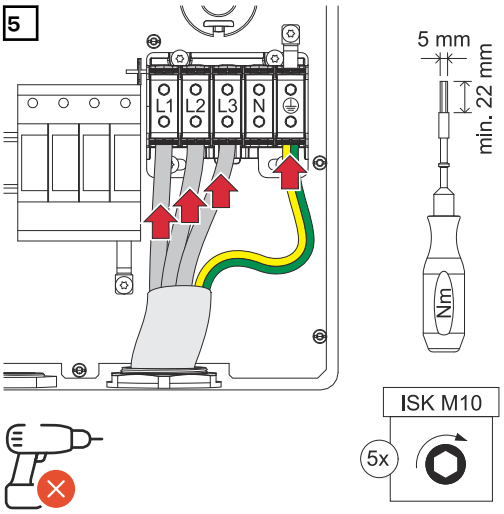


Connection without neutral conductor

For more information about the cable gland, see chapter Cable diameter of the AC cable on page 66.



Connection with neutral conductor



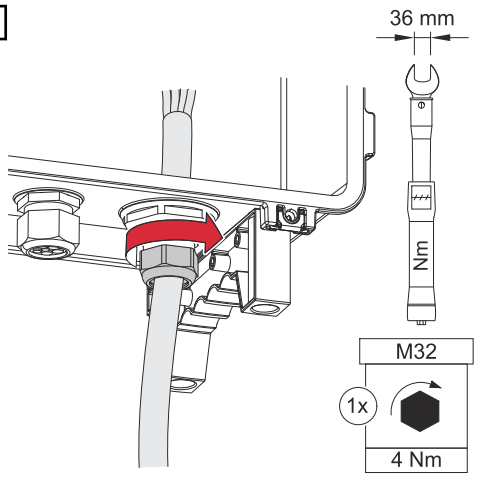
Connection without neutral conductor

IMPORTANT! Observe torques – see Permitted cables for the electrical grid connection on page 64.

IMPORTANT!
The ground conductor must be dimensioned longer and laid with a movement loop so that it is last loaded in the event of a failure of the cable gland.

L1	Phase conductor
L2	Phase conductor
L3	Phase conductor
N	Neutral conductor (optional)
PE	Ground conductor

6

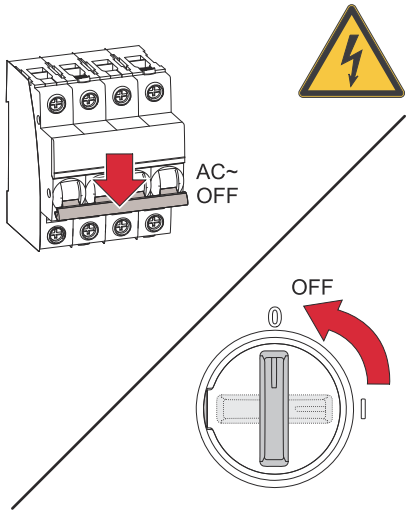


Fasten the union nut of the cable gland with a torque of 4 Nm.

Connecting the inverter to the public grid with the PEN conductor (AC side)

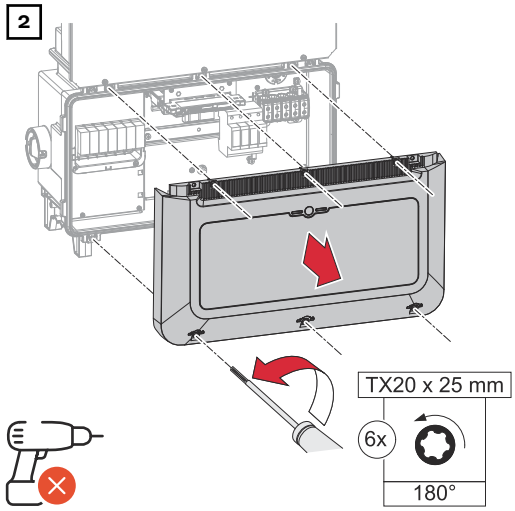
It is not possible to operate the inverter in ungrounded grids, e.g., IT grids (insulated grids without ground conductor).

1



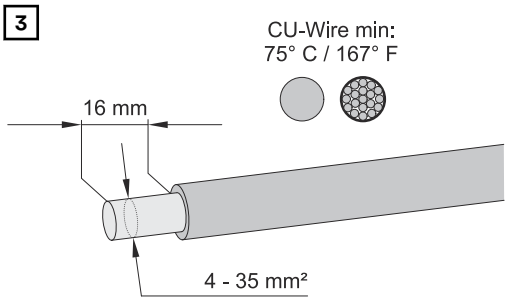
Turn off the automatic circuit breaker. Make sure that the DC disconnector is set to the "Off" switch setting.

2



Loosen the 6 screws of the connection area cover by rotating them 180° to the left using a screwdriver (TX20). Remove the connection area cover from the device.

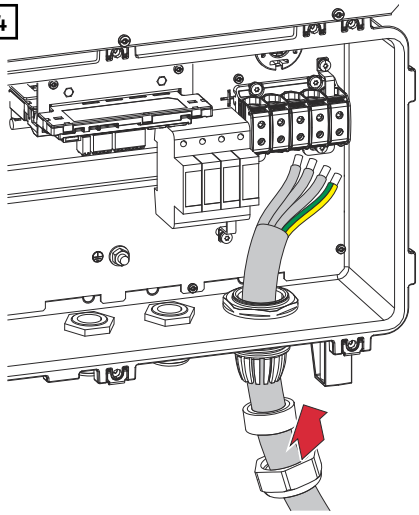
3



Strip the insulation of the single conductors by 16 mm.
Select the cable cross-section in accordance with the instructions in Permitted cables for the electrical grid connection from page 64.

IMPORTANT!
Only one conductor may be connected to each pin. With a twin ferrule, two conductors can be connected to one pin.

4



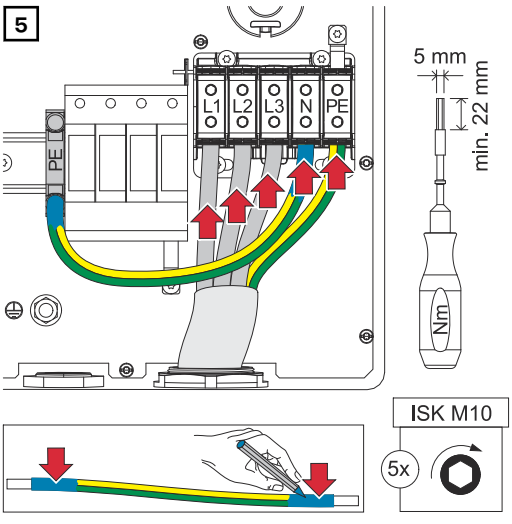
For more information about the cable gland, see chapter Cable diameter of the AC cable on page 66.

NOTE!
The PEN conductor must have ends that are permanently marked blue, according to the national regulations.

IMPORTANT!
The ground conductor must be dimensioned longer and laid with a movement loop so that it is last loaded in the event of a failure of the cable gland.

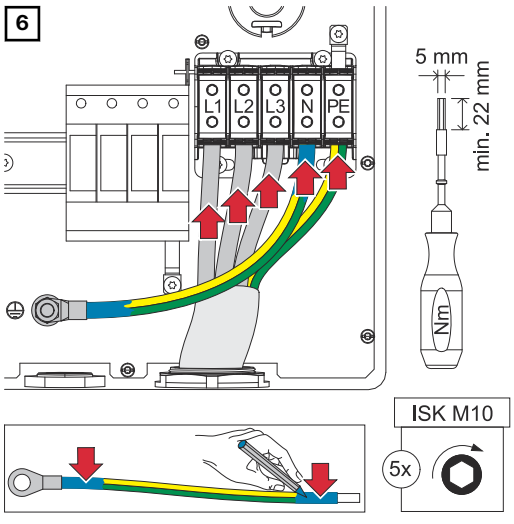
IMPORTANT!
Observe torques - see Permitted cables for the electrical grid connection on page 64.

5



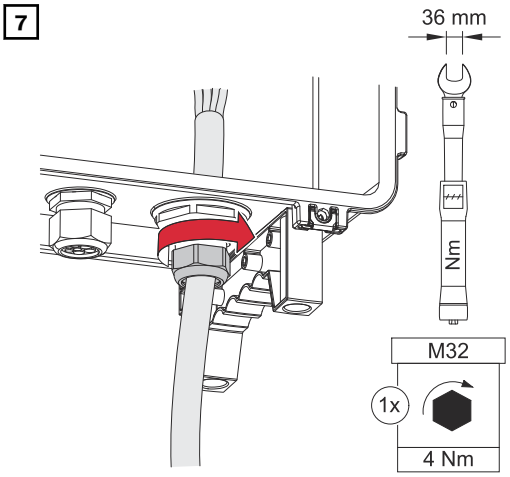
PEN conductor version: Terminal on DIN rail

6



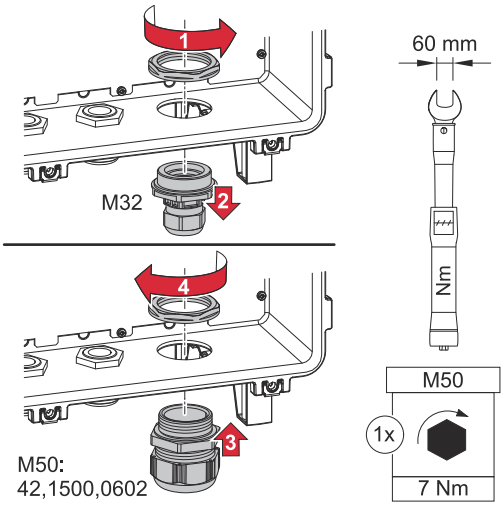
PEN conductor version: Earthing bolt

7



Fasten the union nut of the cable gland with a torque of 4 Nm.

Replacing the PG screw joint



Connecting solar module strings to the inverter

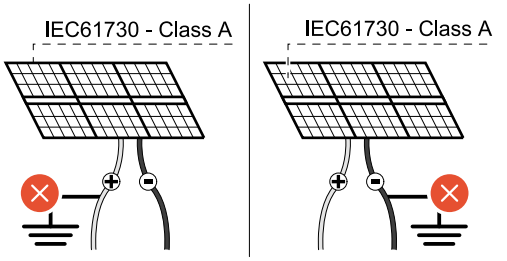
General comments regarding PV modules

To enable suitable PV modules to be chosen and to use the inverter as efficiently as possible, it is important to bear the following points in mind:

- If insolation is constant and the temperature is falling, the open-circuit voltage of the PV modules will increase. The open-circuit voltage must not exceed the maximum permissible system voltage. If the open-circuit voltage exceeds the specified values, the inverter will be destroyed and all warranty claims will be forfeited.
- The temperature coefficients on the data sheet of the PV modules must be observed.
- Exact values for sizing the PV modules can be obtained using suitable calculation tools, such as the Fronius Solar.creator.

IMPORTANT!
Before connecting up the PV modules, check that the voltage for the PV modules specified by the manufacturer corresponds to the actual measured voltage.

IMPORTANT!
The PV modules connected to the inverter must comply with the IEC 61730 Class A standard.



IMPORTANT!
Solar module strings must not be earthed.

Safety

⚠ WARNING!

Danger from incorrect operation and work that is not carried out properly.
This can result in severe personal injury and damage to property.

- ▶ The commissioning, maintenance, and service work in the inverter's power stage set may only be carried out by Fronius-trained service personnel in accordance with the technical specifications.
- ▶ Read the installation instructions and operating instructions before installing and commissioning the equipment.

⚠ WARNING!

Danger from mains voltage and DC voltage from PV modules that are exposed to light.
This can result in severe personal injury and damage to property.
- ▶ All connection, maintenance, and service work should only be carried out when the AC and DC sides have been disconnected from the inverter and are de-energized.
- ▶ Only an authorized electrical engineer is permitted to connect this equipment to the public grid.

⚠ WARNING!

Danger of an electric shock due to improperly connected terminals/PV plug connectors.
An electric shock can be fatal.
- ▶ When connecting, ensure that each pole of a string is routed via the same PV input, e.g.:
  + pole string 1 to the input **PV 1.1+** and **- pole string 1** to the input **PV 1.1-**

⚠ WARNING!

Danger from damaged and/or contaminated terminals.
This can result in severe personal injury and damage to property.
- ▶ Prior to connection work, check the terminals for damage and contamination.
- ▶ Remove any contamination while the equipment is de-energized.
- ▶ Have defective terminals replaced by an authorized specialist company.

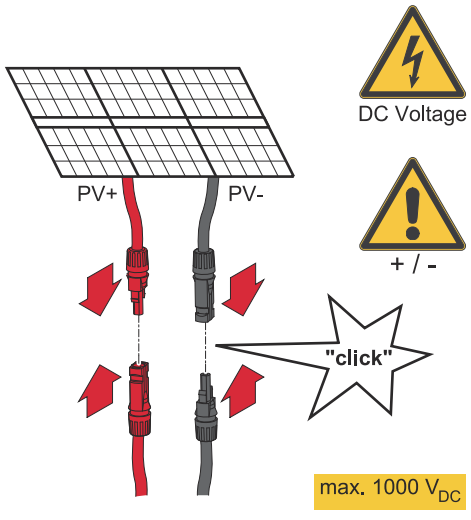
PV Generator, general

Several independent PV inputs are available. These inputs can be connected to a number of different modules.

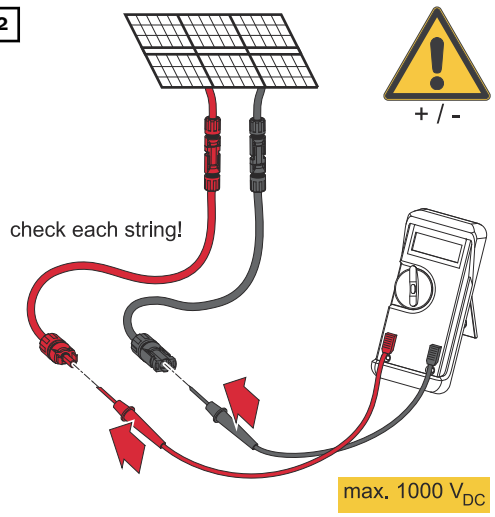
When starting for the first time, set up the PV Generator in accordance with the respective configuration (can also be carried out at a later date in the **System configuration** menu field under menu item **Components**).

Connecting solar module strings to the inverter

1



2



Use a suitable measuring instrument to check the voltage and polarity of the DC cabling.

⚠ CAUTION!

Danger due to polarity reversal at the terminals.
This may result in severe damage to the inverter.

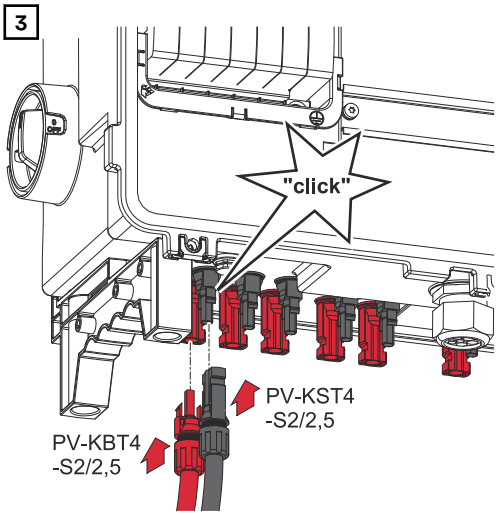
- ▶ Use a suitable measuring instrument to check the polarity of the DC cabling.
- ▶ Use a suitable measuring instrument to check the voltage (**max. 1 000 V_{DC}**)

⚠ CAUTION!

Risk of damage due to incompatible plug connectors.
Incompatible plug connectors can cause thermal damage and may cause a fire.

- ▶ Only use the original plug connectors (MC4) from Stäubli (formerly Multi-Contact).

3



Connect PV cables from the solar modules to the MC4 plugs according to the label

Unused MC4 plugs on the inverter must be closed by the cover caps supplied with the inverter.

Connecting the battery to the inverter

Safety

⚠ WARNING!

Danger due to incorrect operation and incorrectly performed work.
This can result in serious injury and damage to property.
- ▶ Only a technical specialist is permitted to perform commissioning, maintenance, and service activities for inverters and batteries, and only within the scope of the technical regulations.
- ▶ Read the installation instructions and operating instructions from the respective manufacturer before installing and commissioning the equipment.

⚠ WARNING!

Danger from mains voltage and DC voltage from the PV module that are exposed to light, as well as batteries.
This can result in serious injury and damage to property.
- ▶ All connection, maintenance, and service work should only be carried out when the AC and DC sides have been disconnected from the inverter and battery, and are de-energized.
- ▶ Only a technical specialist is permitted to connect this equipment to the public grid.

⚠ WARNING!

Danger from damaged and/or contaminated terminals.
This can result in serious injury and damage to property.
- ▶ Prior to connection work, check the terminals for damage and contamination.
- ▶ Remove any contamination while the equipment is de-energized.
- ▶ Have defective terminals repaired by a technical specialist.

Connecting the battery on the DC side

⚠ CAUTION!

Danger due to operation of the battery above the permissible altitude specified by the manufacturer.
Operating the battery above the permissible altitude can result in restricted operation, loss of operation, and unsafe states of the battery.
- ▶ Adhere to the manufacturer's instructions regarding the permissible altitude.
- ▶ Operate the battery only at the altitude specified by the manufacturer.

IMPORTANT!
Prior to installing a battery, ensure that the battery is switched off. The max. DC cable length for the installation of third-party batteries must be taken into account according to the specifications of the manufacturer, see chapter Suitable batteries on page 31.

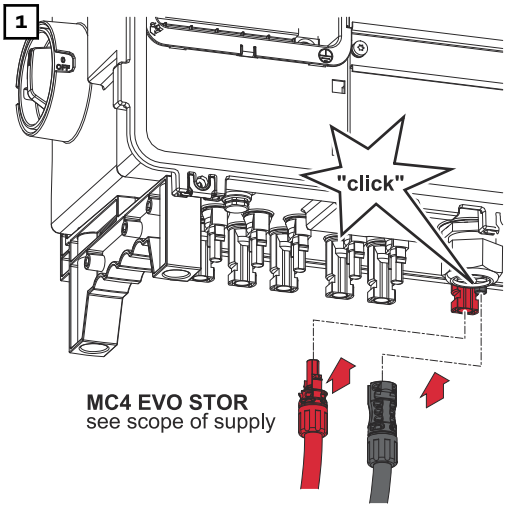
* The battery ground conductor must be connected externally (e.g., switch cabinet). Observe the minimum cross-section of the battery ground conductor.

⚠ CAUTION!

Risk of damage due to incompatible plug connectors.
Incompatible plug connectors can cause thermal damage and may cause a fire.
- ▶ Only use the original plug connectors (MC4) from Stäubli (formerly Multi-Contact).

⚠ CAUTION!

Danger due to polarity reversal at the terminals.
Serious damage to the PV system may result.
- ▶ Use a suitable measuring instrument to check the polarity of the DC cabling when the battery is switched on.
- ▶ The maximum voltage for the battery input must not be exceeded (see Technical data on page 142).



Connect PV cables from the solar modules to the MC4 plugs according to the label

Unused MC4 plugs on the inverter must be closed by the cover caps supplied with the inverter.

⚠ CAUTION!

Danger due to overvoltage when using other slots on the terminal.
This may result in damage to the battery and/or the PV modules due to discharge.
- ▶ Only use the slots labeled "BAT" for connecting the battery.

IMPORTANT!
Information for connection on the battery side can be found in the installation instructions from the relevant manufacturer.

Connecting backup power - Full Backup

Safety

⚠ WARNING!

Danger from incorrect installation, commissioning, operation, or incorrect use.
This can result in severe personal injury/damage to property.
- ▶ Only trained and qualified personnel are authorized to install and commission the system, and only within the scope of the technical regulations.
- ▶ The Installation and Operating Instructions must be read carefully prior to use.
- ▶ If anything is unclear, contact your vendor immediately.

IMPORTANT!
The valid national laws, standards, and provisions, as well as the specifications of the relevant grid operator are to be taken into account and applied.
It is highly recommended to coordinate the concrete examples implemented and in particular the specific installation with the grid operator to obtain their explicit approval. This obligation applies to system constructors in particular (e.g., installers).
The examples suggested here show a backup power supply with or without an external protection relay (external grid and system protection unit). The respective grid operator decides whether an external protection relay must be used or not.

IMPORTANT!
An uninterruptible power supply (UPS) may only be used to supply individual loads (e.g., computers). Feeding into the power supply of the house network is not permitted. The Installation and Operating Instructions must be read carefully prior to use. If anything is unclear, contact your vendor immediately.

The examples given in this document (in particular cabling variants and circuit diagrams) are suggestions only. These examples have been carefully developed and tested. They can therefore be used as a basis for real-life installation. Anyone following or using these examples does so at their own risk.

Testing backup power mode

Testing backup power mode is recommended:
- During the initial installation and configuration
- After working on the switch cabinet
- During ongoing operation (recommendation: at least once a year)

For test mode, a battery charge of min. 30% is recommended.

A description on how to run test mode can be found in the backup power checklist (https://www.fronius.com/en/search-page, item number: 42,0426,0365).

Connecting the data communication cables

Modbus participants

The inputs M0 and M1 can be freely selected. A maximum of four Modbus participants can be connected to the Modbus terminal at inputs M0 and M1.

IMPORTANT!
Only one primary meter, one battery, and one Ohmpilot can be connected per inverter. Due to the high data transfer of the battery, the battery occupies two subscribers. If the **Inverter Control via Modbus** function is activated in the **Communication** > **Modbus** menu area, no Modbus participants are possible. It is not possible to send and receive data at the same time.

Example 1:

Input	Battery	Fronius Ohmpilot	Number of primary meters	Number of secondary meters
Modbus 0 (M0)	✗	✗	0	4
	✓	✗	0	2
	✓	✓	0	1
Modbus 1 (M1)	✗	✗	1	3

Example 2:

Input	Battery	Fronius Ohmpilot	Number of primary meters	Number of secondary meters
Modbus 0 (M0)	✗	✗	1	3
Modbus 1 (M1)	✗	✗	0	4
	✓	✗	0	2
	✓	✓	0	1

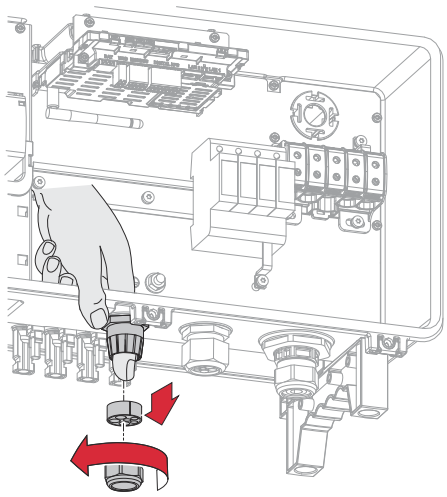
Routing data communication cables

IMPORTANT!
If data communication cables are wired into the inverter, observe the following points:

- Depending on the number and cross-section of the wired data communication cables, remove the corresponding blanking plugs from the sealing insert and insert the data communication cables.
- Make sure that you insert the corresponding blanking plugs into any free openings on the sealing insert.

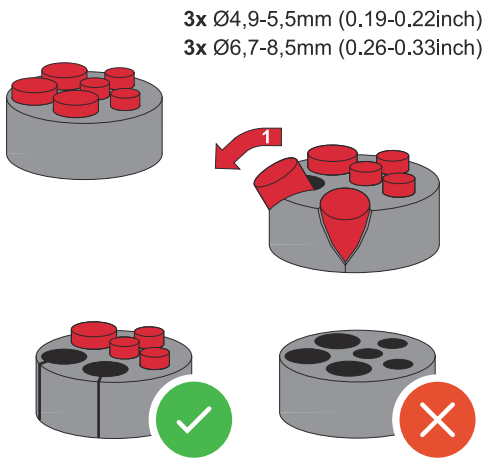
IMPORTANT!
Safety class IP 66 cannot be ensured if blanking plugs are missing or incorrectly inserted.

1



Remove the union nut on the cable gland and press the sealing ring with the blanking plugs out from the inside of the device.

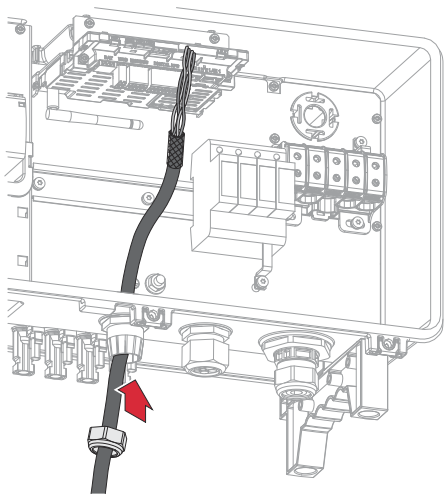
2



Open up the sealing ring at the location where the blanking plugs are to be removed.

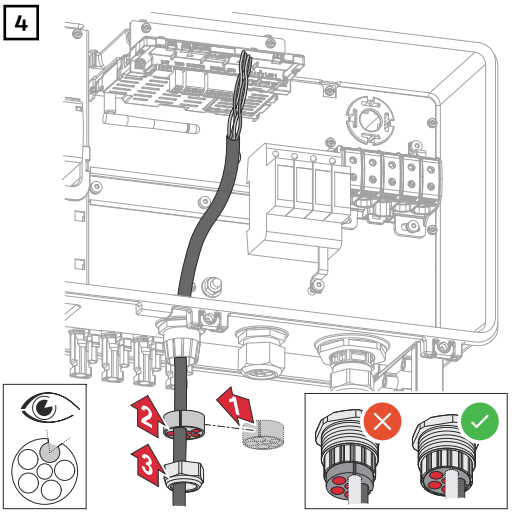
***** Remove the blanking plugs with a sideways motion.

3



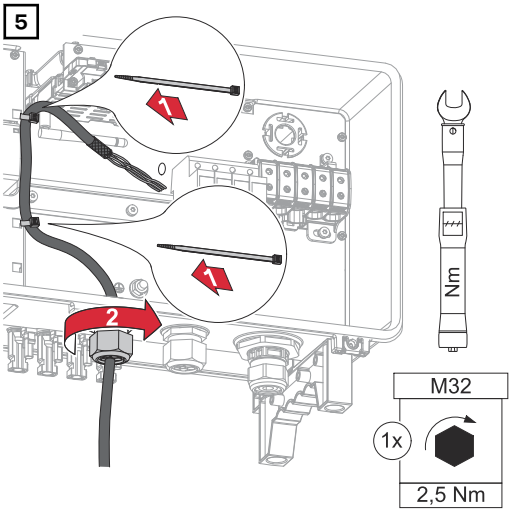
First, guide the data cables through the union nut of the cable gland and then through the housing opening.

4



Insert the sealing ring between the union nut and the housing opening. Press the data cables into the seal's cable guide. Then press in the seal until it reaches the underside of the cable gland.

5



Using a cable tie, attach the data cables to the protective cover of the DC surge protection device (SPD). Fasten the union nut of the cable gland with a torque of min. 2.5 - max. 4 Nm.

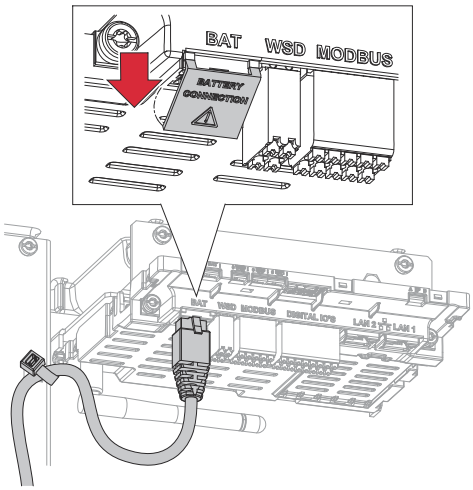
Connecting the battery communication cable

Battery Connection (Modbus RJ45)

NOTE!

Power supply
Voltage is present at the connection. If network devices (e.g., WiFi router) are connected, damage to the device will result.
▶ Only connect batteries to the **Battery Connection**

IMPORTANT!
For this connection variant, the BAT switch in the Data communication area must be in position 1.



1 Break out the protective cover

2 Connect the cable to the RJ45 socket

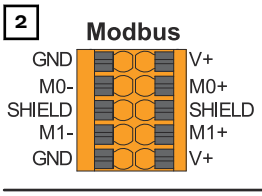
✓ *The LEDs of the RJ45 socket light up red when the battery is active.*

Modbus terminal

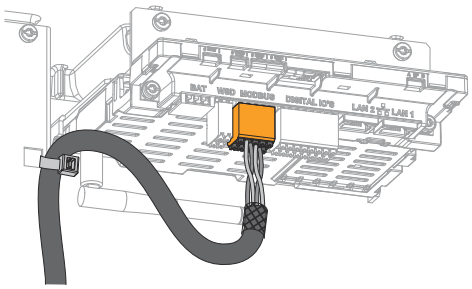
IMPORTANT!
To connect several single conductors to an input of the push-in terminals, connect the conductors to the corresponding ferrule.

1 Strip 10 mm of insulation from the single conductors and fit the ferrules if necessary.

2



Battery	Modbus
	M0+
	M0-
	GND
	V+
	Shield



Insert the cables into the respective slot and check the cables are securely retained.

IMPORTANT!
Use a twisted cable pair for data cables that belong together.

Twist the cable shield and insert into the "SHIELD" slot.

IMPORTANT!
Improperly fitted shielding can cause data communication problems.

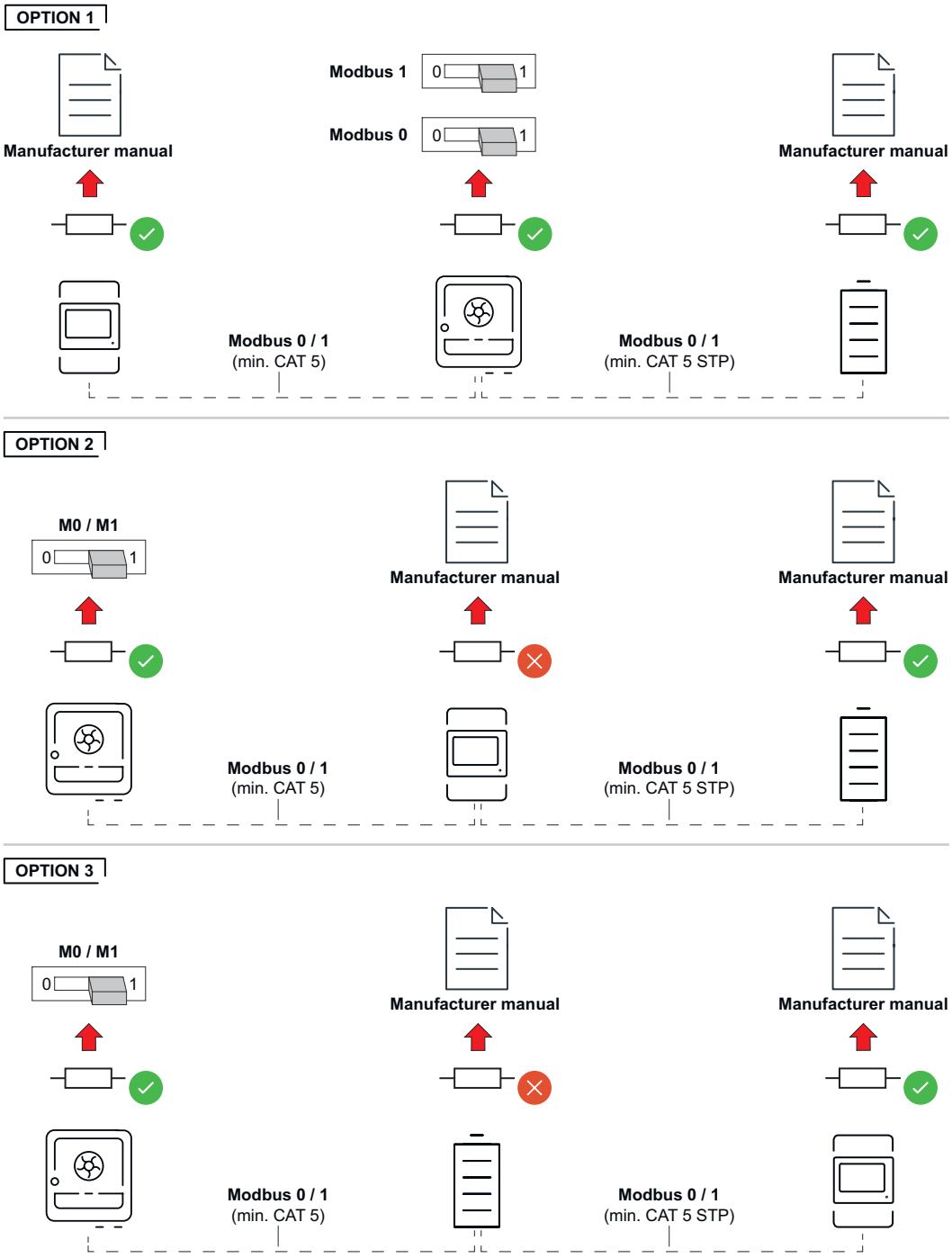
Wiring proposal recommended by Fronius, see page 165.

Terminating resistors

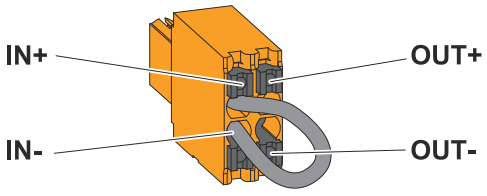
It may be possible for the system to function without terminating resistors. However, owing to interference, the use of terminating resistors according to the following overview is recommended for trouble-free operation.

For permissible cables and max. distances for the data communication area, refer to the chapter headed Permitted cables for the data communication connection on page 65.

IMPORTANT!
Terminating resistors that are not positioned as illustrated can result in interference in the data communication.



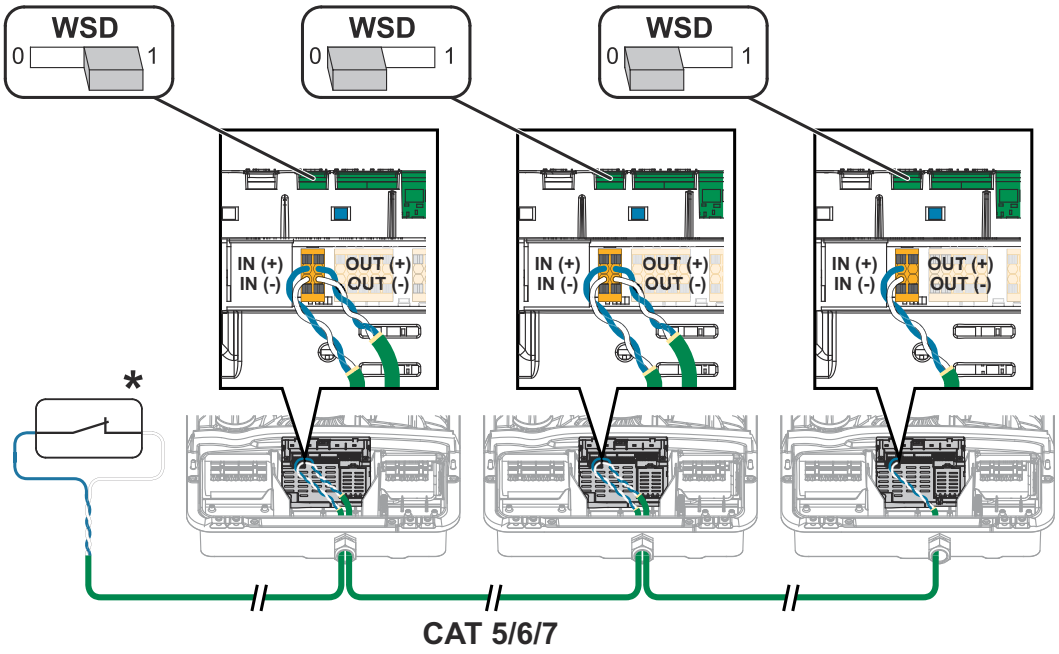
Installing the WSD (wired shutdown)



IMPORTANT!
The push-in WSD terminal in the inverter's connection area is delivered with a bypass ex works as standard. The bypass must be removed when installing a trigger device or a WSD chain.

The WSD switch of the first inverter with connected trigger device in the WSD chain must be in position 1 (master). The WSD switch of all other inverters should be in position 0 (slave).

Max. distance between two devices: 100 m
Max. Number of devices: 28

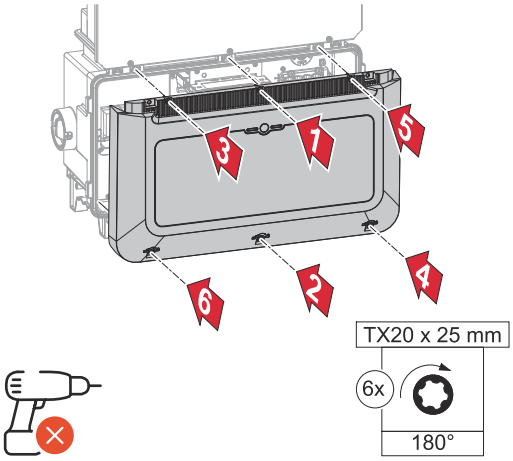


* Floating contact of the trigger device (e.g., central grid and system protection). If several floating contacts are used in a WSD chain, these must be connected in series.

Closing and commissioning the inverter

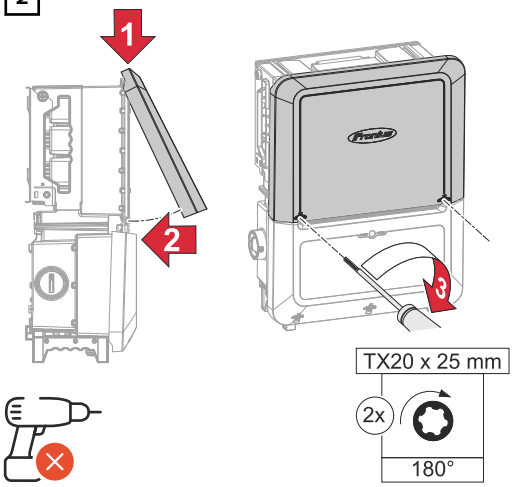
Closing the inverter's connection area/housing cover, and commissioning

1



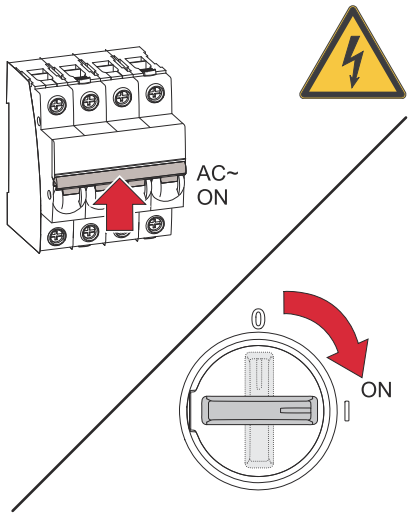
Place the cover on the connection area. Tighten six screws by rotating them 180° to the right using a screwdriver (TX20).

2



Clip the housing cover into the inverter from above.
Press on the lower part of the housing cover and tighten the two screws by rotating them 180° to the right using a screwdriver (TX20).

3



Turn the DC disconnectors to the "Off" switch setting. Turn on the automatic circuit breaker.

IMPORTANT! Open the WiFi access point with the optical sensor; refer to the chapter headed Button functions and LED status indicator on page 40

Starting the inverter for the first time

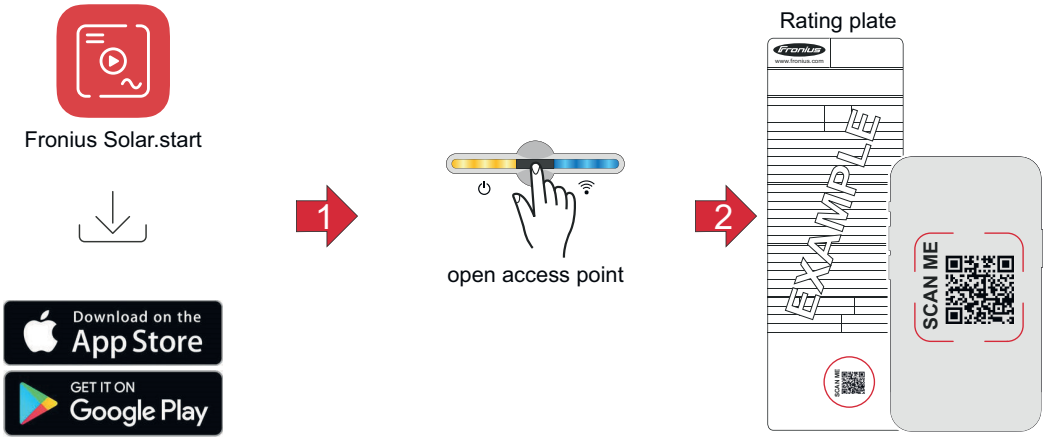
When starting the inverter for the first time, various setup settings must be configured.

If the setup is canceled before completion, the input data is not saved and the start screen with the installation wizard is shown once again. The data is saved in the event of an interruption, e.g., a power failure. Commissioning is continued at the point at which the interruption occurred after the power supply is restored. If the setup was interrupted, the inverter feeds energy into the grid at maximum 500 W and the operating status LED flashes yellow.

The country setup can only be set when starting the inverter for the first time. If the country setup needs to be changed at a later date, contact your installer/ technical support.

Installation with the app

The Fronius Solar.start app is required for installation. Depending on the mobile device used to perform the installation, the app is available on the relevant platform.



1 Download and install the Fronius Solar.start app.

2 Open the access point by touching the sensor .

✓ *Communications LED flashes blue.*

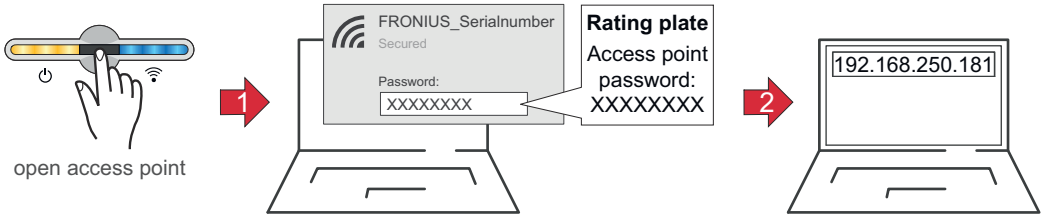
3 Open the Fronius Solar.start app and follow the installation wizard. Scan the QR code on the rating plate with a smartphone or tablet to connect to the inverter.

4 Add system components in Fronius Solar.web and commission the PV system.

The network wizard and product setup can be performed independently. A network connection is required for the Fronius Solar.web installation wizard.

Installation with the browser

WLAN:



1 Open the access point by touching the sensor

✓ *Communications LED flashes blue.*

2 Establish the connection to the inverter in the network settings (the inverter is displayed with the name "FRONIUS_" and the serial number of the device).

3 Enter the password from the rating plate and confirm.
IMPORTANT!
To enter the password in Windows 10, first select the **Connect using a security key instead** link to be able to establish the connection with the password.

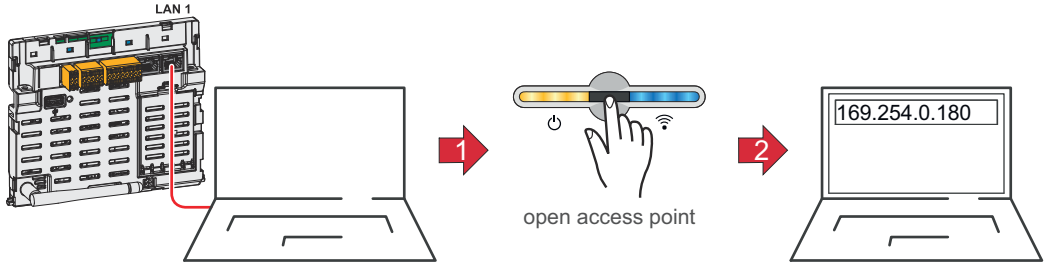
4 Enter the IP address 192.168.250.181 in the address bar of the browser and confirm. The installation wizard opens.

5 Follow the installation wizard and complete the installation in the individual areas.

6 Add the system components in Fronius Solar.web and commission the PV system.

The network wizard and product setup can be performed independently. A network connection is required for the Fronius Solar.web installation wizard.

Ethernet:



1 Establish a connection to the inverter (LAN1) using a network cable (min. CAT5 STP).

2 Open the access point by touching the sensor once

✓ *Communications LED flashes blue.*

3 Enter the IP address 169.254.0.180 in the address bar of the browser and confirm. The installation wizard opens.

4 Follow the installation wizard and complete the installation in the individual areas.

5 Add the system components in Fronius Solar.web and commission the PV system.

The network wizard and product setup can be performed independently. A network connection is required for the Fronius Solar.web installation wizard.

De-energizing the inverter and switching it back on

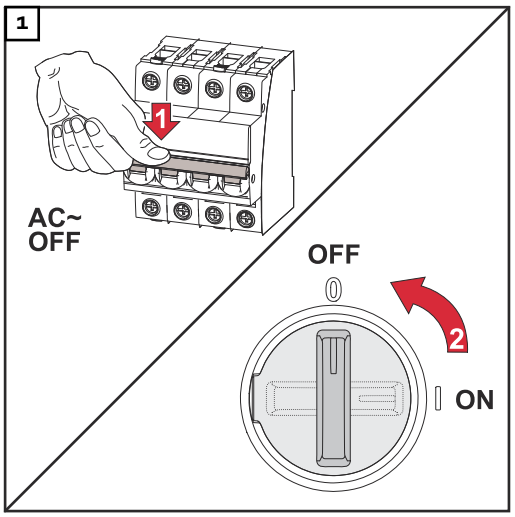
Risk of rupture

⚠ WARNING!

In the case of electrical devices with a high housing protection class, there is a risk of explosion in the event of a fault. Possible causes are defective components that release gases, improperly installed or commissioned devices, or the penetration of gas via lines (conduits).
Serious personal injury and damage to property may result.

- ▶ Turn off the automatic circuit breaker
- ▶ If possible, switch off the DC line in front of the inverter (additional external DC disconnector)
- ▶ Remove the connection area cover
- ▶ Allow the capacitors of the inverter to discharge (2 minutes)
- ▶ Turn the DC disconnector to the "OFF" switch setting

De-energizing the inverter and switching it back on



1. Turn off the automatic circuit breaker.
2. Turn the DC disconnector to the "off" switch setting.

To start up the inverter again, follow the steps listed above in reverse order.

IMPORTANT!
Wait for the capacitors of the inverter to discharge!

Settings – User interface of the inverter

User settings

User login

1. Open the user interface of the inverter in the browser.
2. In the **Login** menu area, log in with username and password, or, in the **User** > **User Login** menu area, log in with username and password.

IMPORTANT!
Depending on the authorization of the user, settings can be made in the individual menu areas.

Selecting languages

1. In the **User** > **Language** menu area, select the desired language.

Device configuration

Components

All available components of the system can be added via **Add component+**.

PV Generator
Activate the MPP tracker and enter the connected PV output in the relevant field. In the case of combined solar module strings, **PV 1 + PV 2 connected in parallel** must be activated.

Primary meter
For problem-free operation with further energy generators and in Full Backup power mode, it is important to install the Fronius Smart Meter at the feed-in point. The inverter and further producers must be connected to the public grid via the Fronius Smart Meter.
This setting also has an effect on the behavior of the inverter during the night. If the function is deactivated, the inverter switches to standby mode as soon as there is no more PV power available and no energy management specification is sent to the battery (e.g., minimum state of charge reached). The message "Power low" is displayed. The inverter starts again as soon as an energy management specification is sent or sufficient PV power is available.
If the function is activated, the inverter remains permanently connected to the grid in order to draw energy from other producers at any time.
After connecting the meter, select one of the following device types:
- **Modbus RTU**
- **Modbus TCP**
- **MQTT** (available **MQTT device** is displayed automatically)

NOTE!
For communication via MQTT, the inverter and Smart Meter must be in the same sub-network.

The following parameters must also be defined for the Smart Meter:
- **Application** (**Production meter** or **Consumption Meter**)
- **Name**
- **Category** (e.g., **inverter**)
- **IP Address** (for Modbus TCP)
- **Port** (for Modbus TCP)
- **Modbus Address** (for Modbus RTU and TCP)

The Watt value for the production meter is the sum of all production meters. The Watt value for the consumption meter is the sum of all secondary meters.

Battery
If the **SoC Limit Mode** is set to **Auto**, the values **SoC Minimum** and **SoC Maximum** are preset according to the technical specifications of the battery manufacturer.

If the **SoC Limit Mode** is set to **Manual**, the values **SoC Minimum** and **SoC Maximum** can be changed after consultation with the battery manufacturer within the framework of their technical specifications. In a backup power situation, the set values are not taken into account.

The setting **Allow battery charging from other generators in the home network** activates/deactivates charging of the battery from other generators.
The power consumption of the Fronius inverter can be restricted by specifying a value in the **Max. Charging Power from AC** field. As a maximum, a power consumption equal to the AC rated power of the Fronius inverter is possible.

The setting **Allow battery charging from public grid** + **Allow battery charging from other generators in the home network** activates/deactivates the charging of the battery from the public grid and, if present, from other generators in the home network.
The normative or compensatory specifications must be taken into account for this setting. Irrespective of this setting, necessary service-related charging from the public grid is performed (e.g., forced re-charging to protect against deep discharge).

IMPORTANT!
Fronius accepts no liability for damage to third-party batteries.

Ohmpilot
All the Ohmpilots available in the system are displayed. Select the desired Ohmpilot and add to the system via **Add**.

Functions and I/Os

Backup Power
In backup power mode, it is possible to select between **Off** and **Full Backup**.
The backup power mode **Full Backup** can only be activated once the required I/O assignments for backup power have been configured. In addition, a meter must be installed and configured at the feed-in point for the backup power mode **Full Backup**.

IMPORTANT!
When configuring the "Full Backup" backup power mode, the instructions in chapter Safety on page 78 must be observed.

Backup Nominal Voltage
When backup power mode is activated, the nominal voltage of the public grid must be selected.

SoC warning level
In backup power mode, a warning is emitted when this residual battery capacity is reached.

Reserve Capacity
The set value results in a residual capacity (depending on the capacity of the battery) that is reserved for backup power situations. The battery is not discharged below the residual capacity in grid connected mode. In backup power mode, the manually set value of **SoC Minimum** is not taken into account. If there is a backup power situation, the battery is always discharged up to the automatically preset, minimum SoC according to the technical specifications of the battery manufacturer.

System preservation during night
To ensure continuous backup power operation even during the night, the inverter calculates a reserve for system preservation depending on the battery capacity. When the calculated limit value is reached, standby mode is activated for the inverter and the battery and maintained for a period of 16 hours. Connected loads are no longer supplied. The battery is discharged up to the preset minimum SoC.

Load Management
Up to four pins for the load management can be selected here. Further settings for the load management are available in the **Load Management** menu item.
Default: Pin 1

Australia - Demand Response Modes (DRM)
The pins for control via DRM can be set here:

Mode	Description	Information	DRM Pin	I/O Pin
DRM0	Inverter disconnects from the grid	DRM0 occurs in the event of an interruption or short circuit on the REF GEN or COM LOAD lines, or in the event of invalid combinations of DRM1 - DRM8. The grid relays open.	REF GEN COM LOAD	IO4 IO5
DRM1	Import P_{nom} ≤ 0% without disconnection from grid	currently not supported	DRM 1/5	IN6
DRM2	Import P_{nom} ≤ 50%	currently not supported	DRM 2/6	IN7
DRM3	Import P_{nom} ≤ 75% & $+Q_{rel}^{*}$ ≥ 0%	currently not supported	DRM 3/7	IN8
DRM4	Import P_{nom} ≤ 100%	currently not supported	DRM 4/8	IN9
DRM5	Export P_{nom} ≤ 0% without disconnection from grid	currently not supported	DRM 1/5	IN6
DRM6	Export P_{nom} ≤ 50%	currently not supported	DRM 2/6	IN7
DRM7	Export P_{nom} ≤ 75% & $-Q_{rel}^{*}$ ≥ 0%	currently not supported	DRM 3/7	IN8
DRM8	Export P_{nom} ≤ 100%	currently not supported	DRM 4/8	IN9

The percentage specifications always relate to the rated device power.

IMPORTANT!
If the Demand Response Mode (DRM) function is activated and no DRM control is connected, the inverter switches into standby mode.

Demand Response Modes (DRM)

Here you can enter a value for the apparent power input and the apparent power output for the Australia country setup.

Inverter

Force standby
When this function is activated, the supply of energy from the inverter into the grid is interrupted. This makes it possible to shut down the inverter without power and protect its components. The standby function is automatically deactivated when the inverter is restarted.

AC grid

Parameter	Value range	Description
Neutral conductor status	Not connected	The neutral conductor is not required in the system configuration and therefore not connected.
	Connected	The neutral conductor is connected.

PV 1 to **PV 3**

Parameter	Value range	Description
Mode	Off	The MPP tracker is deactivated.
	Auto	The inverter uses the voltage at which the max. possible output of the MPP tracker is possible.
	Fixed	The MPP tracker uses the voltage defined in **UDC fixed**.
UDC fixed	150 -870 V	The inverter uses the fixed voltage that is used on the MPP tracker.
Dynamic Peak Manager	Off	Function is deactivated.
	On	The entire solar module string is checked for optimization potential and determines the best possible voltage for the supply of energy from the inverter into the grid.

Ripple control signal
Ripple control signals are signals that are sent by the energy company in order to switch controllable loads on and off. Depending on the installation situation, ripple control signals can be dampened or amplified by the inverter. This can be counteracted if necessary by applying the following settings.

Parameter	Value range	Description
Reduction of influence	Off	Function is deactivated.
	On	Function is activated.
Frequency of ripple control signal	100 - 3 000 Hz	The frequency specified by the energy company must be entered here.
Grid inductance	0.00001 - 0.005 H	The value measured at the feed-in point must be entered here.

Measures to prevent FI/RCMU false alarms
(when using a 30 mA residual current circuit breaker)

NOTE!

A residual current circuit breaker for the AC connecting cable may be required depending on national regulations, the grid operator, and other conditions.
A type A residual current circuit breaker is generally sufficient in this case. Nevertheless, false trips can be triggered for the type A residual current circuit breaker in individual cases and depending on local conditions. For this reason, Fronius recommends using a residual current circuit breaker suitable for frequency inverters with a release current of least 100 mA, taking into account national provisions.

Parameter	Value range	Description
Leakage current factor for reducing RCMU/RCD false trips	0 - 0.25 (default: 0.16)	By reducing the set value, the leakage current is reduced, and the intermediate circuit voltage is increased, which slightly lowers the efficiency. - A setting value of 0.16 ensures optimum efficiency. - Setting value 0 enables minimum leakage currents.
Switch-off before 30 mA RCD trip	Off	The function for reducing the faulty tripping of the residual current circuit breaker is deactivated.
	On	The function for reducing the faulty tripping of the residual current circuit breaker is activated.
Rated residual non-operating current limit value	0.015 - 0.3	Value of the non-trigger fault current determined by the manufacturer for the residual current circuit breaker, at which the residual current circuit breaker does not switch off under specified conditions.

Insulation warning

Parameter	Value range	Description
Insulation warning	Off	The insulation warning is deactivated.
	On	The insulation warning is activated. A warning is output in the event of an insulation fault.
Insulation alternative mode	Accurate	Insulation monitoring takes place with the highest degree of accuracy and the measured insulation resistance is displayed on the user interface of the inverter.
	Fast	Insulation monitoring takes place with a lesser degree of accuracy, whereby the time to take the insulation measurement is shortened and the insulation value is not displayed on the user interface of the inverter.
Insulation warning threshold	100 - 10 000 kΩ	If the value drops below the threshold, status code 1083 is displayed on the user interface of the inverter.

Backup power

Parameter	Value range	Description
Backup power nominal voltage	220 - 240 V	The nominal phase voltage that is output in backup power mode.

Parameter	Value range	Description
Backup power frequency offset	-5 - +5 Hz	The setting value can be used to reduce or increase the nominal backup power frequency (see Technical data) by the offset value. The default value is +3 Hz. Connected loads (e.g., Fronius Ohmpilot) detect active backup power mode based on the changed frequency and react accordingly (e.g., activation of energy-saving mode). **IMPORTANT!** If another AC source is available in the system, the backup power frequency must not be changed. The standard value (+3 Hz) prevents further AC sources from feeding in parallel to the inverter in backup power mode and triggering overvoltages as well as shutting down the dedicated backup power network.
Backup power undervoltage protection limit value U< [pu]	0 - 2 %V	This setting value represents the limit value for shutting down backup power mode e.g., setting value 0.9 = 90% of the nominal voltage.
Backup power undervoltage protection time U<	0.04 - 20 s	Trip time for falling below the backup power undervoltage protection limit value.
Backup power surge protection limit value U> [pu]	0 - 2 %V	This setting value represents the limit value for shutting down backup power mode e.g., setting value 1.1 = 110% of the nominal voltage.
Backup power surge protection time U>	0.04 - 20 s	Trip time for exceeding the backup power surge protection limit value.
Backup power restart delay	0 - 600 s	Waiting time for restarting backup power mode following a shutdown.
Backup power restart attempts	1 - 10	The max. number of automated restart attempts. Once the max. number of automated restart attempts has been reached, service message 1177 must be manually acknowledged.
Backup power external frequency monitoring (Italy only)	Off	Function is deactivated
	On	For Full Backup power mode in Italy, external frequency monitoring must be activated. The mains frequency is checked before ending backup power mode. If the mains frequency is within the permitted limits, the loads are connected to the public grid.

Parameter	Value range	Description
Backup power short circuit trip time	0.001 - 60 s	If a short circuit occurs during backup power mode, backup power mode is interrupted within the set time.

Energy management

Permitted maximum battery charge from the public grid

In Germany, new rules for charging batteries came into force on January 1, 2024. The maximum charging power from public grids is 4.2 kW when controlled in accordance with Section 14a of the EnWG (Energy Industry Act).
The inverter must establish a connection to Fronius Solar.web for documentation purposes and be permanently connected to the Internet in order to be able to prove the implementation of the external control commands.
The charging power is limited to a value below this by default. It is important not to use more than the allowed 4.2 kW charging power.

Battery management

State of charge settings
If the **SoC Limit Mode** is set to **Auto**, the values **SoC Minimum** and **SoC Maximum** are preset according to the technical specifications of the battery manufacturer.

If the **SoC Limit Mode** is set to **Manual**, the values **SoC Minimum** and **SoC Maximum** can be changed after consultation with the battery manufacturer within the framework of their technical specifications. In a backup power situation, the set values are not taken into account.

If **Battery charging from other sources** is activated, the following options are available:
- The setting **From other generators in the home network and from public grid** activates/deactivates the charging of the battery from the public grid and, if present, from other generators in the home network.
  The normative or compensatory specifications must be taken into account for this setting. Irrespective of this setting, necessary service-related charging from the public grid is performed (e.g., forced re-charging to protect against deep discharge).
- The setting **From other generators in the home network** activates/deactivates charging of the battery from other generators.
  The power consumption of the Fronius inverter can be restricted by specifying a value in the **Max. Charging Power from AC** field. As a maximum, a power consumption equal to the AC rated power of the Fronius inverter is possible.

SoC warning level
In backup power mode, a warning is emitted when this residual battery capacity is reached.

Reserve Capacity
The set value results in a residual capacity (depending on the capacity of the battery) that is reserved for backup power situations. The battery is not discharged below the residual capacity in grid connected mode.

IMPORTANT!
Fronius accepts no liability for damage to third-party batteries.

Time-dependent battery control
Using the Time-dependent battery control, it is possible to specify, restrict, or prevent the charging/discharging of the battery at/to a defined power.

Battery Management is influenced, for example, by the following settings:
- Permitted battery charging from the public grid
- Power limit of the inverter, energy storage device, or overall system
- Control specifications via Modbus
- Self-consumption optimization

IMPORTANT!
The defined regulations for battery control have the second lowest priority after Self-Consumption Optimization. Depending on the configuration, the regulations may not be fulfilled due to other settings.

The following values can be selected for the Time-dependent battery control regulations:
- **Max. charging power**
  The max. charging power of the battery is the value set in the **Power** input field.
  If no feed into the public grid and/or direct consumption in the home is possible, the set value **Max. charging power** is ignored and the battery is charged with the generated energy.
- **Min. charging power**
  The min. charging power of the battery is the value set in the **Power** input field.
- **Max. discharge power**
  The max. discharge power of the battery is the value set in the **Power** input field.
- **Min. discharge power**
  The min. discharge power of the battery is the value set in the **Power** input field.

The timing of when the regulation applies is set in the **Time** input fields and by selecting the **days of the week**.

It is not possible to define a time window beyond midnight (00:00).
Example: Two entries are needed to set a regulation of 22:00 to 06:00: "22:00 - 23:59" and "00:00 - 06:00".

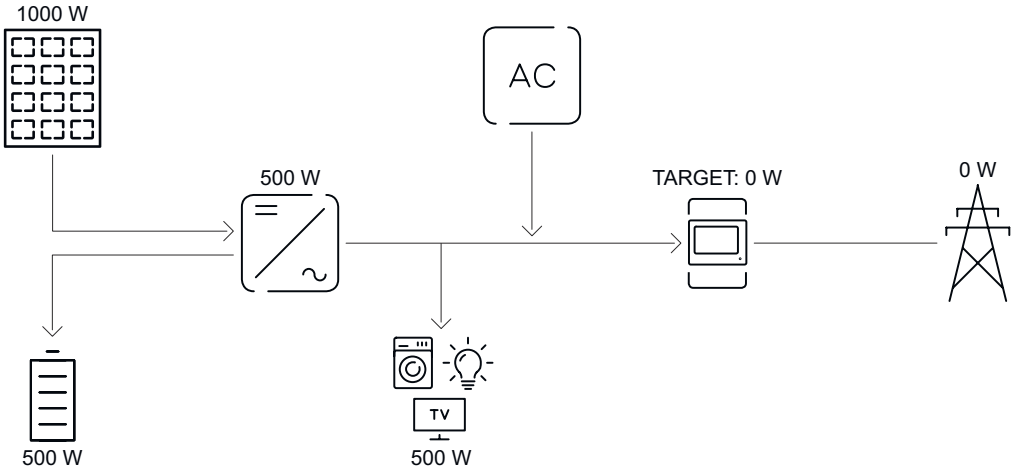
Service Mode
If **Service Mode** is activated, the battery system is charged or discharged to the state of charge of 30% and the state of charge of 30% is maintained until the end of the service mode.

IMPORTANT!
The **Service Mode** is only available for Fronius battery systems.

Examples - Time-dependent battery control

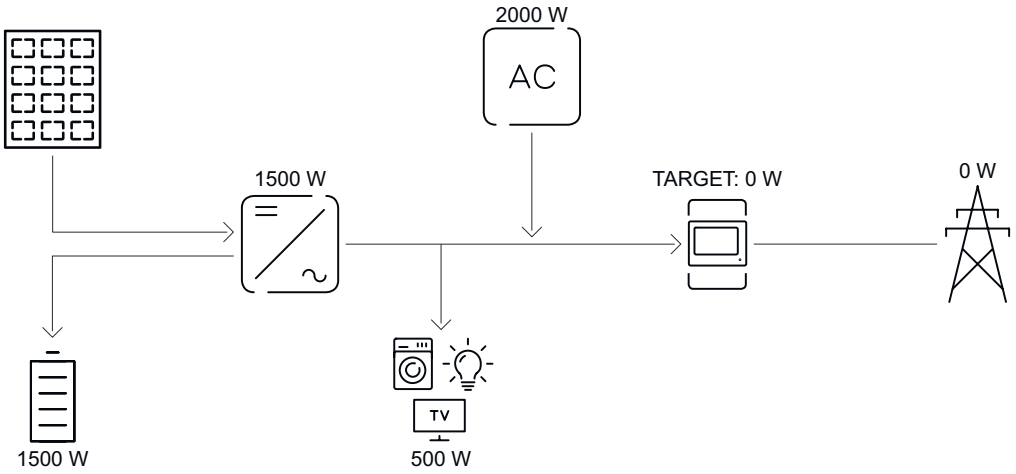
The following examples serve to explain the energy flows. Efficiency levels are not taken into account.

Battery system



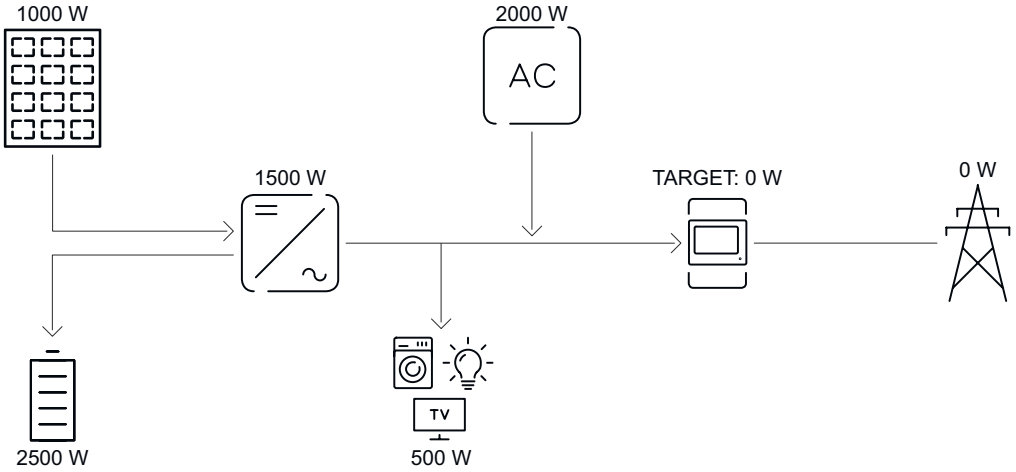
PV system to inverter	1000 W
Power into the battery	500 W
Power output (AC) of the inverter	500 W
Set target value at feed-in point	0 W
Infeed into the public grid	0 W
Consumption in home	500 W

Battery system without photovoltaics, including second generator in the house



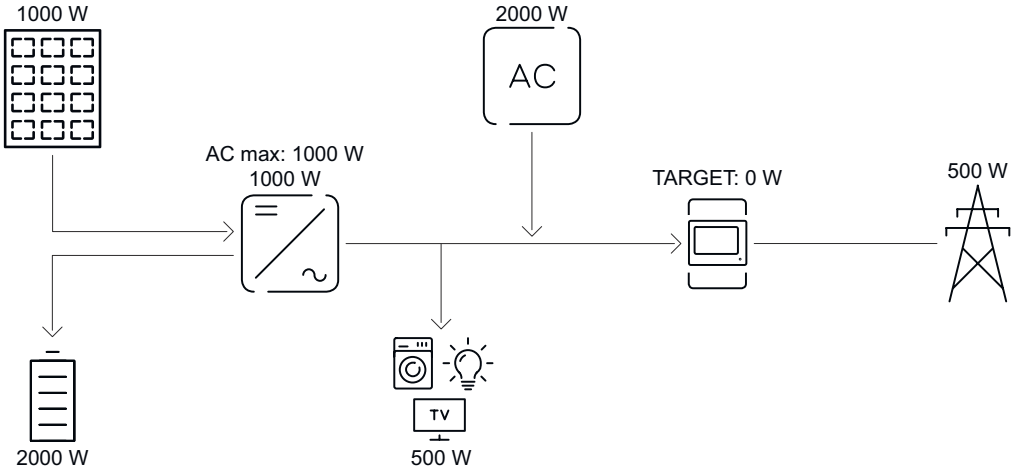
Power into the battery	1500 W
Power consumption (AC) of the inverter	1500 W
Second generator in home network	2000 W
Set target value at feed-in point	0 W
Infeed into the public grid	0 W
Consumption in home	500 W

Battery system including second generator in the house



PV system to inverter	1000 W
Power into the battery	2500 W
Power consumption (AC) of the inverter	1500 W
Second generator in home network	2000 W
Set target value at feed-in point	0 W
Infeed into the public grid	0 W
Consumption in home	500 W

Battery system including second generator in the house
(with AC max. limitation)



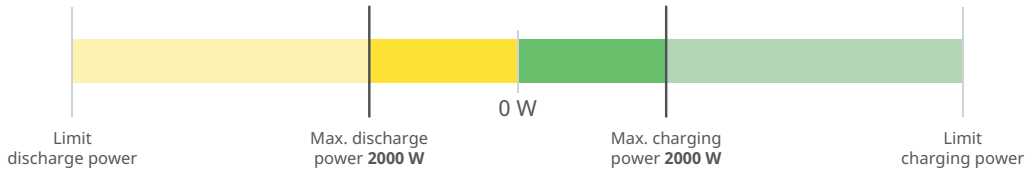
PV system to inverter	1000 W
Power into the battery	2000 W
Power consumption AC max. limited to	1000 W
Power consumption (AC) of the inverter	1000 W
Second generator in home network	2000 W
Set target value at feed-in point	0 W
Infeed into the public grid	500 W
Consumption in home	500 W

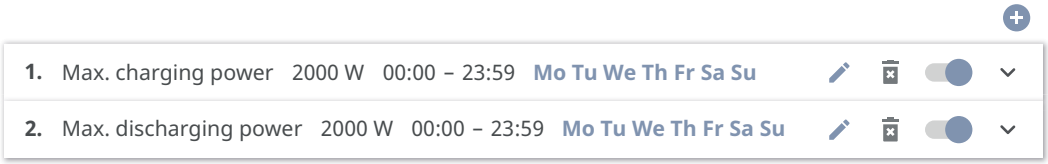
Permitted battery control regulations

A regulation always consists of a restriction or specification, and the **time** and **days of the week** when the regulation is active. The time of regulations with the same restriction (e.g., max. charging power) must not overlap.

Max. charging and discharging limits

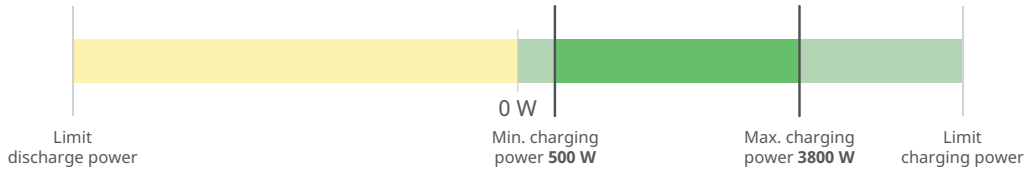
One max. charging and one max. discharging power can be configured at the same time.

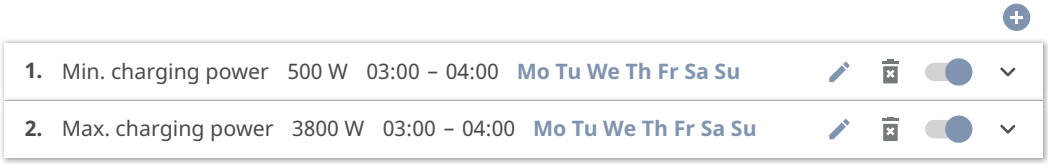




Specify charging range

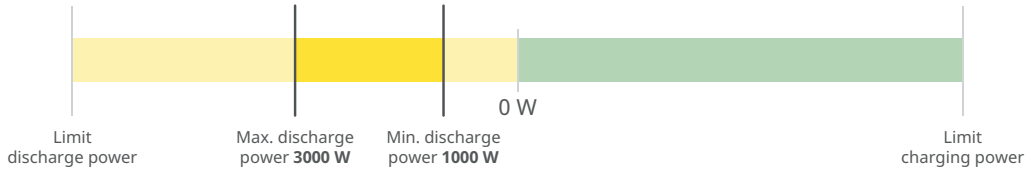
It is possible to define a charging range using a min. and max. charging limit. In this case, it is not possible to discharge the battery.

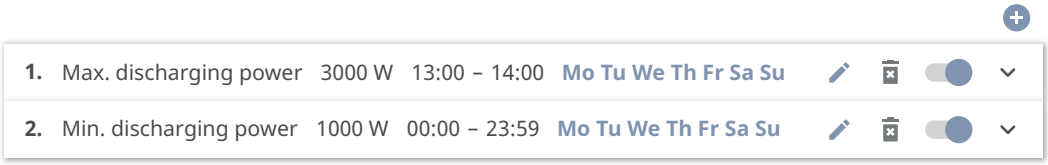




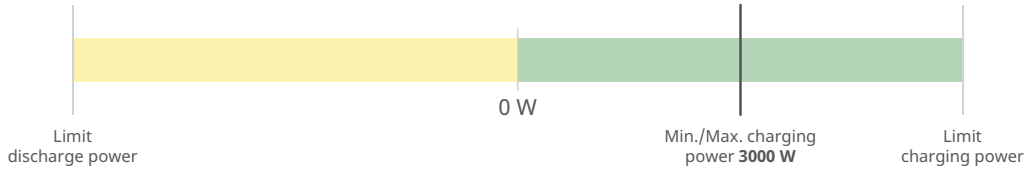
Specify discharging range

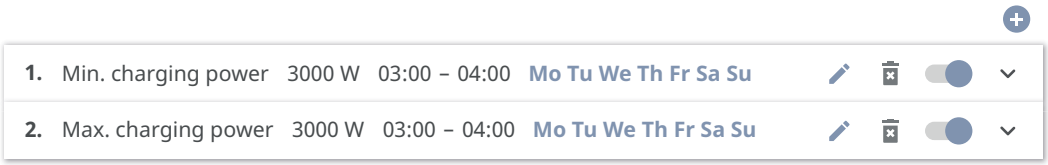
It is possible to define a discharging range using a min. and max. discharging limit. In this case, it is not possible to charge the battery.



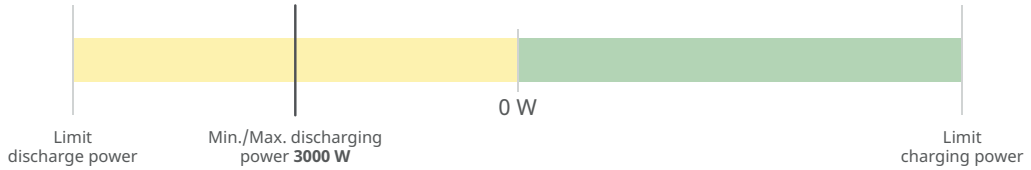


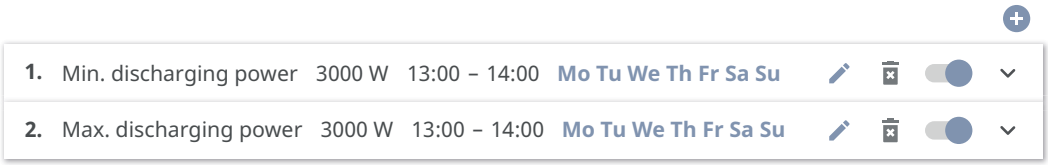
Specify a defined charge
It is possible to specify a defined charging power by setting the min. and max. charging power to the same value.





Specify a defined discharge
It is possible to specify a defined discharging power by setting the min. and max. discharging power to the same value.





Possible applications
- Time-dependent energy tariffs
- Battery reservation in the event of market-specific power limitation
- Time-dependent storage reservation for a backup power situation

PV power reduction

The regulations in the **Battery Management** menu area enable optimal use of the energy generated. Situations may arise, however, in which PV power cannot be used in full due to the time-dependent battery control.

Example	
Fronius inverter (max. output power)	6000 W
Defined discharge of the battery	6000 W
PV power	1000 W

In this case, the inverter would have to reduce the PV power to 0 W, since the output power of the inverter is max. 6000 W and the device is already being fully utilized through discharging.

Since it does not make sense to waste PV power, the power limit is automatically adjusted in battery management such that no PV power is wasted. In the example above, this means that the battery is discharged only at 5000 W, so that the 1000 W PV power can be used.

Load management

Priorities
If additional components (e.g., battery, Fronius Ohmpilot) are present in the system, the priorities can be set here. Devices having higher priority are actuated first, and subsequently, if there is still excess energy available, the other devices.

IMPORTANT!
If there is a Fronius Wattpilot in the photovoltaic system, it is considered to be a load. The priority for the load management of the Fronius Wattpilot must be configured in the Fronius Solar.wattpilot app.

Rules
It is possible for up to four different load management rules to be defined. At the same threshold values, the rules are activated in succession. For deactivation, this is done in reverse; the I/O last switched on is the first to be switched off. In the case of different thresholds, the I/O with the lowest threshold is switched on first, followed by the second lowest, and so on.

I/Os controlled by the produced power are always prioritized over a battery and Fronius Ohmpilot. That is to say that an I/O can switch on and result in the battery no longer being charged or the Fronius Ohmpilot no longer being activated.

IMPORTANT!
An I/O is activated/deactivated after 60 seconds.

Load
- Control is **Off** (deactivated).
- Control is effected by the **Power Production**.
- Control is effected by **Power Surplus** (with feed-in limits). This option can only be selected if a meter has been connected. Control is effected using the actual power of feeding in with respect to the grid.

Thresholds
- **On**: For entering an effective power limit, at which the output is activated.
- **Off**: For entering an effective power limit, at which the output is deactivated.

Duration
- Field for activating the **Minimum duration per on-signal** for which the output is to be activated for each switch-on process.
- Field for activating the **Maximum duration per day**.
- Field for activating the **Desired duration** for which the output is to be activated in total per day (several switch-on processes are allowed for).

Self-consumption optimization

Self-Consumption Optimization
Set the operating mode to **Manual** or **Automatic**. The inverter always adjusts to the set **Target value at feed-in point**. In **Automatic** operating mode (factory setting), an adjustment is made to 0 W at the feed-in point (max. self-consumption).

The **Target value at feed-in point** also applies if a further source feeds into this Smart Meter. In this case, however:
- The Fronius Smart Meter must be installed and configured at the feed-in point.
- The **Allow battery charging from other generators in the home network** function must be activated in the **Components** > **Battery** menu area.

Target value at feed-in point
If **Manual** has been selected under Self-Consumption Optimization, the **Opera-**

tion Mode (**Consumption**/**Feed-in**) and the **Target value at feed-in point** can be set.

IMPORTANT!
Self-Consumption Optimization has lower priority than **Battery Management**.

System

General

1 Enter the name of the system in the input field **PV System Name** (max. 30 characters).

2 Select the **Timezone** and **Time zone location** in the drop-down lists. The date and time are taken over from the time zone entered.

2 Click **Save**.

✓ *System name, time zone, and time zone location are saved.*

Update

All available updates for inverters and other Fronius devices are provided on the product pages and in the "Fronius Download Search" area at www.fronius.com .

Update

1 Drag the firmware file into the **Drag & drop file here** field, or select via **Browse file**.

✓ *Update is started.*

Setup wizard

The guided setup wizard can be accessed here.

Restoring factory settings

All settings
Resets all configuration data, apart from the country setup. Changes to the country setup may only be made by authorized personnel.

All settings without network
Resets all configuration data, apart from the country setup and the network settings. Changes to the country setup may only be made by authorized personnel.

Event log

Current messages All current events of the linked system components are displayed here.

IMPORTANT!
Depending on the type of event, this must be confirmed via the "tick" button so that it can be further processed.

History
All events of the linked system components that are no longer present are displayed here.

Information

All the information regarding the system and the current settings is displayed and provided for download in this menu area.

License Manager

The license file contains the performance data and the scope of functions of the inverter. When replacing the inverter or data communication area, the license file must also be replaced.

Licensing - online (recommended):
An Internet connection and completed configuration on Solar.web is required.

1. Complete the installation work (see chapter Closing the inverter's connection area/housing cover, and commissioning on page 85).
2. Connect to the user interface of the inverter.
3. Enter the serial number and verification code (VCode) of the defective and replacement unit. The serial number and the VCode can be found on the rating plate of the inverter (see chapter Information on the device on page 17).
4. Click on the **"Start online licensing"** button.
5. Skip the terms and conditions of use and Network settings menu items by clicking on **"Next"**.

The license activation starts.

Licensing - offline:
There must be no Internet connection for this. When licensing offline with an established Internet connection, the license file is automatically uploaded to the inverter. Therefore, when uploading the license file, the following error occurs: "The license has already been installed and the wizard can be closed".

1. Complete the installation work (see chapter Closing the inverter's connection area/housing cover, and commissioning on page 85).
2. Connect to the user interface of the inverter.
3. Enter the serial number and verification code (VCode) of the defective and replacement unit. The serial number and the VCode can be found on the rating plate of the inverter (see chapter Information on the device on page 17).
4. Click on the **"Start offline licensing"** button.
5. Download the service file onto the end device by clicking on the **"Download service file"** button.
6. Open the website licensemanager.solarweb.com and log in with your user name and password.
7. Drag or upload the service file into the **"Drop service file here or click to upload"** field.
8. Download the newly generated license file onto the end device using the **"Download license file"** button.
9. Go to the user interface of the inverter and drag the license file into the "Drag & drop license file here" field, or select it via "Choose license file".

The license activation starts.

Support

Activating the support user

1. Click the **Enable Support User Account** button.

✓ *The support user is activated.*

IMPORTANT!
The support user exclusively enables Fronius Technical Support to configure settings on the inverter via a secure connection. Access is deactivated by clicking the **Terminate Support User Session** button.

Generating support info (for Fronius Support)

1 Click the **Generate support info** button.

2 The sdp.cry file is downloaded automatically. For manual download, click the **Download support info** button.

✓ *The sdp.cry file is saved in the downloads.*

Activating remote access

1 Click the **Activate Remote Access** button.

✓ *Remote access is activated for Fronius Support.*

IMPORTANT!
The remote access exclusively enables Fronius Technical Support to access the inverter via a secure connection. In this case, diagnostics data are transmitted, which are used for troubleshooting. The remote access can be activated only upon request by Fronius Support.

Communication

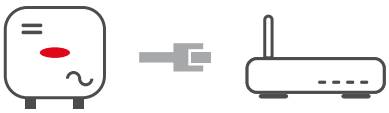
Network

Server addresses for data transfer
If a firewall is used for outgoing connections, the below protocols, server addresses, and ports must be allowed for successful data transfer, see:

https://www.fronius.com/~/downloads/Solar%20Energy/firmware/SE_FW_Changelog_Firewall_Rules_EN.pdf

When using FRITZ!Box products, Internet access must be configured without any restrictions or limitations. The DHCP Lease Time (validity) must not be set to 0 (=infinite).

LAN:



Establishing a connection:

1. Enter the host name.
2. Select the connection type: **Automatic** or **Static**.
3. For the **Static** connection type, enter the IP address, subnet mask, DNS, and gateway.
4. Click the **Connect** button.

✓ *The connection is established.*

After connecting, the status of the connection should be checked (refer to the chapter headed Internet services on page 114).

WLAN:

Establishing a connection via WPS:

☐ The access point of the inverter must be active. This is opened by touching the sensor > Communications LED flashes blue

1. Establish the connection to the inverter in the network settings (the inverter is displayed with the name "FRONIUS_" and the serial number of the device).
2. Enter the password from the rating plate and confirm.
   IMPORTANT!
   To enter the password in Windows 10, first select the **Connect using a security key instead** link to be able to establish the connection with the password.
3. Enter the IP address 192.168.250.181 in the address bar of the browser and confirm.
4. In the **Communication** > **Network** > **WLAN** > **WPS** menu area, click the **Activate** button.
5. Activate WPS on the WLAN router (see WLAN router documentation).
6. Click on the **Start** button. The connection is established automatically.
7. Log in to the user interface of the inverter.
8. Check the network details and connection to Fronius Solar.web.

After connecting, the status of the connection should be checked (refer to the chapter headed Internet services on page 114).

Selecting and connecting to a WLAN network:
The networks found are displayed in the list. Clicking on the Refresh button will ⟳ perform a new search for available WLAN networks. The selection list can be limited further via the **Search network** input field.

1. Select network from the list.
2. Select the connection type: **Automatic** or **Static**.
3. For the **Automatic** connection type, enter the WLAN password and host name.
4. For the **Static** connection type, enter the IP address, subnet mask, DNS, and gateway.
5. Click the **Connect** button.

✓ *The connection is established.*

After connecting, the status of the connection should be checked (refer to the chapter headed Internet services on page 114).

Access point:

The inverter serves as the access point. A PC or smart device connects directly to the inverter. Connecting to the Internet is not possible. In this menu area, **Network Name (SSID)** and **Network Key (PSK)** can be assigned.
It is possible to operate a connection via WLAN and via the access point at the same time.

Modbus

The inverter communicates with system components (e.g., Fronius Smart Meter) and other inverters via Modbus. The primary device (Modbus Client) sends control commands to the secondary device (Modbus Server). The control commands are executed by the secondary device.

Modbus 0 (M0) RTU / Modbus 1 (M1) RTU

If one of the two Modbus RTU interfaces is set to **Modbus Server**, the following input fields are available:

Baud Rate The baud rate influences the speed of the transmission between the individual components connected in the system. When selecting the baud rate, it should be ensured that this is the same on the transmit and receive side.
Parity The parity bit can be used for parity checks. This is used to identify transmission errors. In this case, a parity bit can ensure a specified number of bits. The value (0 or 1) of the parity bit must be calculated at the transmitter, and is checked at the receiver using the same calculation. The calculation of the parity bit can be carried out for even or odd parity.

SunSpec Model Type
There are two different settings, depending on the SunSpec model.

float: SunSpec Inverter Model 111, 112, 113 or 211, 212, 213.
int + SF: SunSpec Inverter Model 101, 102, 103 or 201, 202, 203.

Meter Address

The value entered is the identification number (unit ID) assigned to the meter, which can be found on the user interface of the inverter in the **Communication** > **Modbus** menu area.
Factory setting: 200

Inverter Address
The value entered is the identification number
(unit ID) assigned to the inverter, which can be found on the user interface of the inverter in the **Communication** > **Modbus** menu area.
Factory setting: 1

Modbus Server via TCP

This setting is necessary to enable inverter control via Modbus. If the **Modbus Server via TCP** function is activated, the following input fields are available:

Modbus port
Number of the TCP port to be used for Modbus communication.

SunSpec Model Type
There are two different settings, depending on the SunSpec model.

float: SunSpec Inverter Model 111, 112, 113 or 211, 212, 213.
int + SF: SunSpec Inverter Model 101, 102, 103 or 201, 202, 203.

Meter Address
The value entered is the identification number (unit ID) assigned to the meter, which can be found on the user interface of the inverter in the **Communication** > **Modbus** menu area.
Factory setting: 200

Allow Control

If this option is activated, the inverter is controlled via Modbus.
Inverter control includes the following functions:
- On/off
- Power reduction
- Setting a constant power factor (cos phi)
- Setting a constant reactive power
- Battery control settings with battery

Restrict Control
Here you can enter an IP address that is the only one allowed to control the inverter.

Cloud control

The utility/energy supplier can influence the output power of the inverter with **Cloud control**. This requires the inverter to have an active Internet connection.

Parameter	Display	Description
Cloud control	Off	Cloud control of the inverter is deactivated.
	On	Cloud control of the inverter is activated.

Profile	Value range	Description
Allow cloud control for regulatory purposes (Technician)	Deactivated/ Activated	The function may be mandatory for proper operation of the system.*
Allow cloud control for Virtual Power Plants (Customer)	Deactivated/ Activated	If the **Allow remote control for regulatory purposes (technician)** function is activated (technician access required), the **Allow remote control for virtual power plants** function is automatically activated and cannot be deactivated.*

*** Cloud control**
A virtual power plant is an interconnection of multiple generators. This virtual power plant can be controlled by means of the cloud control via the Internet. An active inverter Internet connection is a prerequisite for this. System data are transferred.

Solar API

The **Solar API** is an IP-based, open JSON interface. If enabled, IOT devices in the local network may access inverter information without authentication. For security reasons, the interface is disabled by default and must be enabled if it is required for a third-party application (e.g., EV charger, smart home solutions, etc.) or the Fronius Wattpilot.

For monitoring, Fronius recommends using Fronius Solar.web, which provides secure access to inverter status and production information.

In the event of a firmware update to version 1.14.x, the Solar API setting is applied. In systems with a version below 1.14.x, the Solar API is activated; with higher versions, it is deactivated but can be switched on and off via the menu.

Activating the Fronius Solar API
On the user interface of the inverter in the **Communication** > **Solar API** menu area, activate thefunction **Activate communication via Solar API**.

Fronius Solar.web

In this menu, you can agree to the technically necessary data processing or reject it.

In addition, the transfer of analysis data and remote configuration via Fronius Solar.web can be enabled or disabled.

Internet services Information regarding connections and the current connection status is displayed in this menu. If there are problems with the connection, a short description of the error is displayed.

Safety and grid requirements

Country setup

⚠ WARNING!

Danger from unauthorized fault analyses and repair work.
This can result in severe personal injury and damage to property.
- ▶ Fault analyses and repair work on the PV system may only be carried out by installers/service technicians from authorized specialist companies in accordance with national standards and regulations.

NOTE!

Risk due to unauthorized access.
Incorrectly set parameters can have a negative effect on the public grid and/or the grid power feed operation of the inverter and result in the loss of standard conformity.
- ▶ Parameters may only be adjusted by installers/service technicians from authorized specialist companies.
- ▶ Do not give the access code to third parties and/or unauthorized persons.

NOTE!

Risk due to incorrectly set parameters.
Incorrectly set parameters can have a negative effect on the public grid and/or cause inverter malfunctions and failures and result in the loss of standard conformity.
- ▶ Parameters may only be adjusted by installers/service technicians from authorized specialist companies.
- ▶ Parameters may only be adjusted if this has been approved or requested by the utility.
- ▶ Any parameter adjustments must be made in compliance with nationally applicable standards and/or directives as well as the specifications of the utility.

The **Country Setup** menu area is intended exclusively for installers/service technicians from authorized specialist companies. To apply for the access code required for this menu area, see chapter Requesting inverter codes in Solar.SOS.

The selected country setup for the country in question contains preset parameters in accordance with nationally applicable standards and requirements.
Changes may need to be made to the selected country setup depending on local grid conditions and the specifications of the utility.

Requesting inverter codes in Solar.SOS

The **Country Setup** menu area is intended exclusively for installers/service technicians from authorized specialist companies. The inverter access code required for this menu area can be requested in the Fronius Solar.SOS portal.

Requesting inverter codes in Fronius Solar.SOS:

1. Open solar-sos.fronius.com in the browser
2. Log in with your Fronius account
3. At the top right, click on the drop-down menu

4 Select the **Show inverter codes** menu item

✓ *A contract page appears on which the request for the access code to change the grid parameters for Fronius inverters is located*

5 Accept the terms and conditions of use by checking **Yes, I have read and agree to the terms of use** and click **Confirm & Save**

6 After that, the codes can be retrieved in the drop-down menu at the top right under **Show inverter codes**

⚠ CAUTION!

Risk due to unauthorized access.
Incorrectly set parameters can have a negative effect on the public grid and/or the grid power feed operation of the inverter and result in the loss of standard conformity.

- ▶ Parameters may only be adjusted by installers/service technicians from authorized specialist companies.
- ▶ Do not give the access code to third parties and/or unauthorized persons.

Feed-in limit

Energy companies or grid operators can prescribe feed-in limits for an inverter (e.g., max. 70% of the kWp or max. 5 kW). The effective power at the grid connection point (installation location of the Fronius Smart Meter or primary meter) is limited to the set value.

The feed-in limit takes account of self-consumption in the household before the power of an inverter is reduced. An individual limit can be set.

In order to minimize the yield losses due to the power of feeding in limitation, the power available from the module array can be:

- Used for (controllable) loads such as Fronius Ohmpilot, Fronius Wattpilot, I/O-controlled loads
- Stored in a battery

If these possibilities have been exhausted, the power drawn from the module array is reduced to such an extent that the feed-in limit is not exceeded.

Installation variants with an inverter, Fronius Smart Meter, and system components are listed under Different operating modes.

Total DC power of the system
Input field for the total DC power of the entire system in Wp.
This value is used if the **Maximum grid feed-in power** is specified in %.

Power Control deactivated
The inverter converts all available PV energy.

Power Control activated
Feeding in limited with the following selection options:

- **Total Power Limit**
  The entire photovoltaic system is limited to a fixed feed-in limit. A value must be set for the permissible total power of feeding in.
- **Limit per phase – asymmetric generation**
  The optimum per phase is determined. The inverter regulates the individual phases in such a way that none of the phases exceeds the set value.
- **Limit per phase – weakest phase**
  Each individual phase is measured. If the permissible feed-in limit is exceeded on one phase, the inverter symmetrically reduces the total power for all phases until the limit is reached.

IMPORTANT!
The settings for **Limit per phase** need to be made if national standards and regulations require a limitation of the single-phase power. A value must be set for the permissible power of feeding in for each phase.

IMPORTANT!
Power Control settings are automatically applied for the dynamic feed-in limit of I/O power management. **Total Power Limit** is the default configuration.

IMPORTANT!
Power Control settings are automatically applied for the dynamic feed-in limit of I/O power management. **Total Power Limit** is the default configuration.

Export Limit Control (Soft Limit)
If this value is exceeded, the inverter readjusts down to the set value.

Export Limit Protection (Hard Limit Trip)
If this value is exceeded, the inverter switches off within max. 5 seconds. This value must be higher than the value set for **Export Limit Control (Soft Limit)**.

Maximum grid feed-in power
Input field for the **Maximum grid feed-in power** in W or % (setting range: -10 to 100%).
If there is no meter in the system or if a meter has failed, the inverter limits its output power to the set value.

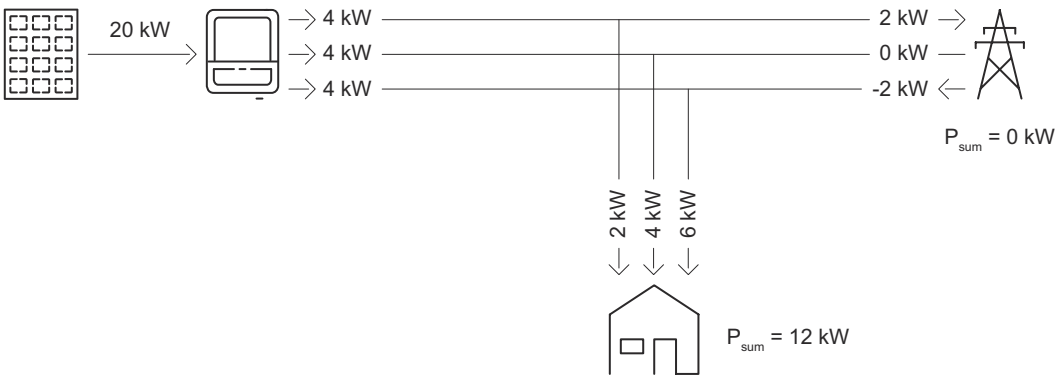
Activate the function **Reduce inverter power to 0% if meter connection has been lost** for control in the event of a fail-safe.

The use of WiFi for communication between the Fronius Smart Meter and the inverter is not recommended for the fail-safe function. Even short-term disconnections can cause the inverter to shut down. This problem is particularly common with weak WiFi signal strengths, a slow or overloaded WiFi connection, and automatic channel selection of the router.

Limit multiple inverters (only Soft Limit)
Control of the dynamic feed-in limit for several inverters, for details on configuration, see chapter Dynamic feed-in limit with multiple inverterson page 119.

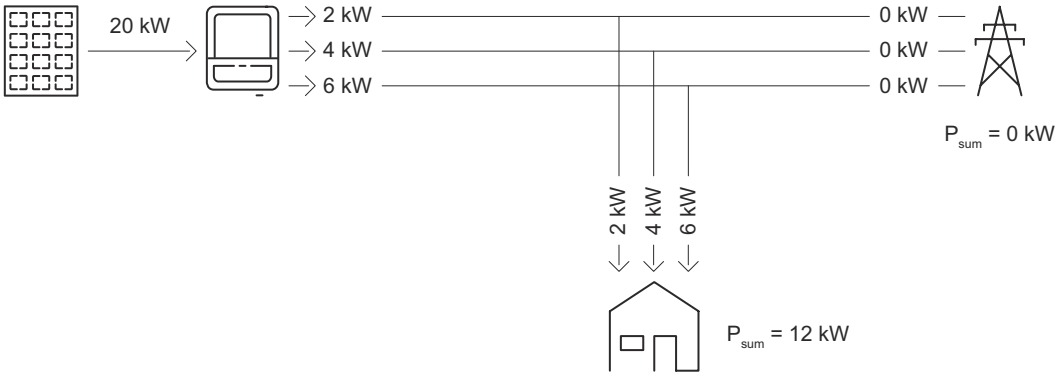
Feed-in limit – examples

"Total Power Limit"
(feed-in limit 0 kW)



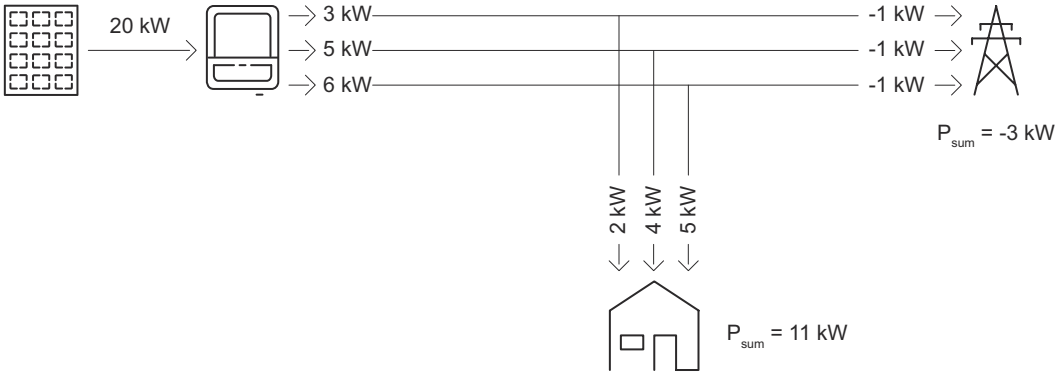
Explanation
No power (0 kW) may be fed into the public grid at the grid feed-in point. The load requirement in the home network (12 kW) is supplied by the power generated by the inverter.

"Limit per phase – asymmetric generation"
(feed-in limit 0 kW per phase) – asymmetric



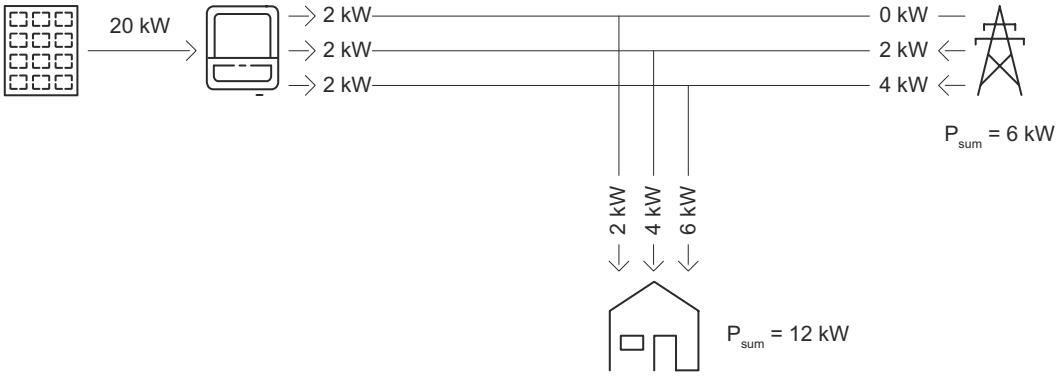
Explanation
The load requirement in the home network per phase is determined and supplied.

"Limit per phase – asymmetric generation"
(feed-in limit 1 kW per phase) – asymmetric



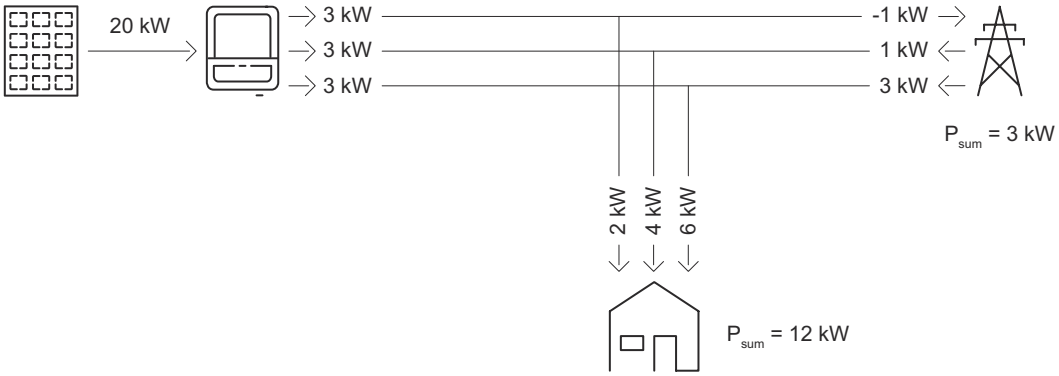
Explanation
The load requirement in the home network per phase is determined and supplied. In addition, the excess production (1 kW per phase) is fed into the public grid in accordance with the maximum permitted feed-in limit.

"Limit per phase – weakest phase"
(feed-in limit 0 kW per phase) – symmetrical



Explanation
The weakest phase in the load requirement in the home network is determined (phase 1 = 2 kW). The result of the weakest phase (2 kW) is applied to all phases. Phase 1 (2 kW) can be supplied. Phase 2 (4 kW) and phase 3 (6 kW) cannot be supplied, power from the public grid is required (phase 2 = 2 kW, phase 3 = 4 kW).

"Limit per phase – weakest phase"
(feed-in limit 1 kW per phase) – symmetrical



Explanation
The weakest phase in the load requirement in the home network is determined (phase 1 = 2 kW) and the max. permitted feed-in limit (1 kW) is added. The result of the weakest phase (2 kW) is applied to all phases. Phase 1 (2 kW) can be supplied. Phase 2 (4 kW) and phase 3 (6 kW) cannot be supplied, power from the public grid is required (phase 2 = 1 kW, phase 3 = 3 kW).

Dynamic feed-in limit with multiple inverters

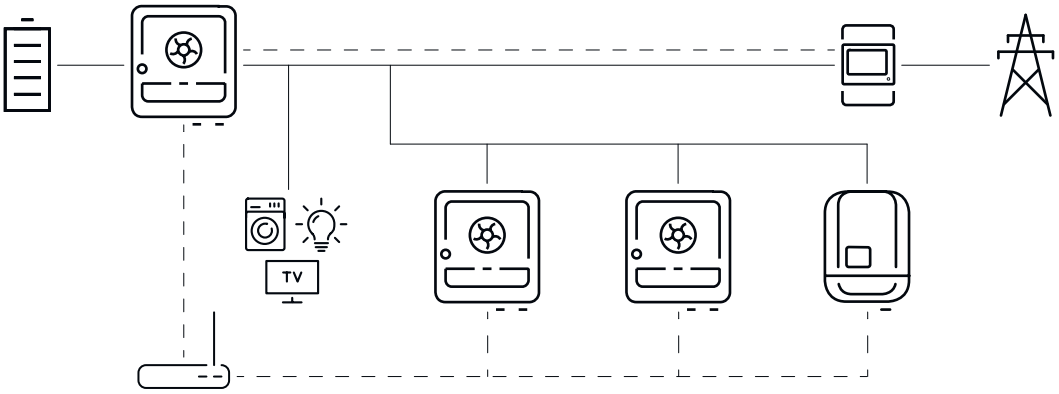
IMPORTANT!
To view and change settings in this menu item, select the user **Technician**, and enter and confirm the password for the user **Technician**. Settings in this menu area may only be made by trained and qualified personnel.

The inverter can be used as a primary device to control dynamic feed-in limits for additional Fronius inverters (secondary devices) so that feed-in limits prescribed by energy companies or utilities can be centrally managed. This control refers to the **Soft Limit** feed-in limit (see Feed-in limit). The following requirements must be met:

- Power Control and the **Limit multiple inverters (only Soft Limit)** function are activated and configured on the user interface of the primary device.
- Primary device and secondary device(s) are physically connected to the same network router via LAN.
- **Inverter Control via Modbus** is activated and configured for all secondary devices.
- The Fronius Smart Meter is configured as a primary meter and connected to the primary device.

IMPORTANT!
Only one primary meter is required for the primary device.

IMPORTANT!
If an inverter with a battery is connected, it must be used as the primary device for dynamic feed-in limits.



Example connection diagram for dynamic feed-in limit with multiple inverters

The dynamic feed-in limit is available for the following device combinations:

Primary device	Secondary devices
Fronius GEN24	Fronius GEN24, Fronius Verto, Fronius Tauro, Fronius SnapINverter with Fronius Datamanager 2.0*
Fronius Verto	Fronius GEN24, Fronius Verto, Fronius Tauro, Fronius SnapINverter with Fronius Datamanager 2.0*
Fronius Tauro	Fronius GEN24, Fronius Verto, Fronius Tauro, Fronius SnapINverter with Fronius Datamanager 2.0*

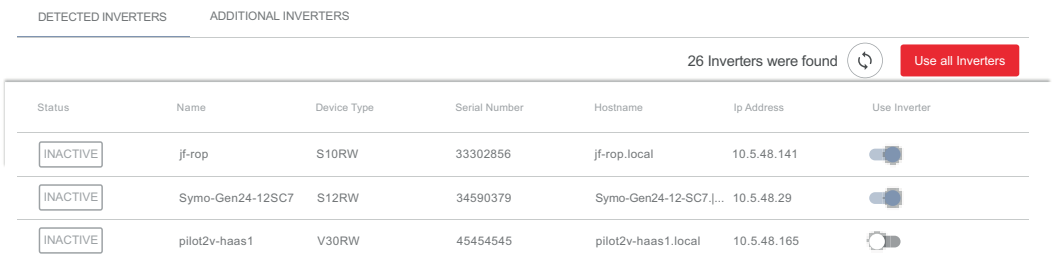
** Up to four additional Fronius SnapINverters can be connected to each Fronius SnapINverter with Fronius Datamanager 2.0.*

Primary meter
The Fronius Smart Meter acts as the only primary meter and is connected directly to the primary device. The Smart Meter measures the total output power of all inverters into the grid and passes this information to the primary device via Modbus.

Primary device
The export limitation is configured on the user interface of the inverter:

1. In the **Safety and Grid Regulations** > **Export Limitation** menu area, activate the **Power Control** function and select **Total Power Limit**.
2. Configure the country-specific settings.
3. In the **Safety and Grid Regulations** > **Export Limitation** menu area, activate the **Limit multiple inverters (only Soft Limit)** function.

The primary device automatically scans the network for available secondary devices. A list of the inverters found is displayed. Click the refresh button ↻ to perform the search again.



4 Activate **Use Inverter** against all secondary devices to which an export limitation applies. Click **Use all inverters** to enable the function for all secondary devices.

The status of the inverters listed is displayed as follows:
- **Inactive**: Secondary device is not configured for the power control.
- **Disconnected**: Secondary device is configured, network connection not possible.
- **Connected**: Secondary device is configured and accessible via the network of the primary device.

5 In the **Safety and Grid Regulations** > **I/O Power Management** menu area, set the controlling priorities as follows:
1. I/O Power Limit
2. Modbus Control
3. Export Limitation

Adding inverters manually

1 Select the **Additional inverters** menu area.

2 Enter the name, hostname or IP address, and the Modbus address of the secondary device.

3 Click **Add inverter +**.

Secondary device
A secondary device takes over the export limitation of the primary device. No data are sent to the primary device for the export limitation. The following configurations must be set for the power control:

User interface secondary device GEN24 / Verto / Tauro

1 Select the user **Technician** and enter the password for the user **Technician**.

2 In the **Modbus** menu area, activate the **Modbus Server via TCP** function.

3 For a fail-safe scenario, in the **Safety and Grid Regulations** > **I/O Power Management** menu area, set the controlling priorities as follows:
1. I/O Power Limit
2. Modbus Control
3. Export Limitation

4 In the **Safety and Grid Regulations** > **Export Limitation** menu area, select and edit the following settings:
- Activate the **Power Control** function
- Select **Total Power Limit** and specify the total DC power of the entire system in W
- Enable **Export Limit Control (Soft Limit)** and enter a value of 0 W for the **Maximum grid feed-in power**.
- Enable the **Reduce inverter power to 0% if meter connection has been lost** function

User interface secondary device Fronius Datamanager 2.0

1 Select the user **Admin** and enter the password for the user **Admin**.

2 In the **Settings – Modbus** menu area, activate the **Exporting data via Modbus** and **Inverter control via Modbus** functions.

3 In the **DNO Editor** > **Control priorities** menu area, set the control priorities for a fail-safe scenario as follows:
1. I/O control
2. Control via Modbus
3. Dynamic power reduction

4 Select the **DNO Editor** > **Dynamic power reduction** menu area

5 Under the menu item **Export Limitation**, activate the **Limit for entire system** function and apply the following settings:
- Specify the total DC power of the entire system in W
- Enable **Export Limit Control (Soft Limit)** and enter a value of 0 W for the **Maximum grid feed-in power**.
- Enable the **Reduce inverter power to 0% if meter connection has been lost** function

✓ *The dynamic feed-in limit with multiple inverters has been configured.*

IMPORTANT!
The secondary device automatically stops energy being fed into the grid in the event of a communication failure if the Modbus control does not send a signal to the inverter.

I/O Power Management

General
Settings relevant to the grid operator are defined as rules under this menu item. This relates to an effective power limit in % or watts and/or a power factor specification.

IMPORTANT!
To view and change settings in this menu item, select the user **Technician**, and enter and confirm the password for the user **Technician**. Only technical specialists may make settings in this menu area.

Under **Rules**, expand a menu area (e.g., **Rule 1**). Configure the following settings:

Limitation

Select the following rules for power management:
- **Export Limit Control (W)**: The effective power fed in at the grid connection point is limited to the set value (e.g., 5,000 watts).
- **I/O Generation Limit single device (%)**: The output power of the inverter is limited to the defined value of the absolute effective power.
- **Shutdown single device**: The inverter stops grid power feed operation and switches to standby mode.

IMPORTANT!
The rules for limiting the output power and shutdown apply to this device and cannot be applied to other inverters in the system. A dynamic feed-in limit for several inverters can be configured under Feed-in limit.

Input pattern (assignment of individual I/Os)
1 click = white, contact open
2 clicks = blue, contact closed
3 clicks = gray, not used

Power Factor (cos φ) (define value)

Impedance response
- **Capacitive**
- **Inductive**

DNO Feedback
If the rule is activated, always configure the **DNO Feedback** output (pin 1 recommended), e.g., for operating a signal device.

The **Import** and **Export** of defined rules can be carried out in the data format *.fpc.

If there is an active rule for the control of the inverter, the device indicates this in the **overview** of the user interface under **Device State**.

Controlling Priorities
Used to set controlling priorities for I/O Power Management (DRM or ripple control receiver), the feed-in limit, and control via Modbus.

1 = highest priority, 3 = lowest priority

Local priorities of the I/O Power Management, the feed-in limit, and the Modbus interface are deactivated by cloud control commands (regulatory purposes and virtual power plants) – see Cloud control on page 113 and by backup power.

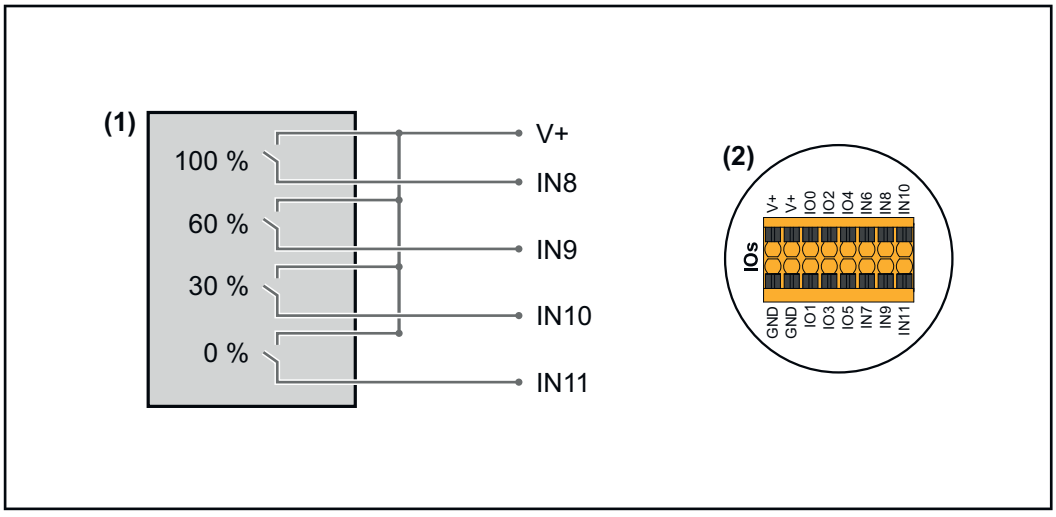
In terms of control priorities, the device differentiates between **power control** and **inverter shutdown**. Inverter shutdown always takes precedence over power control. An inverter shutdown command is always executed and does not need to be prioritized.

Power control
- I/O Power Management (DRM/ripple control receiver signal)—according to command
- Export Limitation (Soft Limit)—always active
- Modbus (generation limit)—according to command

Inverter shutdown
- I/O Power Management with feed-in limit = 0% (DRM/ripple control receiver signal)—according to command
- Export Limitation (Hard Limit)
- Modbus (shutdown command) – according to command

Connection diagram - 4 relays

The ripple control signal receivers and the I/O terminals of the inverter can be connected to one another as shown in the connection diagram.
For distances of over 10 m between the inverter and the ripple control signal receiver, a CAT 5 STP cable is recommended as a minimum and the shielding must be connected on one side at the push-in terminal of the data communication area (SHIELD).



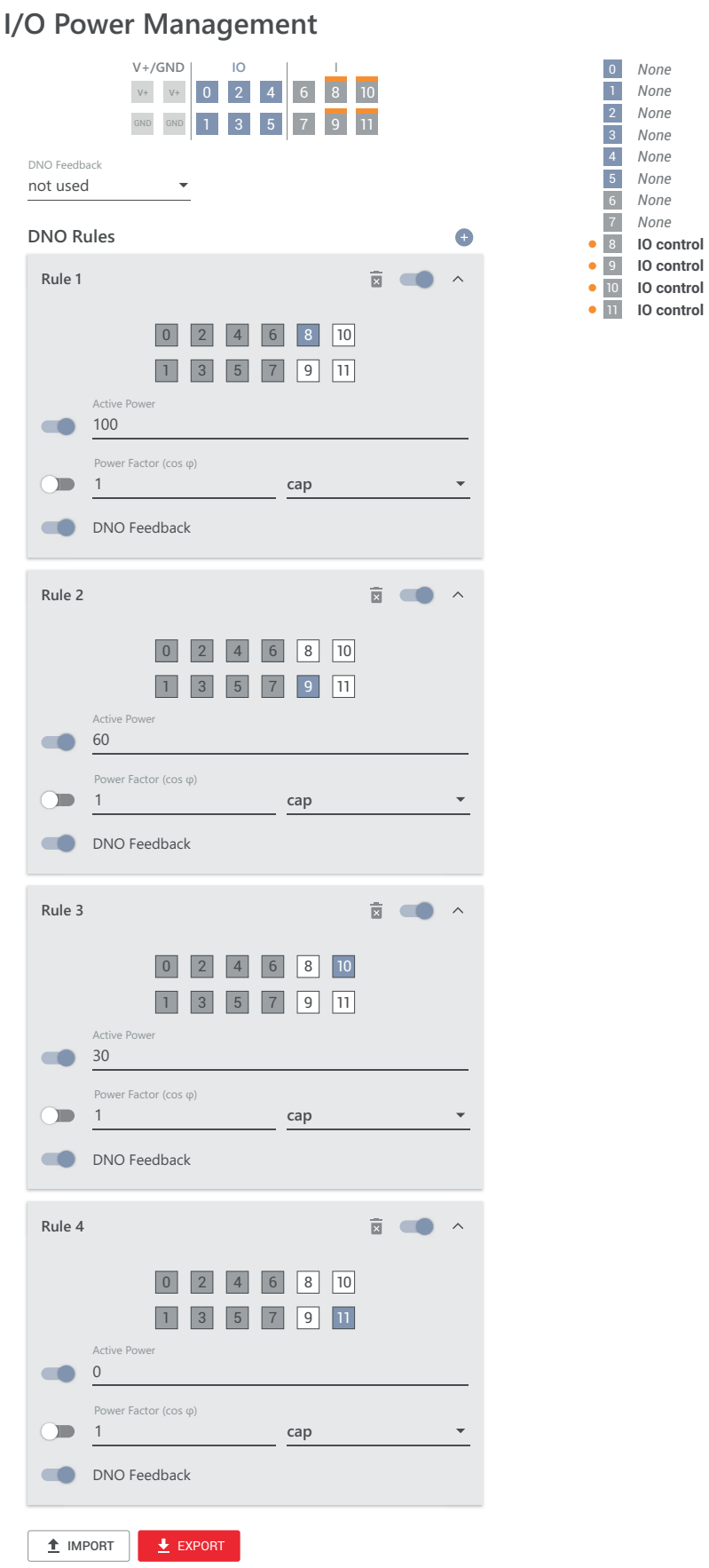
(1) Ripple control signal receiver with four relays for effective power limitation.
(2) I/Os of the data communication area.

Use pre-configured file for 4-relay operation:

1. Download the file (.fpc) under 4-relay operation to the mobile device.
2. Upload the file (.fpc) in the **I/O Power Management** menu area by clicking the **Import** button.
3. Click **Save**.

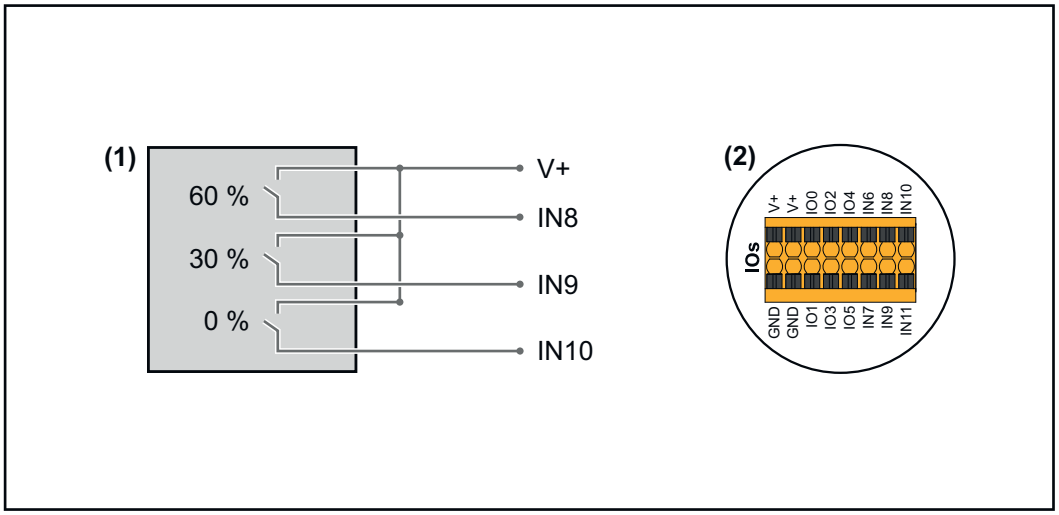
✓ *The settings for 4-relay operation are saved.*

I/O power management settings - 4 relays



Connection diagram - 3 relays

The ripple control signal receivers and the I/O terminals of the inverter can be connected to one another as shown in the connection diagram.
For distances of over 10 m between the inverter and the ripple control signal receiver, a CAT 5 STP cable is recommended as a minimum and the shielding must be connected on one side at the push-in terminal of the data communication area (SHIELD).



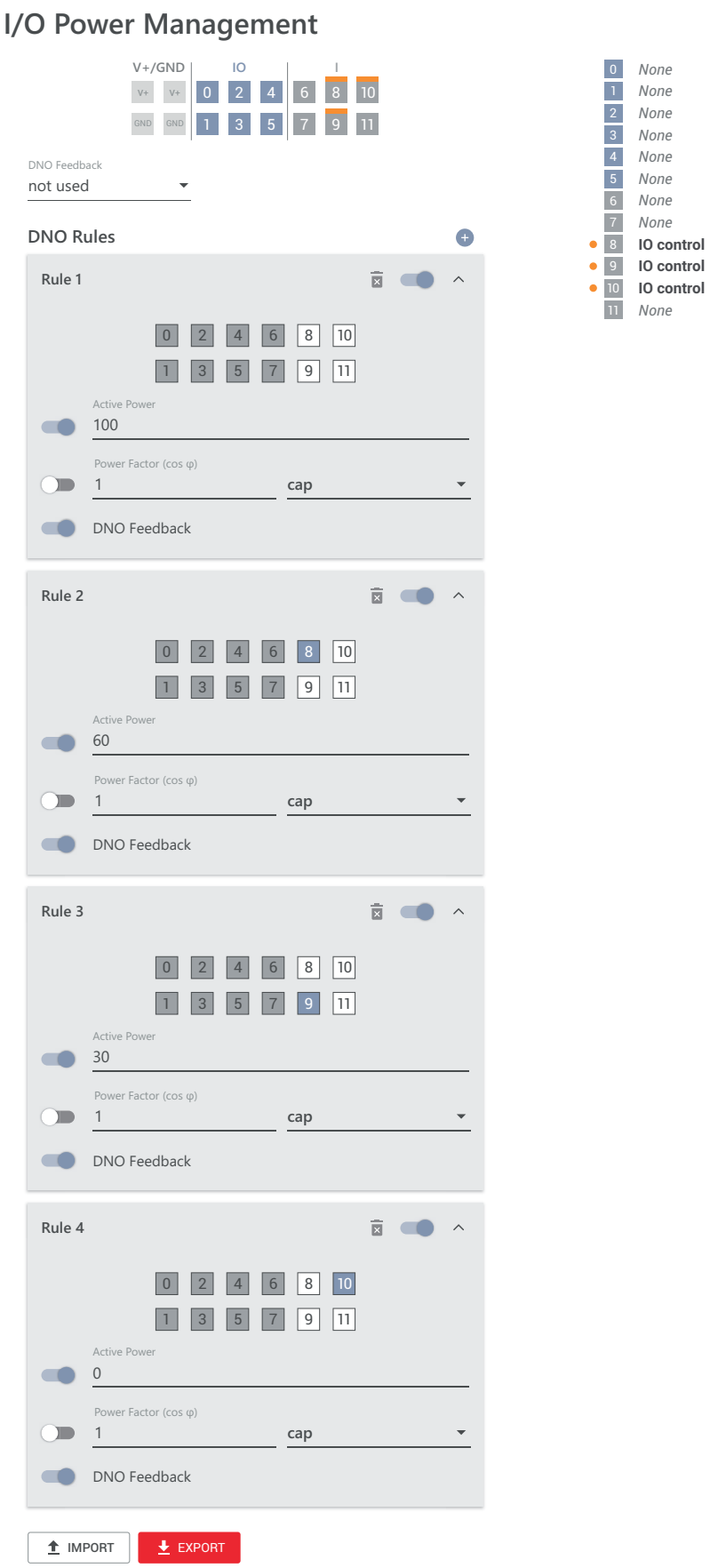
(1) Ripple control signal receiver with three relays for effective power limitation.
(2) I/Os of the data communication area.

Use pre-configured file for 3-relay operation:

1. Download the file (.fpc) under 3-relay operation to the mobile device.
2. Upload the file (.fpc) in the **I/O Power Management** menu area by clicking the **Import** button.
3. Click **Save**.

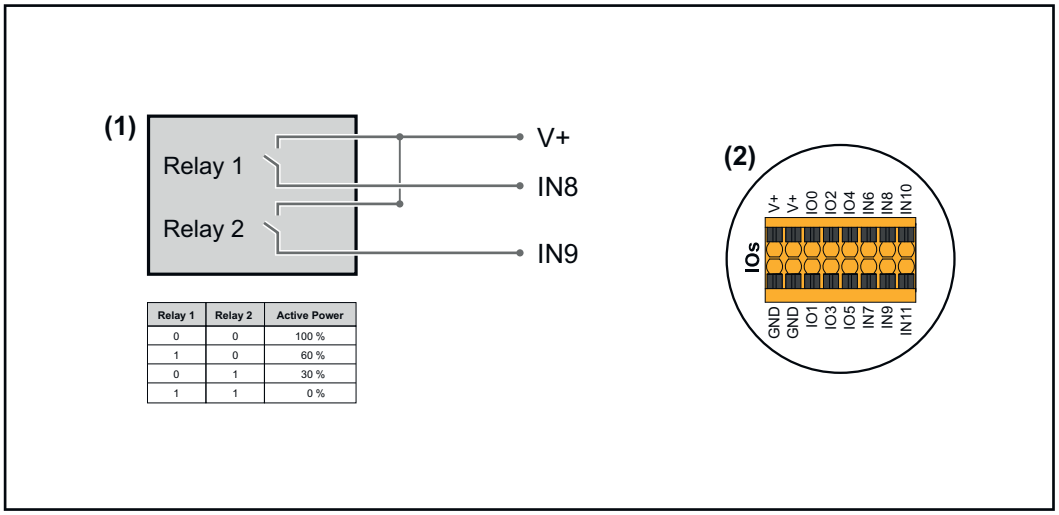
✓ *The settings for 3-relay operation are saved.*

I/O power management settings - 3 relays



Connection diagram - 2 relays

The ripple control signal receivers and the I/O terminals of the inverter can be connected to one another as shown in the connection diagram.
For distances of over 10 m between the inverter and the ripple control signal receiver, a CAT 5 STP cable is recommended as a minimum and the shielding must be connected on one side at the push-in terminal of the data communication area (SHIELD).



Relay 1	Relay 2	Active Power
0	0	100 %
1	0	60 %
0	1	30 %
1	1	0 %

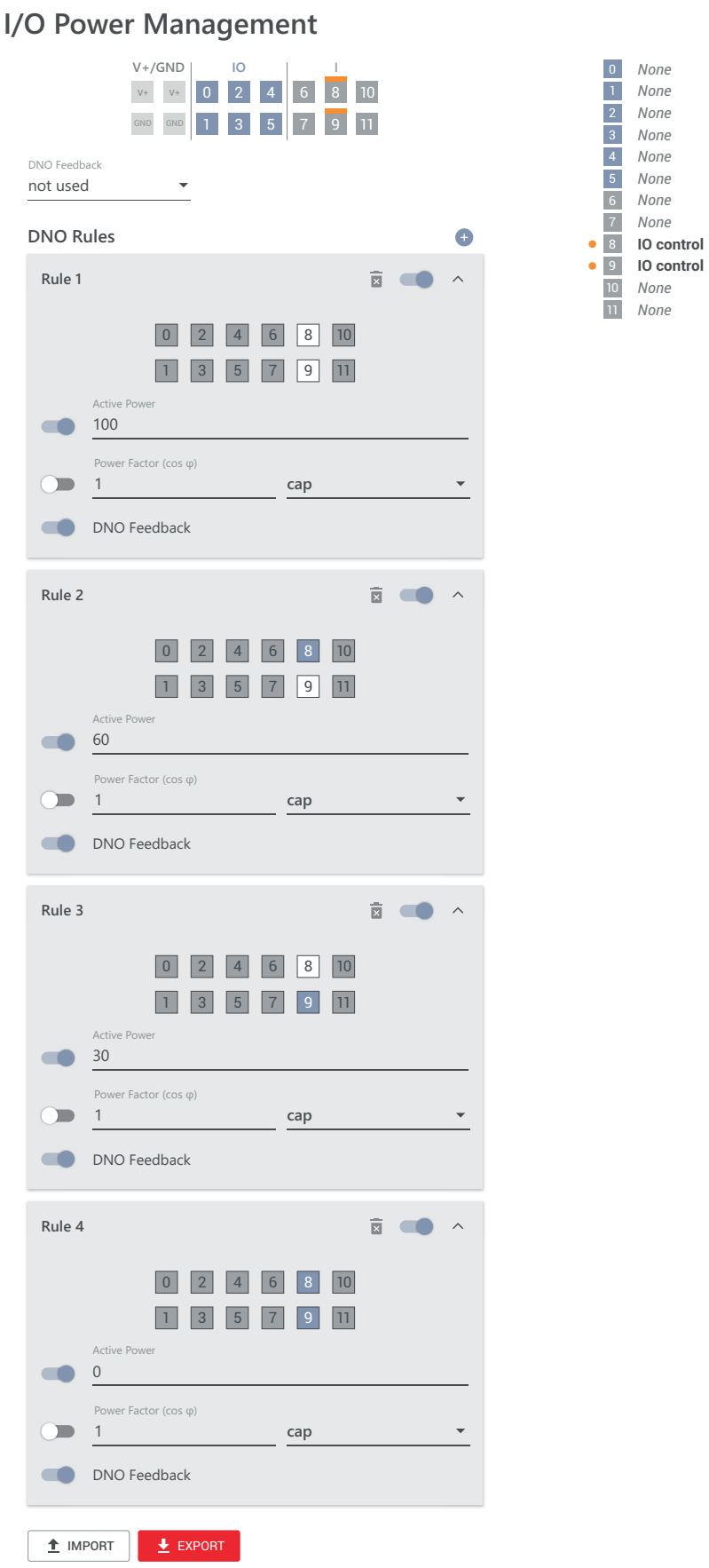
(1) Ripple control signal receiver with two relays for effective power limitation.
(2) I/Os of the data communication area.

Use pre-configured file for 2-relay operation:

1. Download the file (.fpc) under 2-relay operation to the mobile device.
2. Upload the file (.fpc) in the **I/O Power Management** menu area by clicking the **Import** button.
3. Click **Save**.

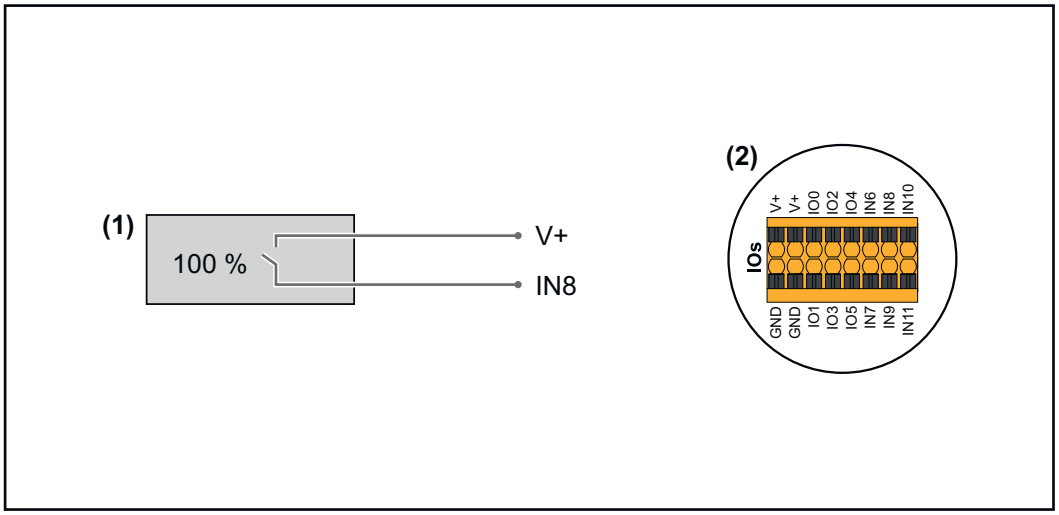
✓ *The settings for 2-relay operation are saved.*

I/O power management settings - 2 relays



Connection diagram - 1 relay

The ripple control signal receivers and the I/O terminals of the inverter can be connected to one another as shown in the connection diagram.
For distances of over 10 m between the inverter and the ripple control signal receiver, a CAT 5 STP cable is recommended as a minimum and the shielding must be connected on one side at the push-in terminal of the data communication area (SHIELD).



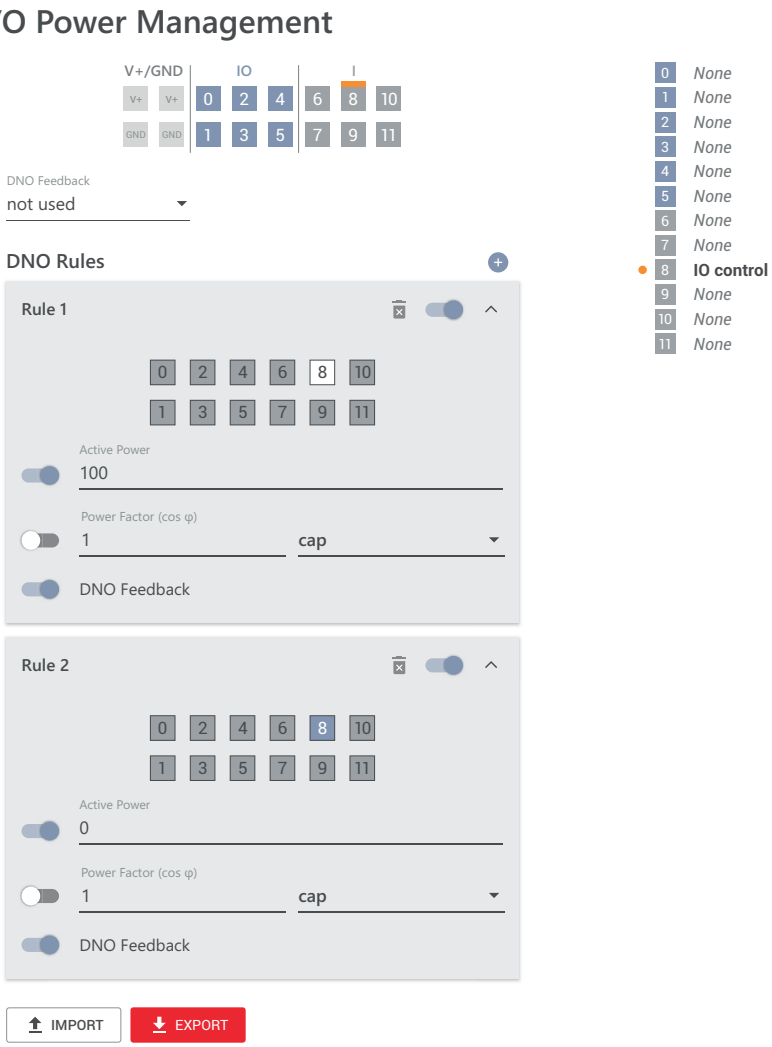
(1) Ripple control signal receiver with one relay for effective power limitation.
(2) I/Os of the data communication area.

Use pre-configured file for 1-relay operation:

1. Download the file (.fpc) under 1-relay operation to the mobile device.
2. Upload the file (.fpc) in the **I/O Power Management** menu area by clicking the **Import** button.
3. Click **Save**.

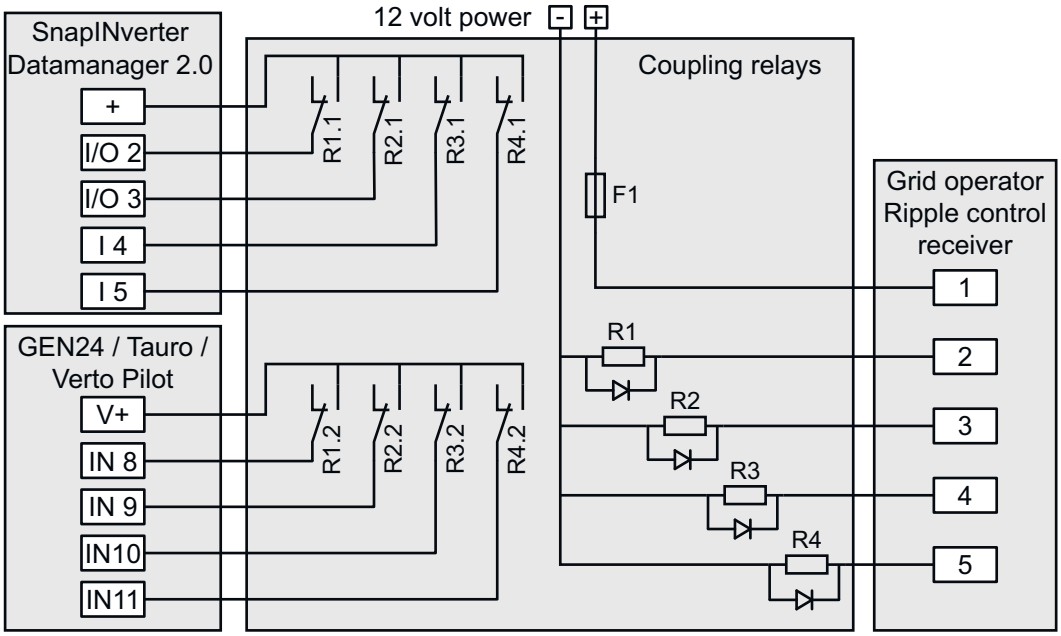
✓ *The settings for 1-relay operation are saved.*

I/O power management settings - 1 relay



Connecting the ripple control receiver with several inverters

The grid operator may request the connection of one or more inverters to a ripple control receiver in order to limit the effective power and/or the power factor of the photovoltaic system.



Connection diagram for ripple control receiver with several inverters

The following Fronius inverters can be connected to the ripple control receiver via a distributor (coupling relay):

- Symo GEN24
- Primo GEN24
- Tauro
- Verto
- SnapINverter (only devices with Fronius Datamanager 2.0)

IMPORTANT!
On the user interface of each inverter connected to the ripple control receiver, the **4-relay mode** setting (see Connection diagram - 4 relays and I/O power management settings - 4 relays) must be activated.

Appendix

Service, maintenance and disposal

General

The inverter is designed so that it does not require additional maintenance work. Nevertheless, a few points must be considered during operation to ensure that the inverter works perfectly.

Maintenance

Maintenance and service work may only be carried out by qualified technical personnel.

Cleaning

Wipe the inverter, if necessary, with a damp cloth.
Do not use cleaning agents, scouring agents, solvents, or similar products to clean the inverter.

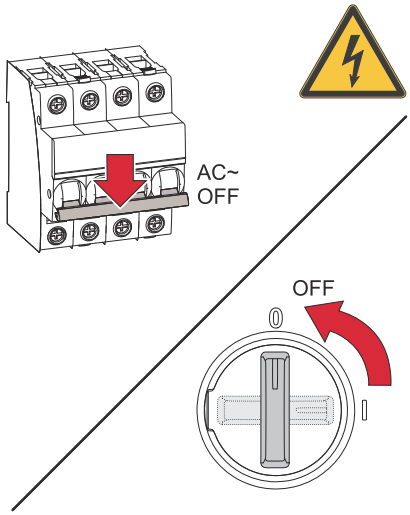
Operation in dusty environments

NOTE!

If the inverter is operated in dusty environments, dirt may build up on the heat sink and fan.
This may result in a loss of power due to insufficient cooling of the inverter.

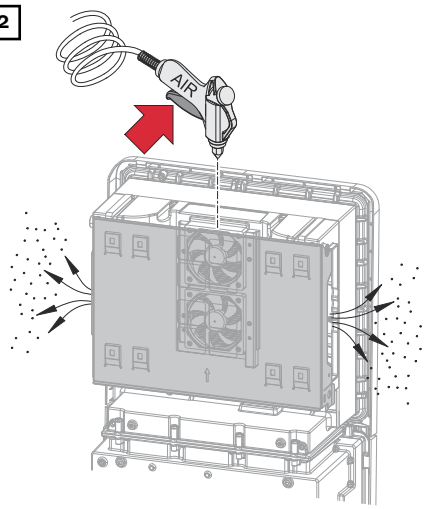
- ▶ Make sure that the ambient air can always flow through the inverter's ventilation slots unimpeded.
- ▶ Remove any build-ups of dirt from the heat sink and the fan.

1



Switch off power to the inverter and wait for the capacitors to discharge (2 minutes) and the fan to shut down. Turn the DC disconnector to the "off" switch setting.

2



Remove any build-up of dirt on the heat sink and fan using compressed air, a cloth, or a brush.

NOTE!

Risk due to damage to the fan bearing in the event of incorrect cleaning.
Excessive speeds and the application of pressure to the fan bearing can cause damage.
- ▶ Block the fan and clean with compressed air.
- ▶ When using a cloth or brush, clean the fan without applying any pressure.

To start up the inverter again, follow the steps listed above in reverse order.

Safety

⚠ WARNING!

Danger from mains voltage and DC voltage from PV modules.
This can result in serious injury and damage to property.
- ▶ The connection area must only be opened by an authorized electrician.
- ▶ The separate power stage set area must only be opened by Fronius-trained service technicians.
- ▶ Prior to any connection work, disconnect the inverter on the AC side and the DC side.

⚠ WARNING!

Danger due to residual voltage from capacitors.
This can result in serious injury and damage to property.
- ▶ Allow the capacitors of the inverter to discharge (2 minutes).

Disposal

Waste electrical and electronic equipment must be collected separately and recycled in an environmentally sound manner in accordance with the European Directive and national law. Used equipment must be returned to the distributor or through a local authorized collection and disposal system. Proper disposal of the used device promotes sustainable recycling of resources and prevents negative effects on health and the environment.

Packaging materials
- Collect separately
- Observe local regulations
- Crush cardboard boxes

Warranty provisions

Fronius manufacturer's warranty

Detailed, country-specific warranty conditions are available at www.fronius.com/solar/warranty.

To obtain the full warranty period for your newly installed Fronius product, please register at www.solarweb.com.

Components for switching to backup power

Components for automatic backup power changeover to Full Backup

Fronius components
With the following Fronius components, no additional components are required for the automatic changeover to backup power. If components are not available depending on national availability, automatic changeover to backup power can be implemented with the following third-party components.

Product	Item number
Fronius Backup Controller 3P-35A*	4,240,047,CK
Fronius Smart Meter 63A-3	43,0001,1473
Fronius Smart Meter 50kA-3	43,0001,1478
Fronius Smart Meter TS 65A-3	43,0001,0044
Fronius Smart Meter TS 5kA-3	43,0001,0046
Fronius Smart Meter WR	43,0001,3591

* Only compatible with Fronius Verto 15.0 - 20.0 Plus.

Third-party components
Manufacturers/types other than the product examples listed are permissible, provided that they meet the same technical and functional requirements.

Grid and system protection	
Manufacturer/type	Bender GmbH & Co. KG VMD460-NA-D-2 Tele Haase Steuergeräte Ges.m.b.H. RE-NA003-M64

K1 and K2 - AC installation contactor with auxiliary contact	
Number of pins	3-pin or 4-pin (depending on the cabling variant)
Rated current	depending on the house connection
Coil voltage	230 V_{AC}
Rated frequency	50 / 60 Hz
Coil fuse	6 A
Min. short circuit current	3 kA (contacts)
Test standard	IEC 60947-4-1
Auxiliary contact	
Number of NC contacts	1
Switching voltage	12 - 230 V @ 50 / 60 Hz
Min. nominal current	1 A
Min. short circuit current	1 kA
Manufacturer/type	ISKRA IK63-40 / Schrack BZ326461

Buffer power supply - Fault Ride Through cabling variant	
Manufacturer/type	BKE JS-20-240/DIN_BUF

K1 and K2 - DC installation contactor with auxiliary contact **(Fault Ride Through)**	
Number of pins	3-pin or 4-pin (depending on the cabling variant)
Rated current	depending on the house connection
Coil voltage	24 V_{DC}
Min. short circuit current	3 kA (contacts)
Test standard	IEC 60947-4-1
Auxiliary contact	
Number of NC contacts	1
Switching voltage	24 V_{DC}
Min. nominal current	1 A
Min. short circuit current	1 kA
Manufacturer/type	Finder 22.64.0.024.4710

K3 - Modular relay	
Number of changeover contacts	2
Coil voltage	12 V_{DC}
Test standard	IEC 60947-4-1
Manufacturer/type	Finder 22.23.9.012.4000 / Schrack relay RT424012 (bracket RT17017, relay base RT78725)

K4 and K5 - Installation contactor	
Number of NC contacts	2 (25 A)
Coil voltage	230 V AC (2P)
Rated frequency	50 / 60 Hz
Coil fuse	6 A
Min. short circuit current	3 kA (contacts)
Test standard	IEC 60947-4-1
Manufacturer/type	ISKRA IKA225-02

Components for manual backup power changeover to Full Backup

Product	Item number
Fronius Smart Meter 63A-3	43,0001,1473
Fronius Smart Meter TS 65A-3	43,0001,0044
Fronius Backup Switch 1P/3P-63A	4,050,221
Fronius Backup Switch 1PN/3PN-63A	4,050,220

Status codes and remedy

Display

Status codes are displayed on the user interface of the inverter in the **System** > **Event Log** menu area or in the user menu under **Notifications** and in Fronius Solar.web*.

* If configured accordingly, see chapter Fronius Solar.web on page 22.

Status codes

1030 – WSD Open (operating LED: flashes red)

Cause: A device that is connected in the WSD chain has interrupted the signal line (e.g., surge protection device) or the bypass installed ex works as standard has been removed and no trigger device has been installed.

Remedy: If the SPD surge protection device has tripped, the inverter must be repaired by an authorized specialist.

OR: Install the bypass installed ex works as standard or a trigger device.

OR: Turn the WSD (wired shutdown) switch to position 1 (WSD primary device).

⚠ WARNING!

Danger from work that is not carried out properly.
This can result in serious injury and damage to property.

- ▶ The installation and connection of an SPD surge protection device may only be carried out by Fronius-trained service personnel in accordance with the technical specifications.
- ▶ Observe safety rules.

Technical data

Verto Plus 15.0

DC input data	Maximum input voltage (at 1000 W/m² / -10 °C in an open circuit)	1000 V_{DC}
	Start-up input voltage	150 V_{DC}
	MPP voltage range	180 - 870 V_{DC}
	Number MPP-controller	3
	Maximum input current ($I_{DC\ max}$) PV1 / PV2 / PV3 per string	28 / 28 / 28 A 28 A
	Max. short circuit current [8] Total PV1 / PV2 / PV3 per string	150 A 50 / 50 / 50 A 50 A
	Maximum PV field power ($P_{PV\ max}$) Total PV1 / PV2 / PV3	22.5 kWp 20 / 20 / 20 kWp
	DC overvoltage category	2
	Max. inverter backfeed current to the array [3]	0 A [4]
	Max. capacity of the PV generator against ground	3000 nF
	Limit value of the insulation resistance test between module array and ground (on delivery) [7]	34 kΩ
	Adjustable range of insulation resistance test between module array and ground [6]	34 - 10,000 kΩ
	Limit value and trip time of sudden residual fault current monitoring (on delivery)	30 mA / 300 ms 60 mA / 150 ms 90 mA / 40 ms
	Limit value and trip time of continuous residual fault current monitoring (on delivery)	300 mA / 300 ms
	Adjustable range of continuous residual current monitoring [6]	30 - 1000 mA
	Cyclic repetition of the insulation resistance test (on delivery)	24 h
	Adjustable range for cyclic repetition of the insulation resistance test	-
DC input data battery [8]	Max. voltage [11]	700 V
	Min. voltage	150 V
	Max. current	50 A
	Max. output	22.5 kW
	DC inputs	1

Output data	Grid voltage range	176 - 528 V_{AC}
	Rated grid voltage	220 / 230 V_{AC} [1)] 253 / 257 V_{AC} [1)]
	Rated power	15 kW
	Max. usable DC power – inverter [10)]	22.5 kW
	Rated apparent power	15 kVA
	Rated frequency	50 / 60 Hz [1)]
	Maximum output current/phase	32.3 A
	Initial symmetrical short-circuit current/phase I_K"	32.3 A
	Power factor (cos phi)	0 - 1 ind./cap.[2)]
	Grid connection	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Maximum output power	15 kW
	Rated output current / phase	22.7 / 21.7 / 19.7 / 18.1 A
	Total harmonic distortion	< 3%
	AC overvoltage category	3
	Current (inrush) [5)]	24.72 A peak / 6.82 A rms over 1.99 ms [4)]
	Max. output fault current / duration	24.38 A / 38.72 ms
AC output data Full Backup [8)]	Max. output current / phase 3 phases 1 phase	32.3 A 43.5 A (AC boost for 5 - 10 s) 32 A (AC boost for 5 - 10 s)
	Rated power	15 kW 30 kVA (AC boost for 5 - 10 s)
	Rated output current (per phase)	32.3 A (max. asymmetry 25 A)
	Nominal mains voltage	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Nominal frequency for Full Backup	53 / 63 Hz [1)]
	Switching time	< 35 s
	Power factor cos phi [2)]	0 - 1 ind./cap.[2)]

General data	Night-time power loss = standby consumption	16 W
	European Efficiency (180 / 600 / 870 V_{DC})	96.65 / 97.35 / 96.58%
	Maximum Efficiency	97.27%
	Safety class	1
	EMC emission class	B
	Pollution degree	3
	Permitted ambient temperature	- 40 °C-+60 °C
	Permitted storage temperature	- 40 °C-+70 °C
	Relative humidity	0-100%
	Sound pressure level	50.3 dB(A) (ref. 20 µPA)
	Protection class	IP 66
	Dimensions (height x width x depth)	865 x 574 x 279 mm
	Weight	40.1 kg (only the inverter lift up) 50.7 kg (with package)
	Inverter topology	Non-insulated, no transformer

Verto Plus 17.5

DC input data	Maximum input voltage (at 1000 W/m² / -10 °C in an open circuit)	1000 V_{DC}
	Start-up input voltage	150 V_{DC}
	MPP voltage range	210 - 870 V_{DC}
	Number MPP-controller	3
	Maximum input current ($I_{DC\ max}$) PV1 / PV2 / PV3 per string	28 / 28 / 28 A 28 A
	Max. short circuit current [8] Total PV1 / PV2 / PV3 per string	150 A 50 / 50 / 50 A 50 A
	Maximum PV field power ($P_{PV\ max}$) Total PV1 / PV2 / PV3	26.25 kWp 20 / 20 / 20 kWp
	DC overvoltage category	2
	Max. inverter backfeed current to the array [3]	0 A[4]
	Max. capacity of the PV generator against ground	3600 nF
	Limit value of the insulation resistance test between module array and ground (on delivery) [7]	34 kΩ
	Adjustable range of insulation resistance test between module array and ground [6]	34 - 10,000 kΩ
	Limit value and trip time of sudden residual fault current monitoring (on delivery)	30 mA / 300 ms 60 mA / 150 ms 90 mA / 40 ms
	Limit value and trip time of continuous residual fault current monitoring (on delivery)	300 mA / 300 ms
	Adjustable range of continuous residual current monitoring [6]	30 - 1000 mA
	Cyclic repetition of the insulation resistance test (on delivery)	24 h
	Adjustable range for cyclic repetition of the insulation resistance test	-

DC input data battery [8]	Max. voltage [11]	700 V
	Min. voltage	150 V
	Max. current	50 A
	Max. output	26.25 kW
	DC inputs	1
Output data	Grid voltage range	176 - 528 V_{AC}
	Rated grid voltage	220 / 230 V_{AC} [1] 253 / 257 V_{AC} [1]
	Rated power	17.5 kW
	Max. usable DC power – inverter [10]	26.25 kW
	Rated apparent power	17.5 kVA
	Rated frequency	50 / 60 Hz [1]
	Maximum output current/phase	32.3 A
	Initial symmetrical short-circuit current/phase I_K''	32.3 A
	Power factor (cos phi)	0 - 1 ind./cap.[2]
	Grid connection	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Maximum output power	17.5 kW
	Rated output current / phase	26.5 / 25.4 / 23.0 / 21.1 A
	Total harmonic distortion	< 3%
	AC overvoltage category	3
	Current (inrush) [5]	24.72 A peak / 6.82 A rms over 1.99 ms [4]
	Max. output fault current / duration	24.38 A / 38.72 ms
AC output data Full Backup [8]	Max. output current / phase 3 phases 1 phase	32.3 A 43.5 A (AC boost for 5 - 10 s) 32 A (AC boost for 5 - 10 s)
	Rated power	17.5 kW 30 kVA (AC boost for 5 - 10 s)
	Rated output current (per phase)	32.3 A (max. asymmetry 25 A)
	Nominal mains voltage	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Nominal frequency for Full Backup	53 / 63 Hz [1]
	Switching time	< 35 s
	Power factor cos phi [2]	0 - 1 ind./cap.[2]

General data	Night-time power loss = standby consumption	16 W
	European Efficiency (210 / 600 / 870 V_{DC})	96.87 / 97.54 / 96.88%
	Maximum Efficiency	97.42%
	Safety class	1
	EMC emission class	B
	Pollution degree	3
	Permitted ambient temperature	- 40 °C-+60 °C
	Permitted storage temperature	- 40 °C-+70 °C
	Relative humidity	0-100%
	Sound pressure level	50.3 dB(A) (ref. 20 µPA)
	Protection class	IP 66
	Dimensions (height x width x depth)	865 x 574 x 279 mm
	Weight	40.1 kg (only the inverter lift up) 50.7 kg (with package)
	Inverter topology	Non-insulated, no transformer

Verto Plus 20.0

DC input data	Maximum input voltage (at 1000 W/m² / -10 °C in an open circuit)	1000 V_{DC}
	Start-up input voltage	150 V_{DC}
	MPP voltage range	240 - 870 V_{DC}
	Number MPP-controller	3
	Maximum input current ($I_{DC\ max}$) PV1 / PV2 / PV3 per string	28 / 28 / 28 A 28 A
	Max. short circuit current [8] Total PV1 / PV2 / PV3 per string	150 A 50 / 50 / 50 A 50 A
	Maximum PV field power ($P_{PV\ max}$) Total PV1 / PV2 / PV3	30.0 kWp 20 / 20 / 20 kWp
	DC overvoltage category	2
	Max. inverter backfeed current to the array [3]	0 A[4]
	Max. capacity of the PV generator against ground	5000 nF
	Limit value of the insulation resistance test between module array and ground (on delivery) [7]	34 kΩ
	Adjustable range of insulation resistance test between module array and ground [6]	34 - 10,000 kΩ
	Limit value and trip time of sudden residual fault current monitoring (on delivery)	30 mA / 300 ms 60 mA / 150 ms 90 mA / 40 ms
	Limit value and trip time of continuous residual fault current monitoring (on delivery)	300 mA / 300 ms
	Adjustable range of continuous residual current monitoring [6]	30 - 1000 mA
	Cyclic repetition of the insulation resistance test (on delivery)	24 h
	Adjustable range for cyclic repetition of the insulation resistance test	-

DC input data battery [8]	Max. voltage [11]	700 V
	Min. voltage	150 V
	Max. current	50 A
	Max. output	30 kW
	DC inputs	1
Output data	Grid voltage range	176 - 528 V_{AC}
	Rated grid voltage	220 / 230 V_{AC} [1] 253 / 257 V_{AC} [1]
	Rated power	20 kW
	Max. usable DC power – inverter [10]	30 kW
	Rated apparent power	20 kVA
	Rated frequency	50 / 60 Hz [1]
	Maximum output current/phase	32.3 A
	Initial symmetrical short-circuit current/phase I_K''	32.3 A
	Power factor (cos phi)	0 - 1 ind./cap.[2]
	Grid connection	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Maximum output power	20 kW
	Rated output current / phase	30.3 / 29 / 26.2 / 24.1 A
	Total harmonic distortion	< 3%
	AC overvoltage category	3
	Current (inrush) [5]	24.72 A peak / 6.82 A rms over 1.99 ms [4]
	Max. output fault current / duration	24.38 A / 38.72 ms
AC output data Full Backup [8]	Max. output current / phase 3 phases 1 phase	32.3 A 43.5 A (AC boost for 5 - 10 s) 32 A (AC boost for 5 - 10 s)
	Rated power	20 kW 30 kVA (AC boost for 5 - 10 s)
	Rated output current (per phase)	32.3 A (max. asymmetry 25 A)
	Nominal mains voltage	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Nominal frequency for Full Backup	53 / 63 Hz [1]
	Switching time	< 35 s
	Power factor cos phi [2]	0 - 1 ind./cap.[2]

General data	Night-time power loss = standby consumption	16 W
	European Efficiency (240 / 600 / 870 V_{DC})	97.08 / 97.95 / 96.93%
	Maximum Efficiency	97.52%
	Safety class	1
	EMC emission class	B
	Pollution degree	3
	Permitted ambient temperature	- 40 °C-+60 °C
	Permitted storage temperature	- 40 °C-+70 °C
	Relative humidity	0-100%
	Sound pressure level	50.3 dB(A) (ref. 20 µPA)
	Protection class	IP 66
	Dimensions (height x width x depth)	865 x 574 x 279 mm
	Weight	40.1 kg (only the inverter lift up) 50.7 kg (with package)
	Inverter topology	Non-insulated, no transformer

Verto Plus 25.0

DC input data	Maximum input voltage (at 1000 W/m² / -10 °C in an open circuit)	1000 V_{DC}
	Start-up input voltage	150 V_{DC}
	MPP voltage range	240 - 870 V_{DC}
	Number MPP-controller	3
	Maximum input current ($I_{DC\ max}$) PV1 / PV2 / PV3 per string	28 / 28 / 28 A 28 A
	Max. short circuit current [8] Total PV1 / PV2 / PV3 per string	150 A 50 / 50 / 50 A 50 A
	Maximum PV field power ($P_{PV\ max}$) Total PV1 / PV2 / PV3	37.5 kWp 20 / 20 / 20 kWp
	DC overvoltage category	2
	Max. inverter backfeed current to the array [3]	0 A[4]
	Max. capacity of the PV generator against ground	5400 nF
	Limit value of the insulation resistance test between module array and ground (on delivery) [7]	34 kΩ
	Adjustable range of insulation resistance test between module array and ground [6]	34 - 10,000 kΩ
	Limit value and trip time of sudden residual fault current monitoring (on delivery)	30 mA / 300 ms 60 mA / 150 ms 90 mA / 40 ms
	Limit value and trip time of continuous residual fault current monitoring (on delivery)	300 mA / 300 ms
	Adjustable range of continuous residual current monitoring [6]	30 - 1000 mA
	Cyclic repetition of the insulation resistance test (on delivery)	24 h
	Adjustable range for cyclic repetition of the insulation resistance test	-

DC input data battery [8]	Max. voltage [11]	700 V
	Min. voltage	150 V
	Max. current	50 A
	Max. output	35 kW
	DC inputs	1
Output data	Grid voltage range	176 - 528 V_{AC}
	Rated grid voltage	220 / 230 V_{AC} [1] 253 / 257 V_{AC} [1]
	Rated power	25 kW
	Max. usable DC power – inverter [10]	32.5 kW
	Rated apparent power	25 kVA
	Rated frequency	50 / 60 Hz [1]
	Maximum output current/phase	53.7 A
	Initial symmetrical short-circuit current/phase I_K''	53.7 A
	Power factor (cos phi)	0 - 1 ind./cap.[2]
	Grid connection	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Maximum output power	25 kW
	Rated output current / phase	37.9 / 36.2 / 32.8 / 30.1 A
	Total harmonic distortion	< 3%
	AC overvoltage category	3
	Current (inrush) [5]	24.72 A peak / 6.82 A rms over 1.99 ms [4]
	Max. output fault current / duration	53.74 A / 13.51 ms
AC output data Full Backup [8]	Max. output current / phase 3 phases 1 phase	53.7 A 72.5 A (AC boost for 5 - 10 s) 72.5 A (AC boost for 5 - 10 s)
	Rated power	25 kW 50 kVA (AC boost for 5 - 10 s)
	Rated output current (per phase)	53.7 A
	Nominal mains voltage	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Nominal frequency for Full Backup	53 / 63 Hz [1]
	Switching time	< 35 s
	Power factor cos phi [2]	0 - 1 ind./cap.[2]

General data	Night-time power loss = standby consumption	16 W
	European Efficiency (300 / 600 / 870 V_{DC})	97.24 / 97.74 / 97.11%
	Maximum Efficiency	97.59%
	Safety class	1
	EMC emission class	B
	Pollution degree	3
	Permitted ambient temperature	- 40 °C-+60 °C
	Permitted storage temperature	- 40 °C-+70 °C
	Relative humidity	0-100%
	Sound pressure level	56.7 dB(A) (ref. 20 µPA)
	Protection class	IP 66
	Dimensions (height x width x depth)	865 x 574 x 279 mm
	Weight	40.1 kg (only the inverter lift up) 50.7 kg (with package)
	Inverter topology	Non-insulated, no transformer

Verto Plus 30.0

DC input data	Maximum input voltage (at 1000 W/m² / -10 °C in an open circuit)	1000 V_{DC}
	Start-up input voltage	150 V_{DC}
	MPP voltage range	360 - 870 V_{DC}
	Number MPP-controller	3
	Maximum input current ($I_{DC\ max}$) PV1 / PV2 / PV3 per string	28 / 28 / 28 A 28 A
	Max. short circuit current [8] Total PV1 / PV2 / PV3 per string	150 A 50 / 50 / 50 A 50 A
	Maximum PV field power ($P_{PV\ max}$) Total PV1 / PV2 / PV3	45 kWp 20 / 20 / 20 kWp
	DC overvoltage category	2
	Max. inverter backfeed current to the array [3]	0 A[4]
	Max. capacity of the PV generator against ground	6000 nF
	Limit value of the insulation resistance test between module array and ground (on delivery) [7]	34 kΩ
	Adjustable range of insulation resistance test between module array and ground [6]	34 - 10,000 kΩ
	Limit value and trip time of sudden residual fault current monitoring (on delivery)	30 mA / 300 ms 60 mA / 150 ms 90 mA / 40 ms
	Limit value and trip time of continuous residual fault current monitoring (on delivery)	300 mA / 300 ms
	Adjustable range of continuous residual current monitoring [6]	30 - 1000 mA
	Cyclic repetition of the insulation resistance test (on delivery)	24 h
	Adjustable range for cyclic repetition of the insulation resistance test	-

DC input data battery [8]	Max. voltage [11]	700 V
	Min. voltage	150 V
	Max. current	50 A
	Max. output	35 kW
	DC inputs	1
Output data	Grid voltage range	176 - 528 V_{AC}
	Rated grid voltage	220 / 230 V_{AC} [1] 253 / 257 V_{AC} [1]
	Rated power	29.99 kW
	Max. usable DC power – inverter [10]	39 kW
	Rated apparent power	29.99 kVA
	Rated frequency	50 / 60 Hz [1]
	Maximum output current/phase	53.7 A
	Initial symmetrical short-circuit current/phase I_K''	53.7 A
	Power factor (cos phi)	0 - 1 ind./cap.[2]
	Grid connection	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Maximum output power	29.99 kW
	Rated output current / phase	45.5 / 43.5 / 39.4 / 36.1 A
	Total harmonic distortion	< 3%
	AC overvoltage category	3
	Current (inrush) [5]	24.72 A peak / 6.82 A rms over 1.99 ms [4]
	Max. output fault current / duration	53.74 A / 13.51 ms
AC output data Full Backup [8]	Max. output current / phase 3 phases 1 phase	53.7 A 72.5 A (AC boost for 5 - 10 s) 72.5 A (AC boost for 5 - 10 s)
	Rated power	29.99 kW 50 kVA (AC boost for 5 - 10 s)
	Rated output current (per phase)	53.7 A
	Nominal mains voltage	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Nominal frequency for Full Backup	53 / 63 Hz [1]
	Switching time	< 35 s
	Power factor cos phi [2]	0 - 1 ind./cap.[2]

General data	Night-time power loss = standby consumption	16 W
	European Efficiency (360 / 600 / 870 V_{DC})	97.35 / 97.96 / 97.57%
	Maximum Efficiency	97.72%
	Safety class	1
	EMC emission class	B
	Pollution degree	3
	Permitted ambient temperature	- 40 °C-+60 °C
	Permitted storage temperature	- 40 °C-+70 °C
	Relative humidity	0-100%
	Sound pressure level	56.7 dB(A) (ref. 20 µPA)
	Protection class	IP 66
	Dimensions (height x width x depth)	865 x 574 x 279 mm
	Weight	40.1 kg (only the inverter lift up) 50.7 kg (with package)
	Inverter topology	Non-insulated, no transformer

Verto Plus 33.3

DC input data	Maximum input voltage (at 1000 W/m² / -10 °C in an open circuit)	1000 V_{DC}
	Start-up input voltage	150 V_{DC}
	MPP voltage range	410 - 870 V_{DC}
	Number MPP-controller	3
	Maximum input current ($I_{DC\ max}$) PV1 / PV2 / PV3 per string	28 / 28 / 28 A 28 A
	Max. short circuit current [8] Total PV1 / PV2 / PV3 per string	150 A 50 / 50 / 50 A 50 A
	Maximum PV field power ($P_{PV\ max}$) Total PV1 / PV2 / PV3	50 kWp 20 / 20 / 20 kWp
	DC overvoltage category	2
	Max. inverter backfeed current to the array [3]	0 A[4]
	Max. capacity of the PV generator against ground	6660 nF
	Limit value of the insulation resistance test between module array and ground (on delivery) [7]	34 kΩ
	Adjustable range of insulation resistance test between module array and ground [6]	34 - 10,000 kΩ
	Limit value and trip time of sudden residual fault current monitoring (on delivery)	30 mA / 300 ms 60 mA / 150 ms 90 mA / 40 ms
	Limit value and trip time of continuous residual fault current monitoring (on delivery)	300 mA / 300 ms
	Adjustable range of continuous residual current monitoring [6]	30 - 1000 mA
	Cyclic repetition of the insulation resistance test (on delivery)	24 h
	Adjustable range for cyclic repetition of the insulation resistance test	-

DC input data battery [8]	Max. voltage [11]	700 V
	Min. voltage	150 V
	Max. current	50 A
	Max. output	35 kW
	DC inputs	1
Output data	Grid voltage range	176 - 528 V_{AC}
	Rated grid voltage	220 / 230 V_{AC} [1] 253 / 257 V_{AC} [1]
	Rated power	33.3 kW
	Max. usable DC power – inverter [10]	39 kW
	Rated apparent power	33.3 kVA
	Rated frequency	50 / 60 Hz [1]
	Maximum output current/phase	53.7 A
	Initial symmetrical short-circuit current/phase I_K''	53.7 A
	Power factor (cos phi)	0 - 1 ind./cap.[2]
	Grid connection	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Maximum output power	33.3 kW
	Rated output current / phase	50.5 / 48.3 / 43.7 / 40.1 A
	Total harmonic distortion	< 3%
	AC overvoltage category	3
	Current (inrush) [5]	24.72 A peak / 6.82 A rms over 1.99 ms [4]
	Max. output fault current / duration	53.74 A / 13.51 ms
AC output data Full Backup [8]	Max. output current / phase 3 phases 1 phase	53.7 A 72.5 A (AC boost for 5 - 10 s) 72.5 A (AC boost for 5 - 10 s)
	Rated power	33.3 kW 50 kVA (AC boost for 5 - 10 s)
	Rated output current (per phase)	53.7 A
	Nominal mains voltage	3~ (N)PE 380 / 220 V_{AC} 3~ (N)PE 400 / 230 V_{AC} 3~ (N)PE 440 / 253 V_{AC} 3~ (N)PE 480 / 277 V_{AC}
	Nominal frequency for Full Backup	53 / 63 Hz [1]
	Switching time	< 35 s
	Power factor cos phi [2]	0 - 1 ind./cap.[2]

General data	Night-time power loss = standby consumption	16 W
	European Efficiency (400 / 600 / 870 V_{DC})	97.42 / 97.95 / 97.56%
	Maximum Efficiency	97.72%
	Safety class	1
	EMC emission class	B
	Pollution degree	3
	Permitted ambient temperature	- 40 °C-+60 °C
	Permitted storage temperature	- 40 °C-+70 °C
	Relative humidity	0-100%
	Sound pressure level	56.7 dB(A) (ref. 20 µPA)
	Protection class	IP 66
	Dimensions (height x width x depth)	865 x 574 x 279 mm
	Weight	40.1 kg (only the inverter lift up) 50.7 kg (with package)
	Inverter topology	Non-insulated, no transformer

Protection devices

DC disconnector	Integrated
Cooling principle	Controlled forced-air ventilation
RCMU [9)]	Integrated
RCMU classification	The software class of the safety platform(s) is defined as a class B control function (single-channel with periodic self-test) in accordance with IEC 60730 Annex H.
DC isolation measurement [9)]	integrated [2)]
Overload performance	Operating point shift power limitation
Active anti-islanding method	Frequency shift method
AFCI	Integrated
AFPE (AFCI) classification (according to IEC 63027) [9)]	F-I-AFPE-1-4/2-2 Full coverage Integrated AFPE 1 monitored string per input port 4/2 input ports per channel (AFPE1 for MPP1 & MPP2: 4, AFPE2 for MPP3 & MPP3: 2) 2 monitored channels

WLAN

Frequency range	2412 - 2462 MHz
Channels / power used	Channel: 1-11 b,g,n HT20 Channel: 3-9 HT40 <18 dBm

Modulation	802.11b: DSSS (1Mbps DBPSK, 2Mbps DQPSK, 5.5/11Mbps CCK) 802.11g: OFDM (6/9Mbps BPSK, 12/18Mbps QPSK, 24/36Mbps 16-QAM, 48/54Mbps 64-QAM) 802.11n: OFDM (6.5 BPSK, QPSK, 16-QAM, 64-QAM)

Surge protection device DC SPD type 1+2

General data	
Rated discharge current (I_n) - 8/20 µs pulses	20 kA
Protection level (U_p)	4 kV
Short circuit strength PV (I_{scpv})	9 kA

Disconnector	
Thermal disconnector	Integrated
External fuse	None

Mechanical properties	
Disconnection indicator	Mechanical indicator
Remote communication of the connection interruption	Output on the changeover contact
Housing material	Thermoplastic UL-94-V0
Test standards	IEC 61643-31 / EN 61643-31

Explanation of footnotes

1) The values provided are standard values. If required, the inverter is customized for a specific country.
2) Depending on the country setup or device-specific settings
(ind. = inductive; cap. = capacitive)
3) Maximum current from a defective PV module to all other PV modules. From the inverter itself to the PV side of the inverter, this is 0 amperes.
4) Assured by the electrical design of the inverter
5) Peak current when turning on the inverter
6) The values provided are standard values. These values must be adjusted according to requirements and PV output.
7) The value provided is a maximum value. If this value is exceeded, this may impair the function.
8) $I_{SC\ PV} = I_{SC\ max} \geq I_{SC}$ (STC) x 1.25 acc. to e.g.: IEC 60364-7-712, NEC 2020, AS/NZS 5033:2021
9) Software class B (single-channel with periodic self-test) according to IEC 60730-1 Appendix H.
10) Max. power that can be used in parallel for the output power (AC) and the battery charging power (DC).

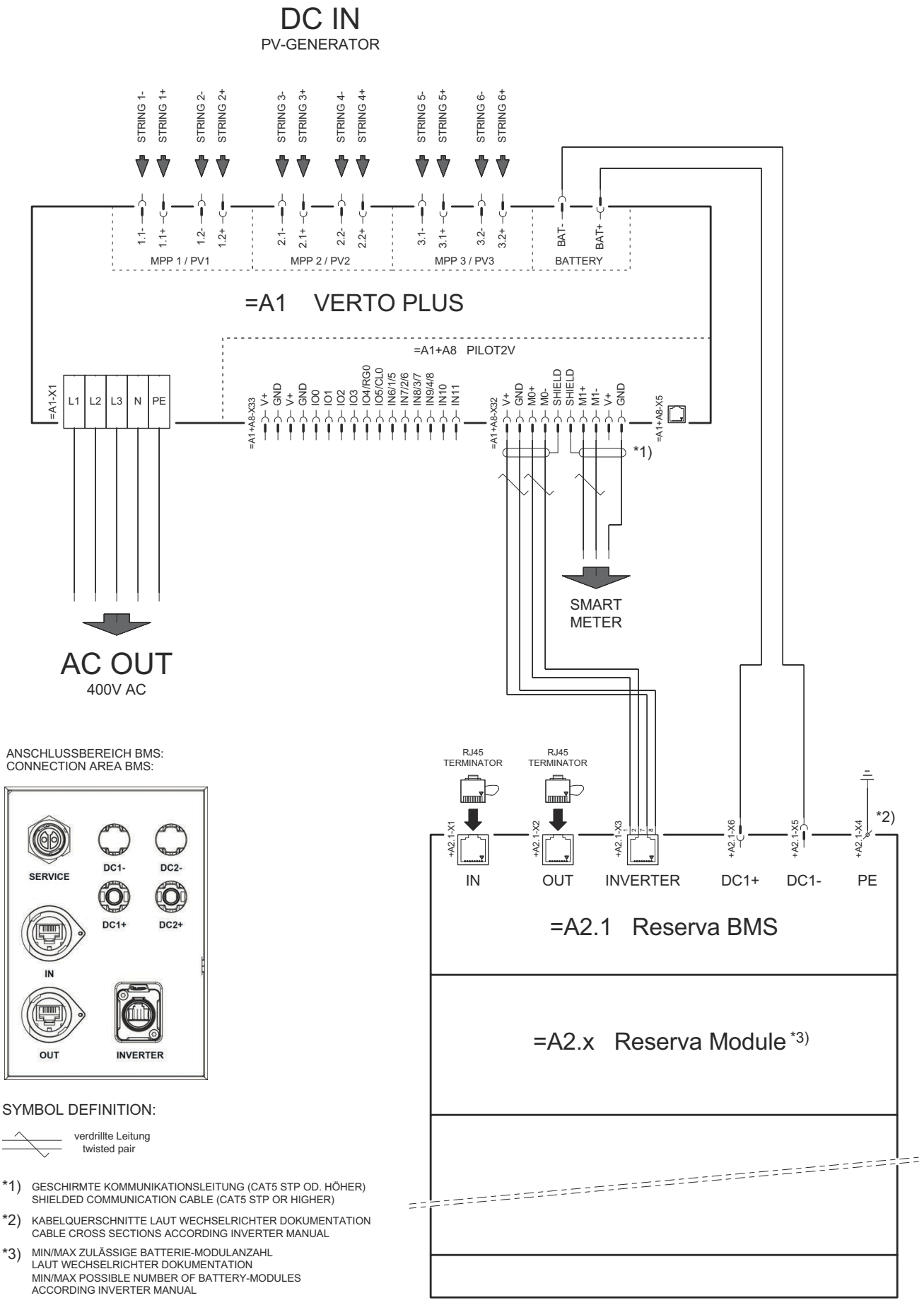
Integrated DC disconnector

General data	
Product name	Benedict LSA32 E 8237
Rated insulation voltage	1000 V_{DC}
Rated impulse withstand voltage	8 kV
Suitability for insulation	Yes, DC only
Utilization category and/or PV utilization category	according to IEC/EN 60947-3 utilization category DC-PV2
Rated short-time withstand current (I_{cw})	Rated short-time withstand current (I_{cw}): 1000 A
Rated short-circuit capacity (I_{cm})	Rated short-circuit capacity (I_{cm}): 1000 A

Rated operating current and rated breaking capacity				
Rated operating voltage (U_e)	Rated operating current (I_e)	$I_{(make)}$ / $I_{(break)}$	Rated operating current (I_e)	$I_{(make)}$ / $I_{(break)}$
≤ 500 V_{DC}	14 A	56 A	38 A	152 A
600 V_{DC}	11.5 A	46 A	33 A	132 A
700 V_{DC}	7.5 A	30 A	28 A	112 A
800 V_{DC}	5.75 A	23 A	23 A	92 A
900 V_{DC}	4.75 A	19 A	20 A	80 A
1000 V_{DC}	4 A	16 A	13 A	52 A
Number of pins	1	1	2	2

Circuit Diagrams

Fronius Verto Plus and Fronius Reserva



SYMBOL DEFINITION:

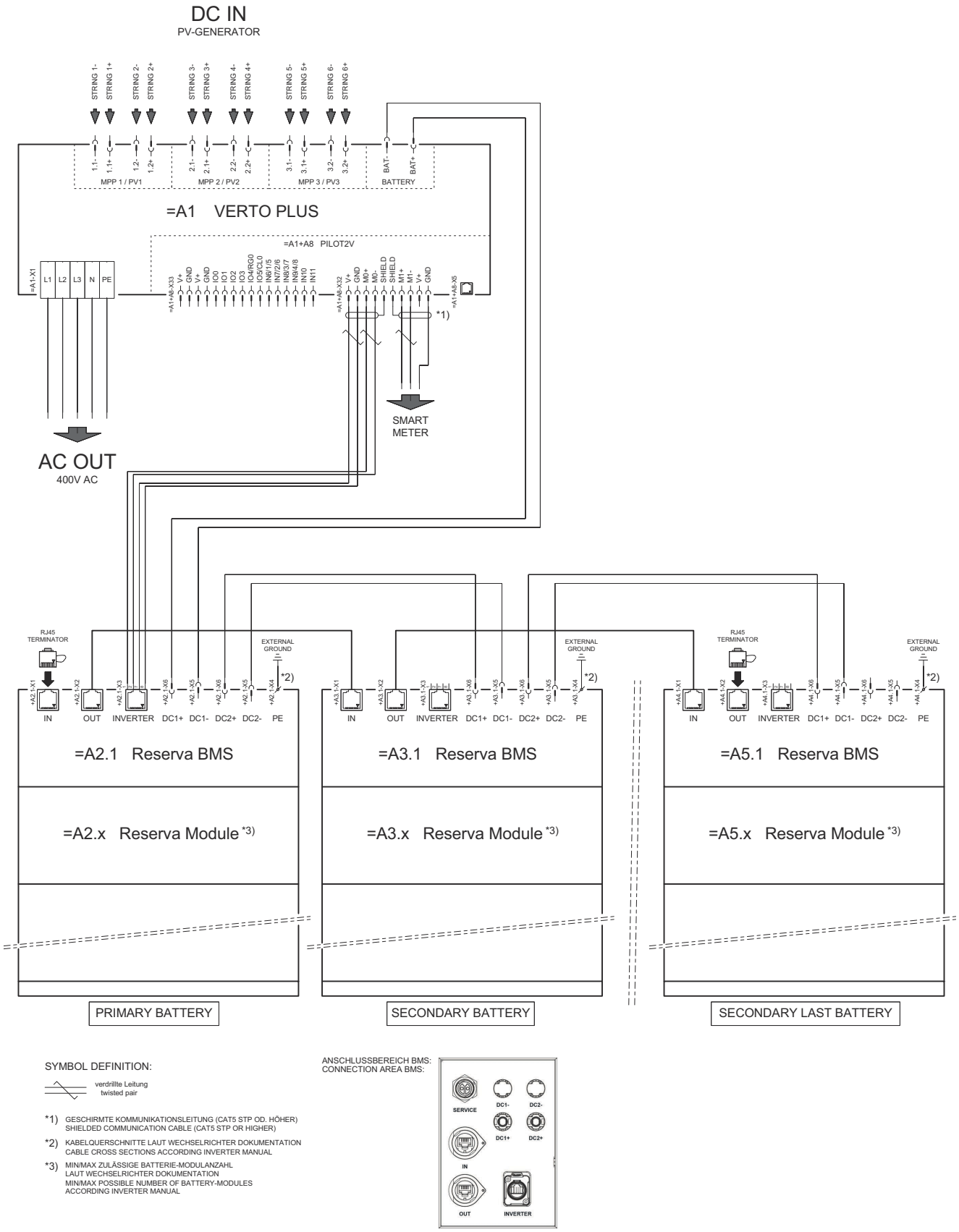
verdrillte Leitung
twisted pair

*1) GESCHIRMTE KOMMUNIKATIONSLEITUNG (CAT5 STP OD. HÖHER)
SHIELDED COMMUNICATION CABLE (CAT5 STP OR HIGHER)

*2) KABELQUERSCHNITTE LAUT WECHSELRICHTER DOKUMENTATION
CABLE CROSS SECTIONS ACCORDING INVERTER MANUAL

*3) MIN/MAX ZULÄSSIGE BATTERIE-MODULANZAHL
LAUT WECHSELRICHTER DOKUMENTATION
MIN/MAX POSSIBLE NUMBER OF BATTERY-MODULES
ACCORDING INVERTER MANUAL

Fronius Verto Plus with Fronius Reserva connected in parallel



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MIN/MAX POSSIBLE NUMBER OF BATTERY-MODULES
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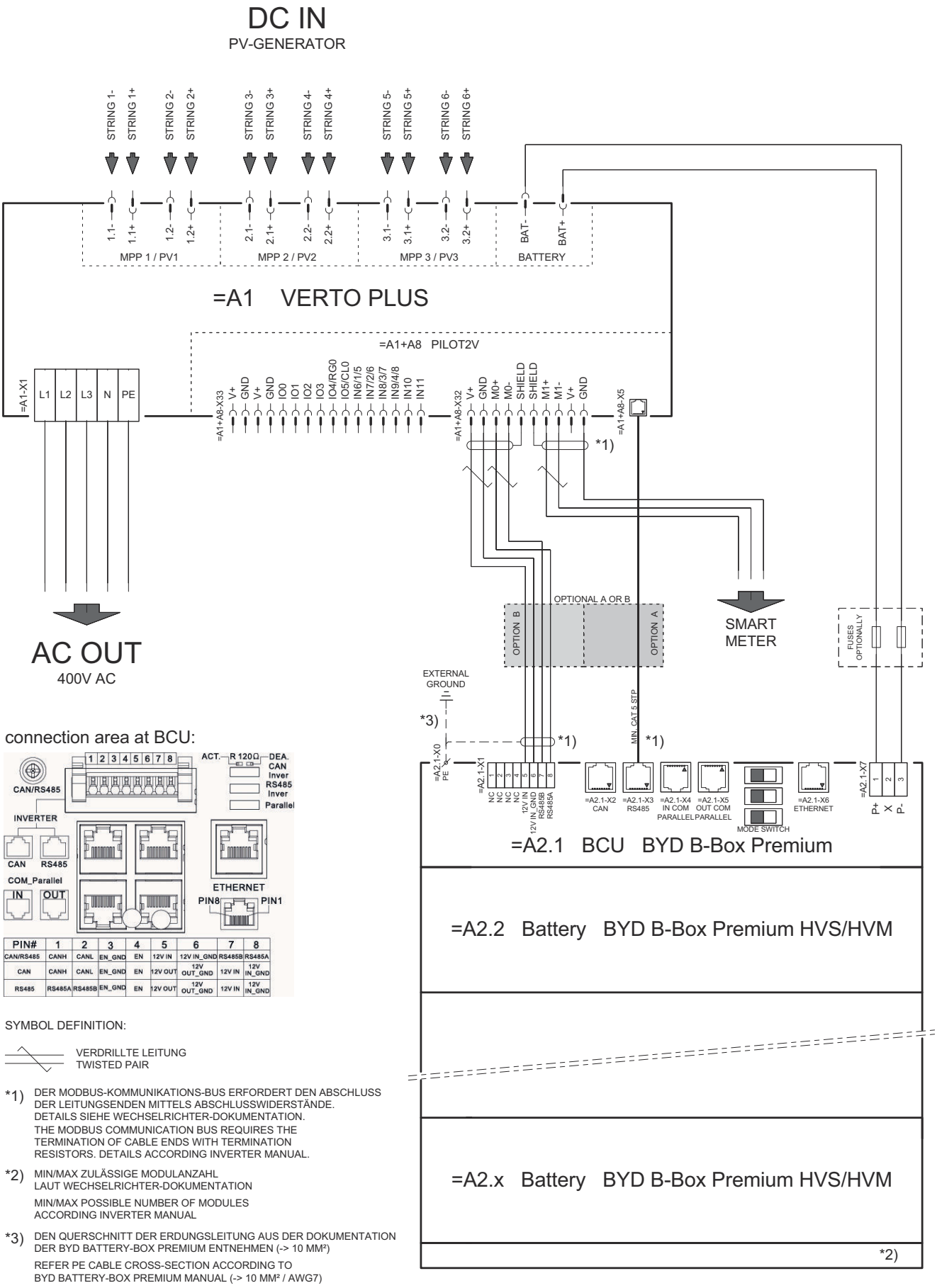
ANSCHLUSSBEREICH BMS:
CONNECTION AREA BMS:

Fronius Verto Plus and BYD Battery-Box Premium HV



connection area at BCU:

PIN#	1	2	3	4	5	6	7	8
CAN/RS485	CANH	CANL	EN_GND	EN	12V IN	12V IN_GND	RS485B	RS485A
CAN	CANH	CANL	EN_GND	EN	12V OUT	12V OUT_GND	12V IN	12V IN_GND
RS485	RS485A	RS485B	EN_GND	EN	12V OUT	12V OUT_GND	12V IN	12V IN_GND

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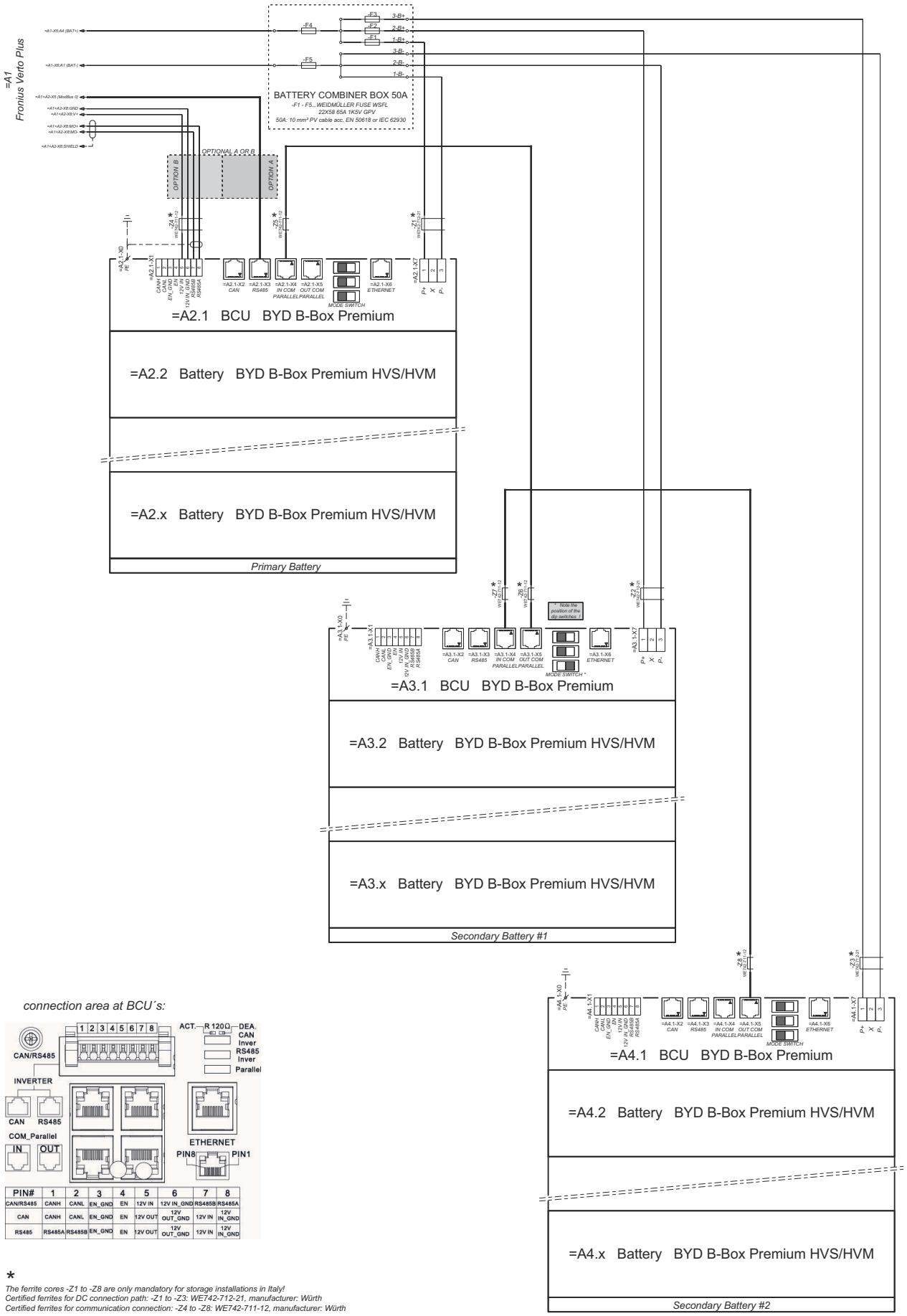
LAUT WECHSELRICHTER-DOKUMENTATION
MIN/MAX POSSIBLE NUMBER OF MODULES
ACCORDING INVERTER MANUAL

*3) DEN QUERSCHNITT DER ERDUNGSLEITUNG AUS DER DOKUMENTATION DER BYD BATTERY-BOX PREMIUM ENTNEHMEN (-> 10 MM²)
REFER PE CABLE CROSS-SECTION ACCORDING TO BYD BATTERY-BOX PREMIUM MANUAL (-> 10 MM² / AWG7)

Fronius Verto Plus with 3 BYD Battery-Box Premium HV connected in parallel



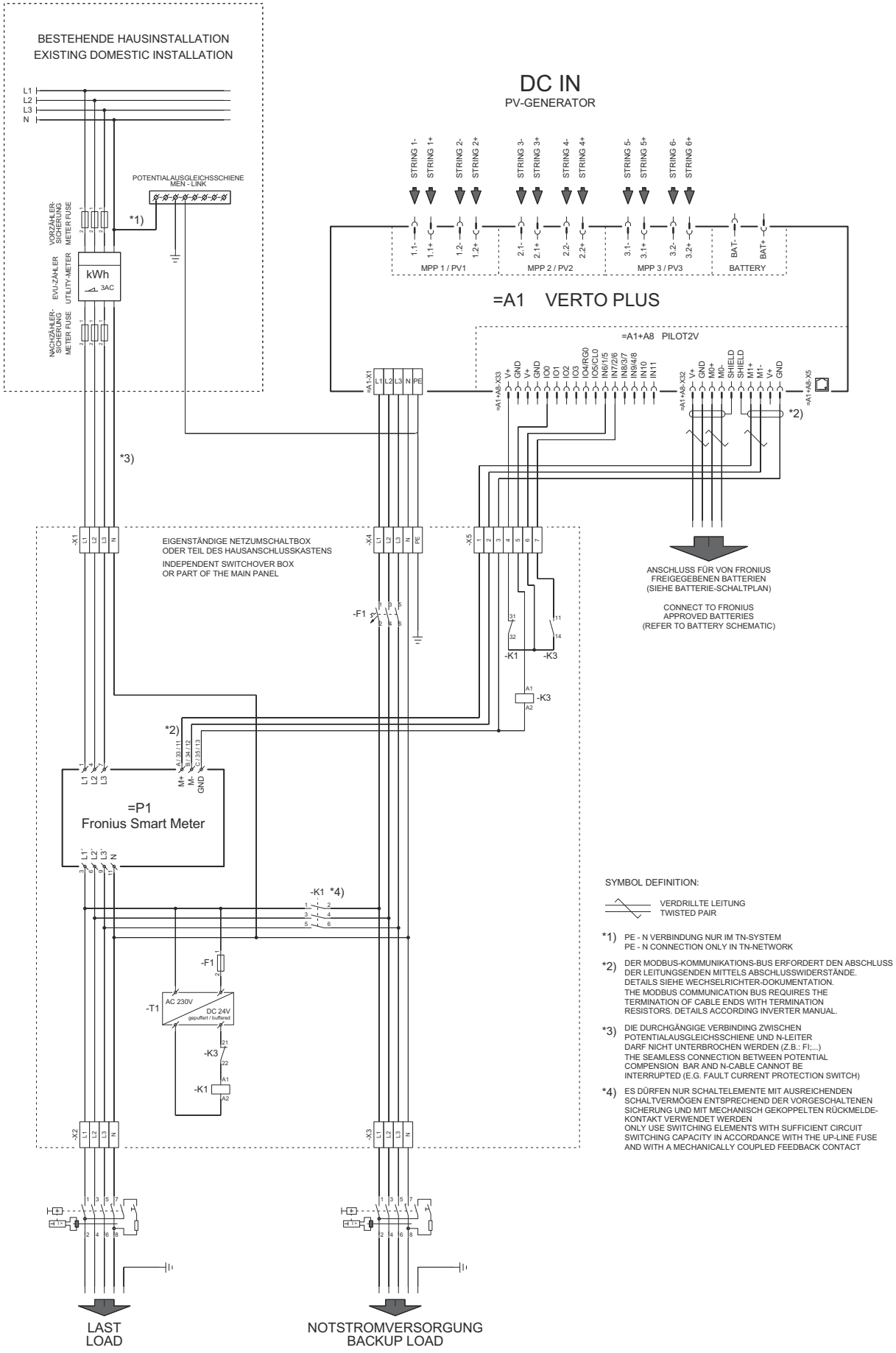
connection area at BCU´s:

PIN#	1	2	3	4	5	6	7	8
CAN/RS485	CANH	CANL	EN_GND	EN	12V IN	12V IN_GND	RS485B	RS485A
CAN	CANH	CANL	EN_GND	EN	12V OUT	12V OUT_GND	12V IN	12V IN_GND
RS485	RS485A	RS485B	EN_GND	EN	12V OUT	12V OUT_GND	12V IN	12V IN_GND

*

The ferrite cores -Z1 to -Z8 are only mandatory for storage installations in Italy!
Certified ferrites for DC connection path: -Z1 to -Z3: WE742-712-21, manufacturer: Würth
Certified ferrites for communication connection: -Z4 to -Z8: WE742-711-12, manufacturer: Würth

Automatic switch to backup power 3-pin single FRT-capable separation - e.g., Austria



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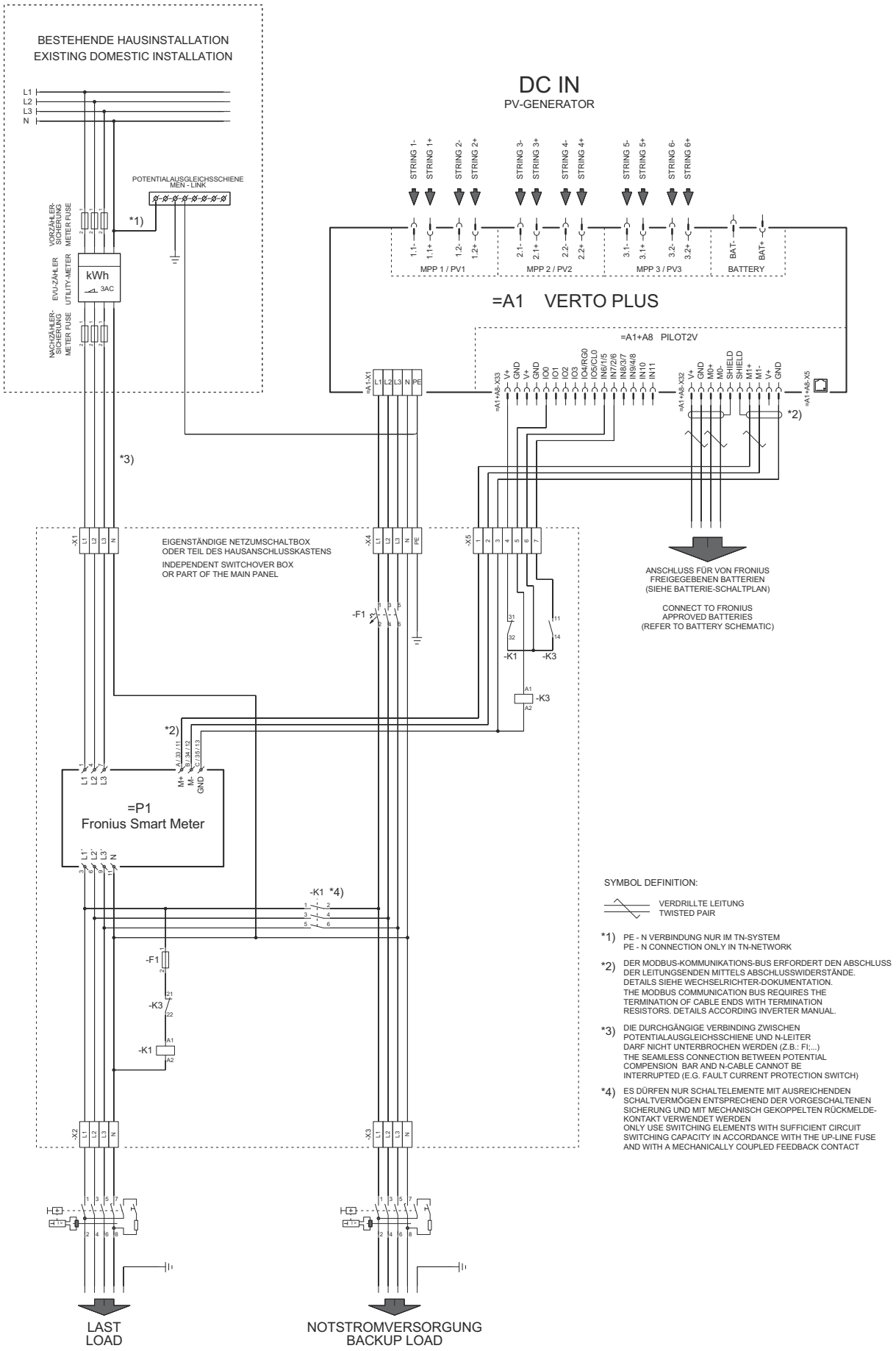
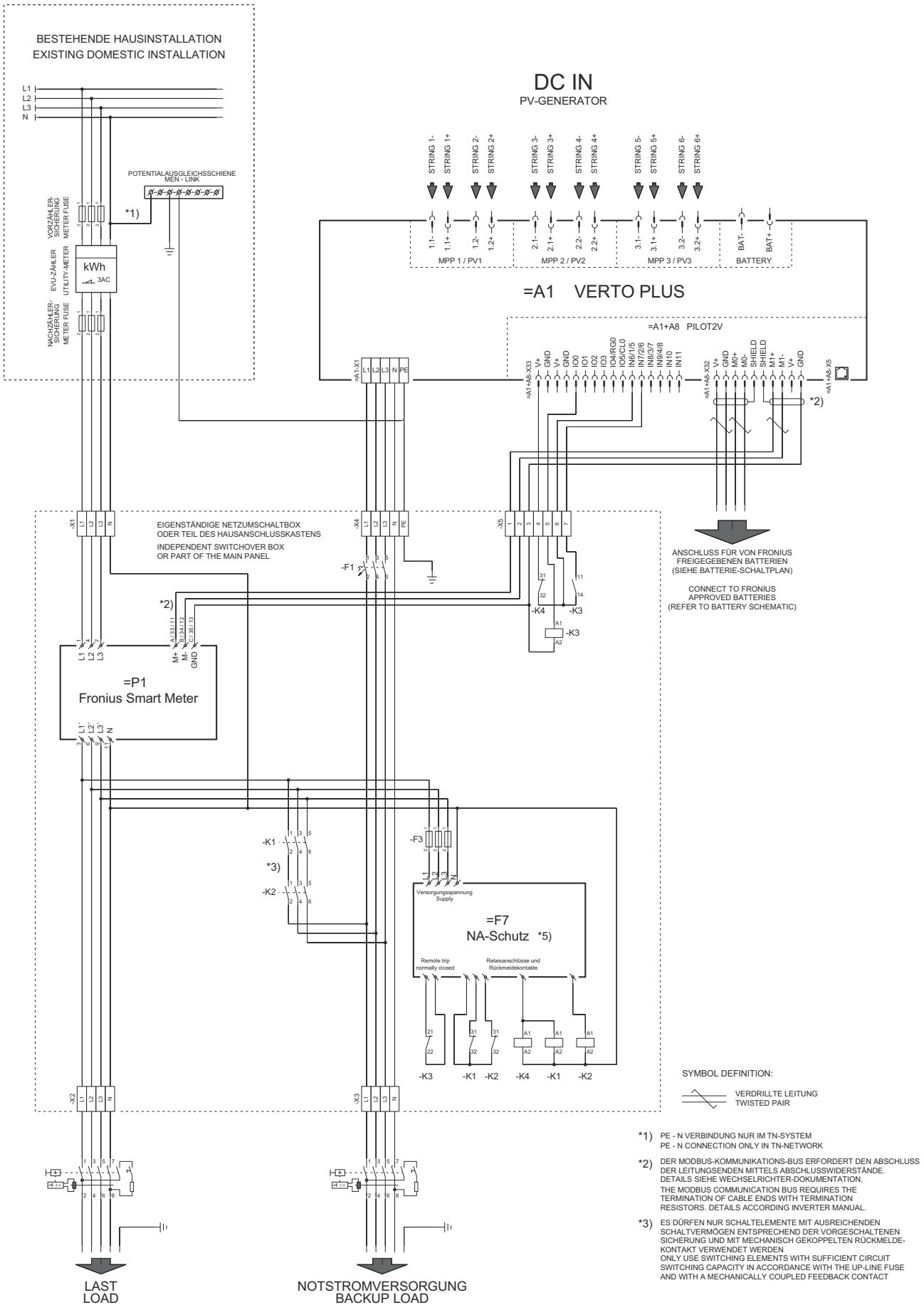


Automatic switch to backup power 3-pin double separation with ext. grid and system protection



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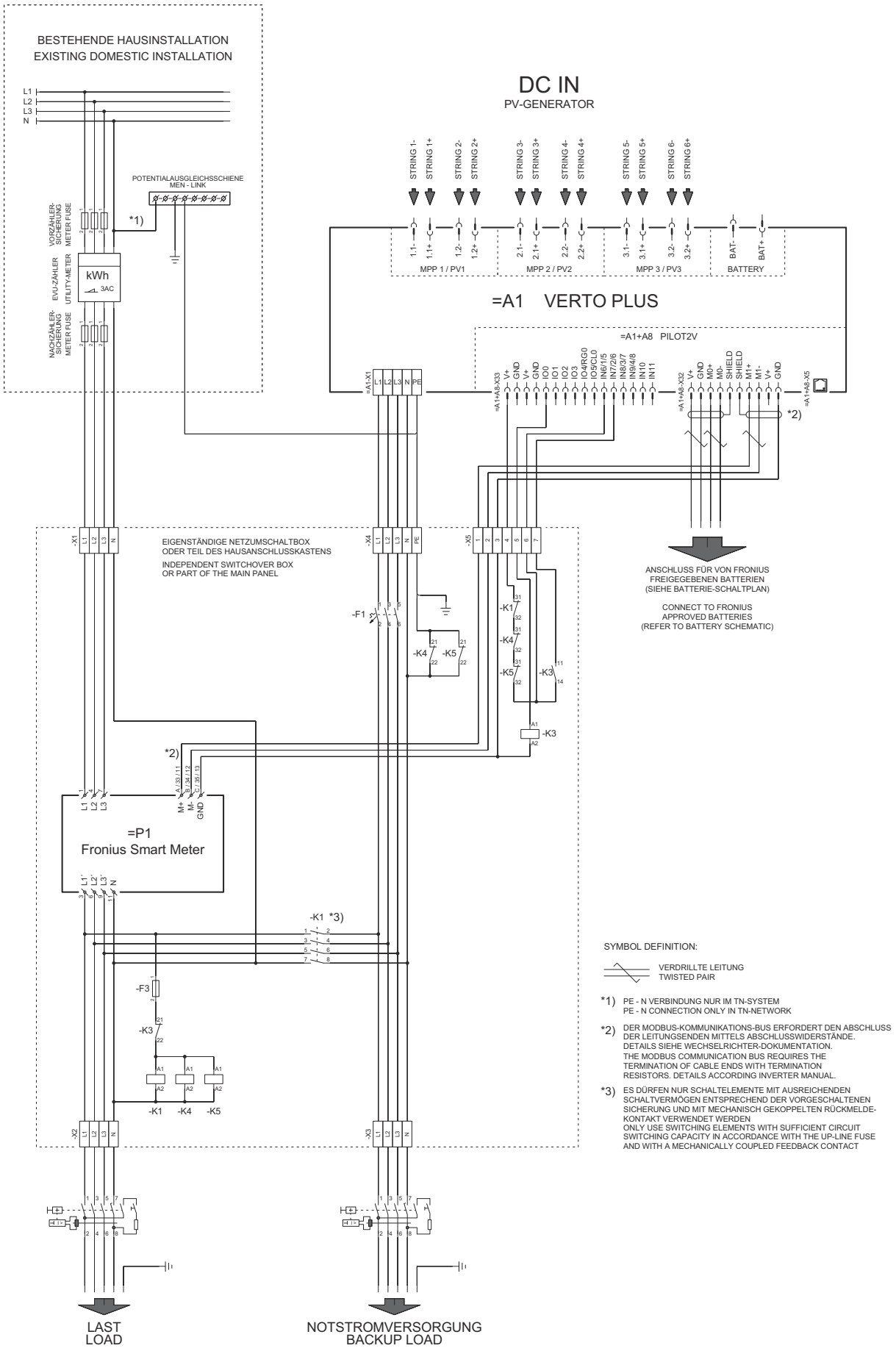
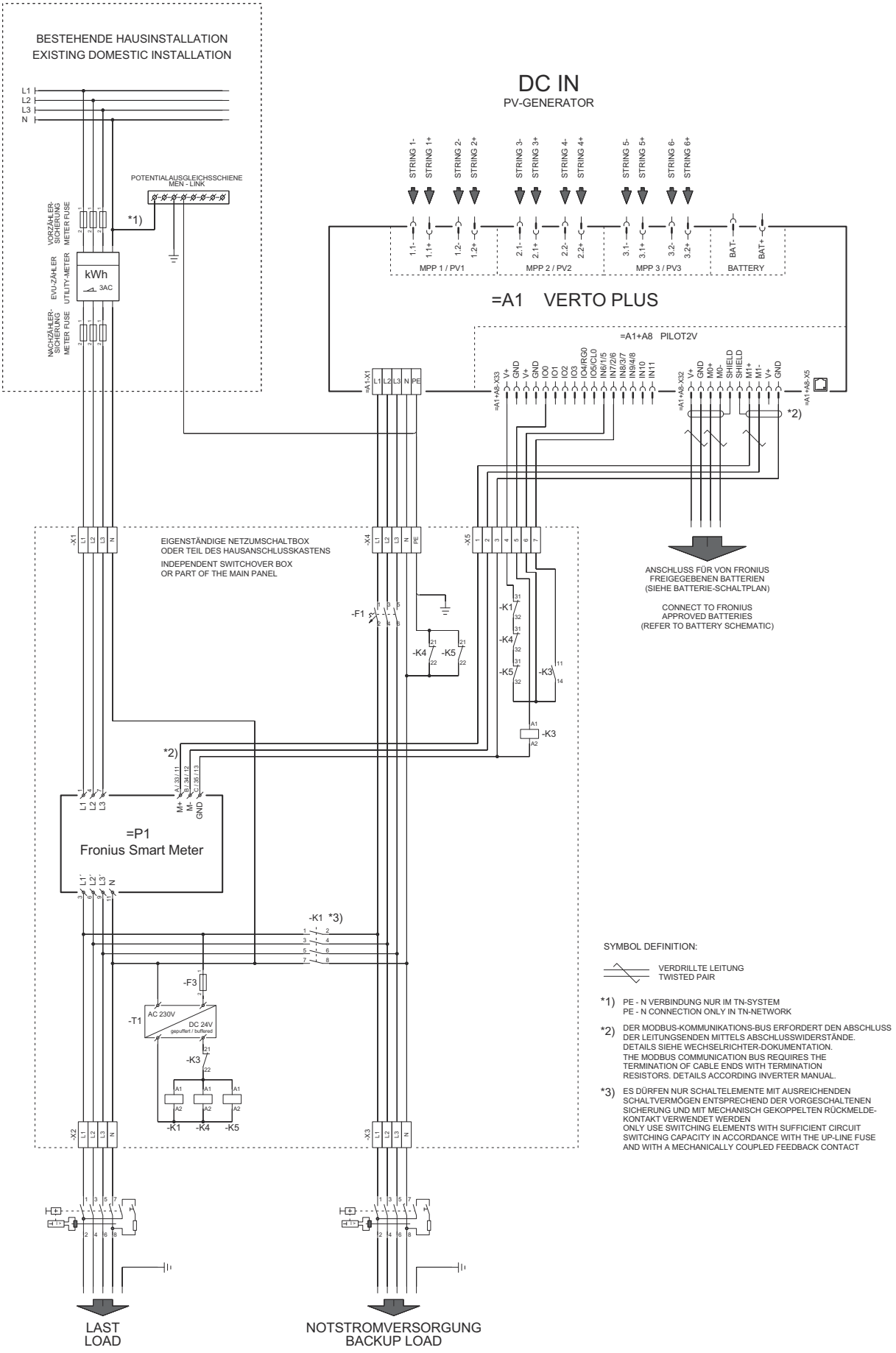
ONLY USE SWITCHING ELEMENTS WITH SUFFICIENT CIRCUIT SWITCHING CAPACITY IN ACCORDANCE WITH THE UP-LINE FUSE AND WITH A MECHANICALLY COUPLED FEEDBACK CONTACT

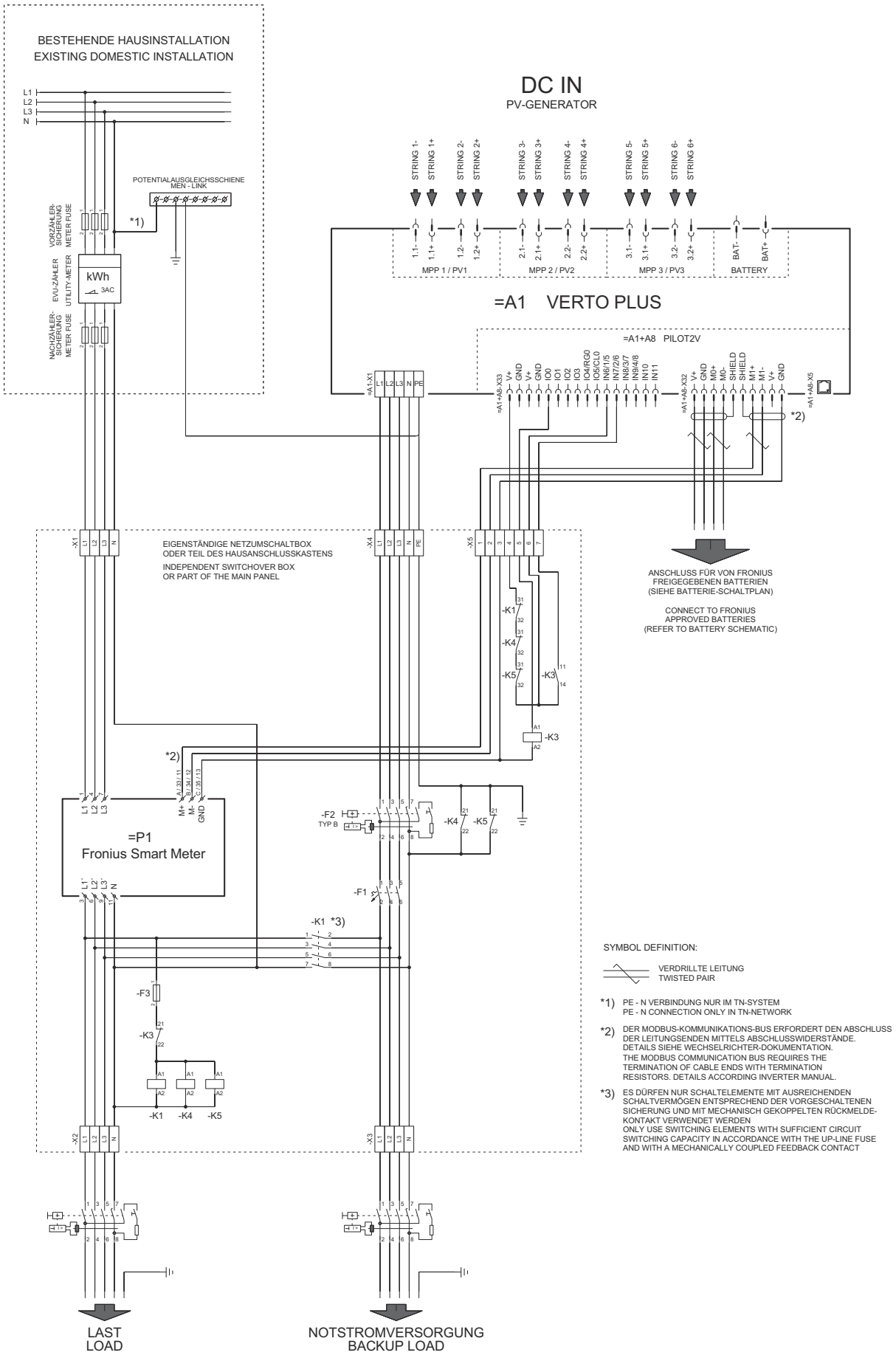
Automatic switch to backup power 4-pin single separation - e.g., Germany



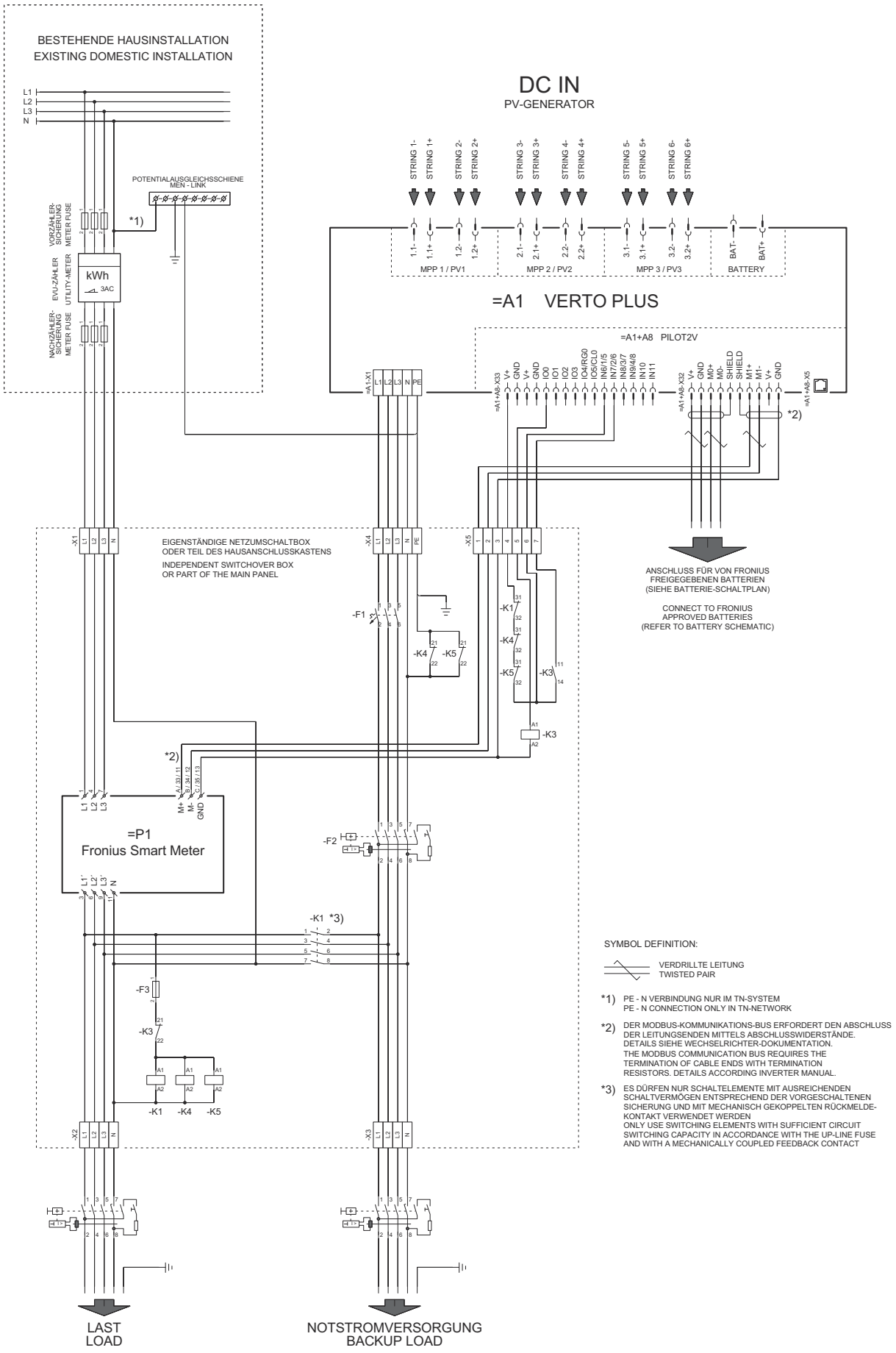
Automatic switch to backup power 4-pin single FRT-capable separation



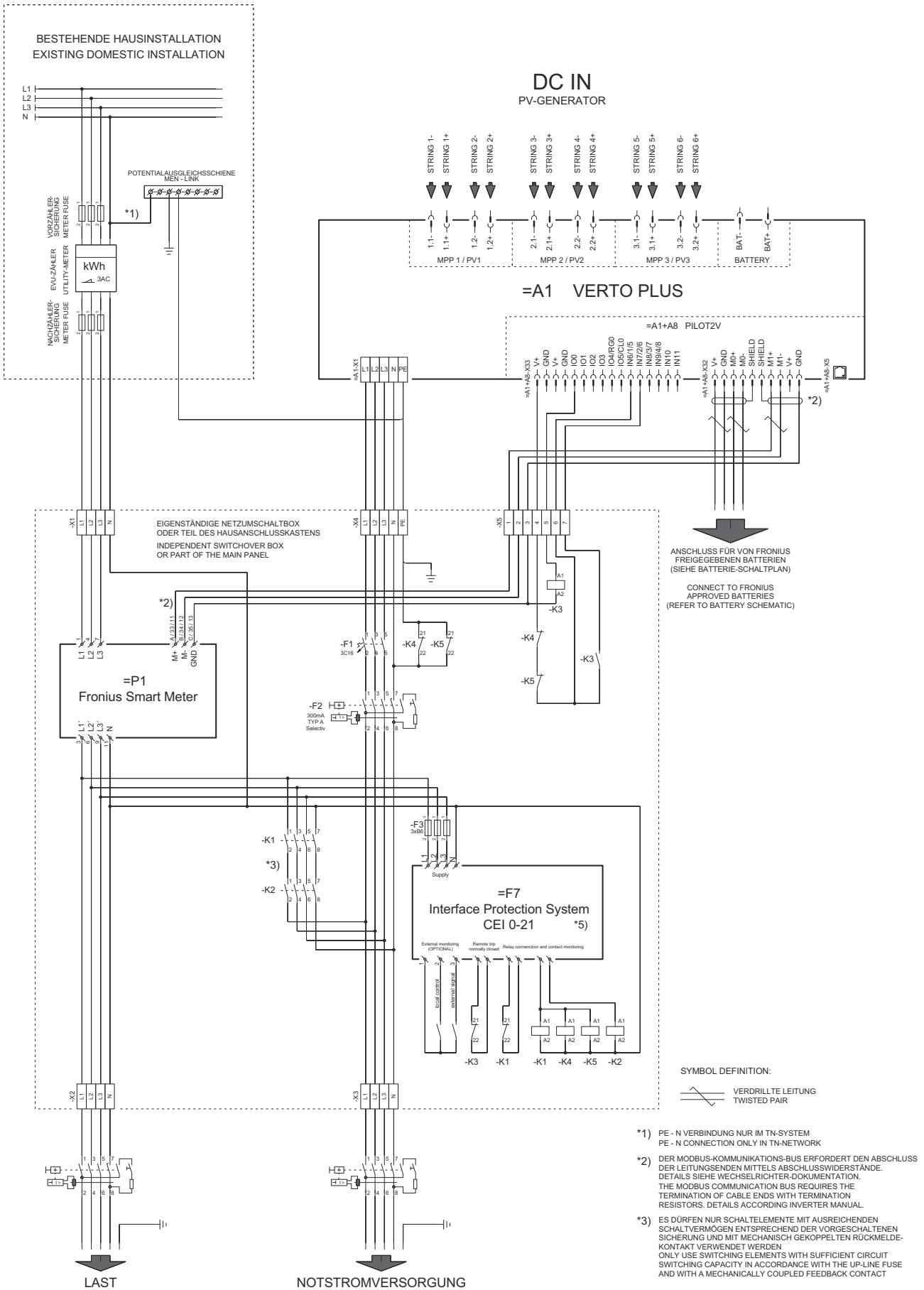
Automatic switch to backup power 4-pin single separation - e.g., France



Automatic switch to backup power 4-pin single separation - e.g., Spain



Automatic switch to backup power 4-pin double separation with ext. grid and system protection - e.g., Italy



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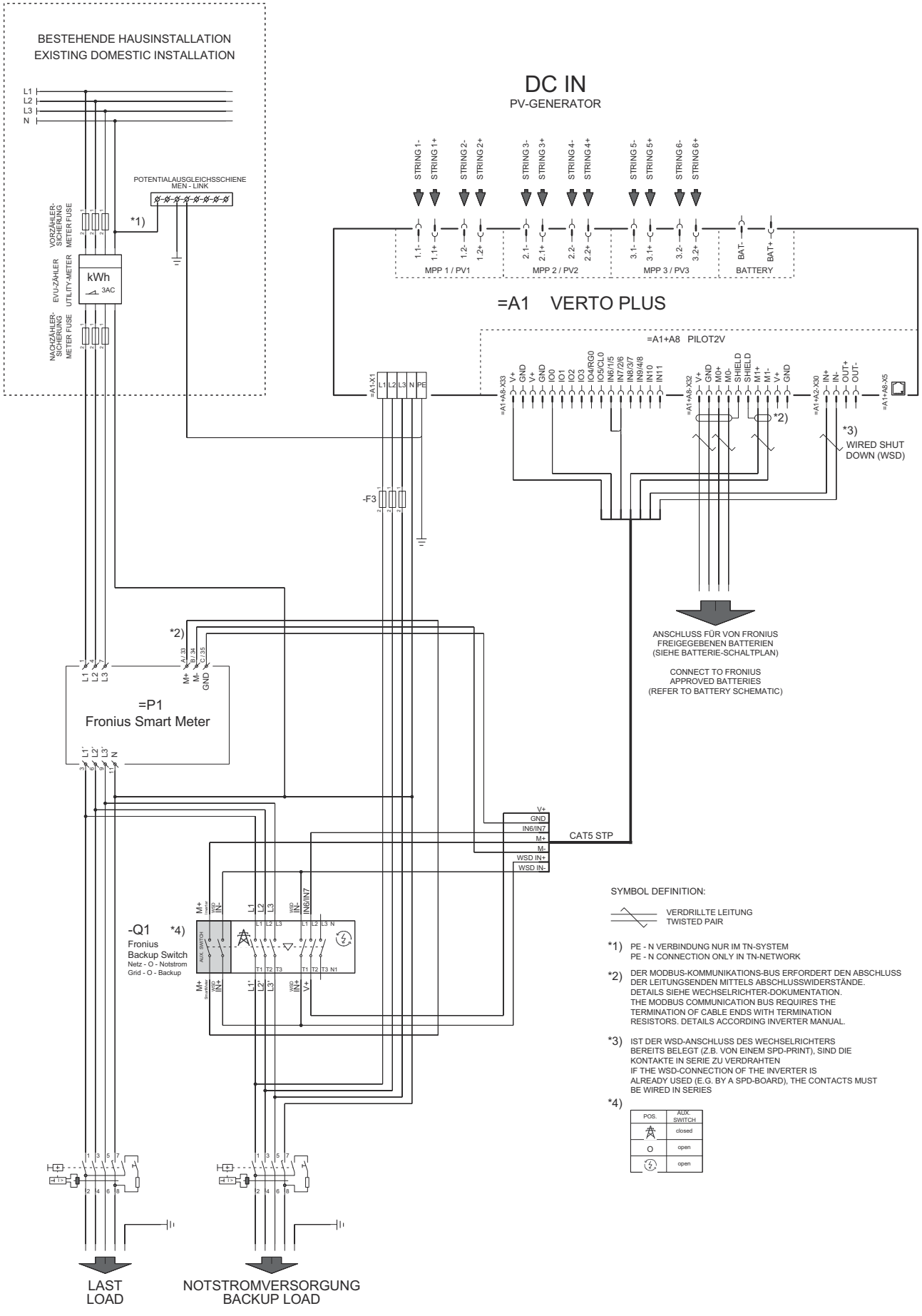
Manual switch to backup power 3-pin separation, e.g., Austria



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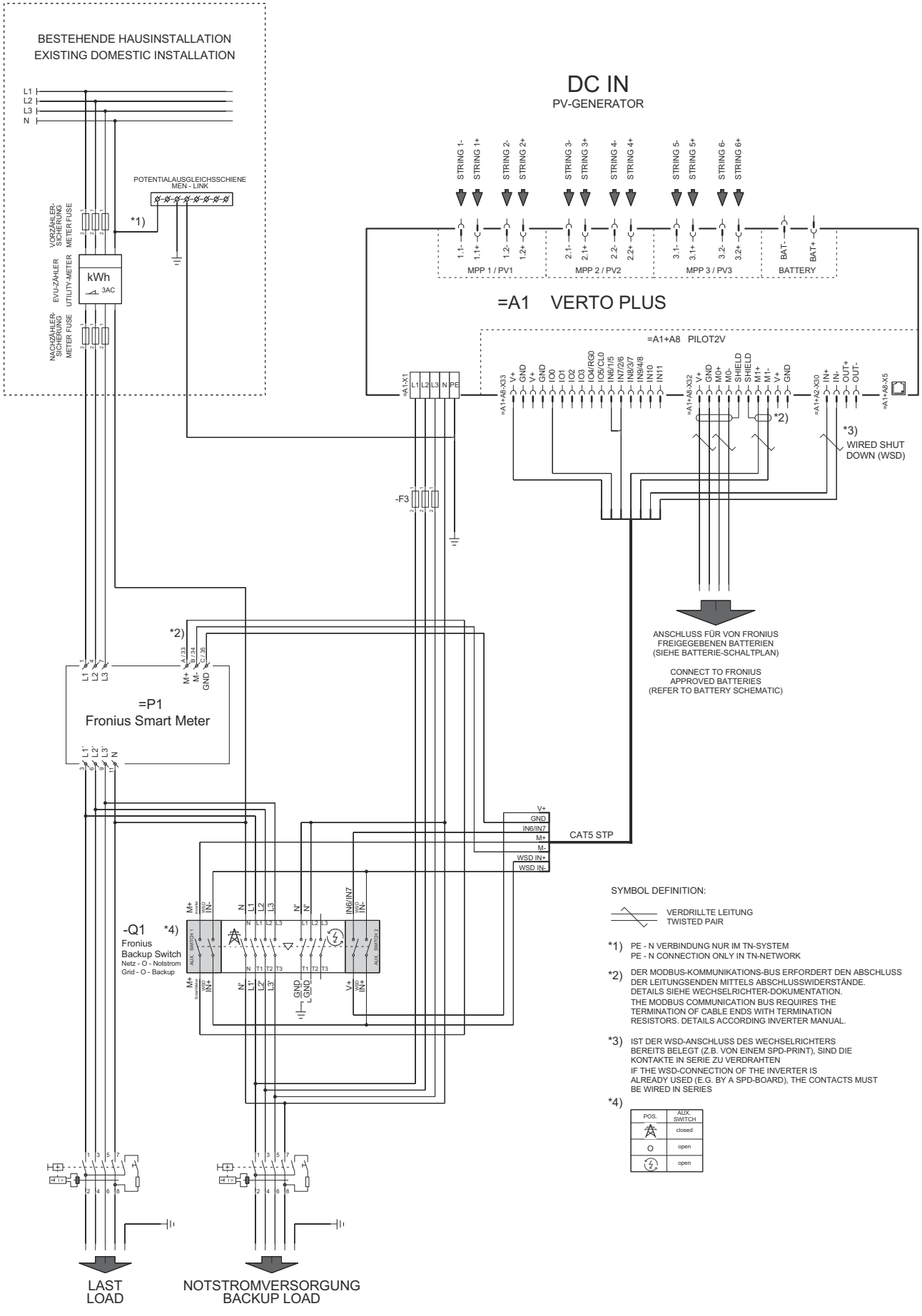
*3) IST DER WSD-ANSCHLUSS DES WECHSELRICHTERS BEREITS BELEGT (Z.B. VON EINEM SPD-PRINT), SIND DIE KONTAKTE IN SERIE ZU VERDRAHTEN
IF THE WSD-CONNECTION OF THE INVERTER IS ALREADY USED (E.G. BY A SPD-BOARD), THE CONTACTS MUST BE WIRED IN SERIES

*4)

POS.	AUX. SWITCH
	closed
O	open
	open

Manual switch to backup power 4-pin separation, e.g., Germany



Fronius International GmbH
Froniusstraße 1
4643 Pettenbach
Austria
contact@fronius.com
www.fronius.com

At www.fronius.com/contact you will find the contact details of all Fronius subsidiaries and Sales & Service Partners.