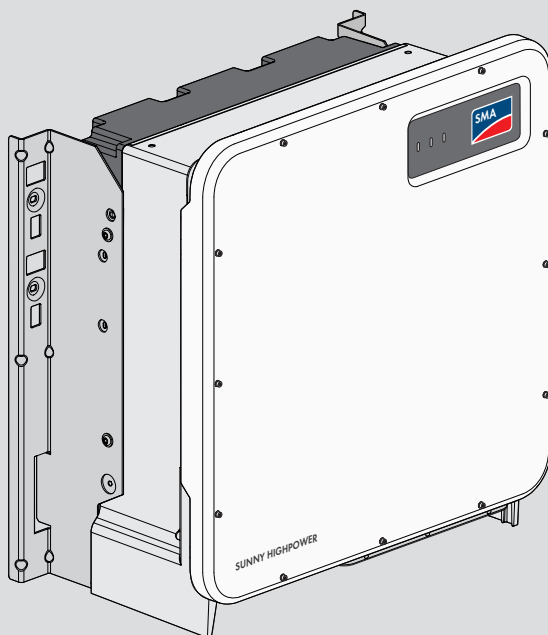


Operating manual

SUNNY HIGHPOWER PEAK3

SHP 125-US-20 / SHP 150-US-20



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You can download the current warranty conditions from the Internet at www.SMA-Solar.com.

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The licenses for the installed software modules (open source) can be found in the user interface of the product.

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1 Information on this Document

1.1 Validity

This document is valid for:

- SHP 125-US-20 (Sunny Highpower PEAK3)
- SHP 150-US-20 (Sunny Highpower PEAK3)

1.2 Target Group

This document is intended for qualified persons and end users. Only qualified persons are allowed to perform the activities marked in this document with a warning symbol and the caption "Qualified person". Tasks that do not require any particular qualification are not marked and can also be performed by end users. Qualified persons must have the following skills:

- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing, repairing and using electrical devices and installations
- Training in the installation and commissioning of electrical devices and installations
- Knowledge of all applicable laws, standards and directives
- Knowledge of and compliance with this document and all safety information

1.3 Content and Structure of this Document

This document describes the mounting, installation, commissioning, configuration, operation, troubleshooting and decommissioning of the product as well as the operation of the product user interface.

You will find the latest version of this document and further information on the product in PDF format and as eManual at www.SMA-Solar.com. You can also call up the eManual via the user interface of the product.

Illustrations in this document are reduced to the essential information and may deviate from the real product.

1.4 Levels of Warning Messages

The following levels of warning messages may occur when handling the product.

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.





CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, can result in property damage.

1.5 Symbols in the Document

Symbol	Explanation
	Information that is important for a specific topic or goal, but is not safety-relevant
<input type="checkbox"/>	Indicates a requirement for meeting a specific goal
<input checked="" type="checkbox"/>	Desired result
	A problem that might occur
	Example
	Sections describing activities to be performed by qualified persons only

1.6 Typographical Elements in the Document

Typography	Use	Example
bold	<ul style="list-style-type: none"> Messages Terminals Elements on a user interface Elements to be selected Elements to be entered 	<ul style="list-style-type: none"> Connect the insulated conductors to the terminals X703:1 to X703:6. Enter 10 in the field Minutes.
>	<ul style="list-style-type: none"> Connects several elements to be selected 	<ul style="list-style-type: none"> Select Settings > Date.
[Button] [Key]	<ul style="list-style-type: none"> Button or key to be selected or pressed 	<ul style="list-style-type: none"> Select [Enter].
#	<ul style="list-style-type: none"> Placeholder for variable components (e.g., parameter names) 	<ul style="list-style-type: none"> Parameter WCtlHz.Hz#

1.7 Designations in the Document

Complete designation	Designation in this document
Sunny Highpower PEAK3	Sunny Highpower, inverter, product

1.8 Additional Information

For more information, please go to www.SMA-Solar.com.

Title and information content	Type of information
"Application for SMA Grid Guard Code"	Form
"PUBLIC CYBER SECURITY - Guidelines for a Secure PV System Communication"	Technical information
"Grid Support Utility Interactive Inverters" Information about how to activate and to set the grid supporting features according to UL 1741 SA	Technical Information
"Efficiency and Derating" Efficiency and derating behavior of the SMA inverters	Technical Information
"Parameters and Measured Values" Overview of all inverter operating parameters and their configuration options	Technical Information
"SMA and SunSpec Modbus® Interface" Information on the Modbus interface	Technical Information
"Modbus® parameters and measured values" Device-specific list of the Modbus register	Technical Information
"SMA SPEEDWIRE FIELDBUS"	Technical information
"Temperature Derating"	Technical Information
Important Requirements for Medium-Voltage Transformers Requirements for Medium-Voltage Transformers	Technical Information

2 Safety

2.1 Intended Use

The Sunny Highpower is a transformerless PV inverter. It converts the direct current from the PV array into grid-compliant three-phase current and feeds it into the utility grid via a separate transformer.

The product is intended for use in commercial, industrial or business sectors.

The product is suitable for operation in a chemically active environment in accordance with IEC 60721-3-4 as per Class 4C2.

The product is suitable for indoor and outdoor use.

The product must only be operated with PV modules of protection class II in accordance with IEC 61730, application class A. The PV modules must be compatible with this product.

The product must only be operated with PV arrays (PV modules and cabling) that are approved by the electrical standards applicable on-site and the *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1.

The product may only be operated in connection with a suitable medium-voltage transformer. The low-voltage side must be configured in a star formation and the neutral point must be grounded (for information about the requirements of the medium-voltage transformer, consult the technical information "Important Requirements for Medium-Voltage Transformers" under www.SMA-Solar.com).

No galvanic isolation

The product is not equipped with a transformer and therefore has no galvanic isolation.

- Do not operate grounded PV modules together with the product. If grounded PV modules are connected to the product, an event will occur. The event will be displayed, along with the associated message, in the event list on the user interface of the product.
- Only ground the mounting frames of the PV modules.

PV modules with a high capacity to ground may only be used if their coupling capacity does not exceed 32 μF .

To protect the PV system against excessive reverse currents under fault conditions, a DC-side overcurrent protective device must be connected in accordance with the *National Electrical Code*® to prevent any short-circuit currents that exceed the ampacity of the DC electric circuit or the maximum series fuse rating of the PV modules. Typically, string fuses are used if more than two strings are connected in parallel.

All components must remain within their permitted operating ranges and their installation requirements at all times.

The product is approved for the US and Canadian market.

Use SMA products only in accordance with the information provided in the enclosed documentation and with the locally applicable laws, regulations, standards and directives. Any other application may cause personal injury or property damage.

Alterations to SMA products, e.g., changes or modifications, are only permitted with the express written permission of and according to the instructions from SMA Solar Technology AG. Unauthorized alterations can be dangerous and lead to personal injury. In addition, an unauthorized alteration will void guarantee and warranty claims and in most cases terminate the operating license. SMA Solar Technology AG shall not be held liable for any damage caused by such changes.

Any use of the product other than that described in the Intended Use section does not qualify as the intended use.

The enclosed documentation is an integral part of this product. Keep the documentation in a convenient, dry place for future reference and observe all instructions contained therein.

This document does not replace and is not intended to replace any local, state, provincial, federal or national laws, regulations or codes applicable to the installation, electrical safety and use of the product. SMA Solar Technology AG assumes no responsibility for the compliance or non-compliance with such laws or codes in connection with the installation of the product.

The type label must remain permanently attached to the product.

2.2 IMPORTANT SAFETY INSTRUCTIONS

Keep the manual for future reference.

This section contains safety information that must be observed at all times when working.

The product has been designed and tested in accordance with international safety requirements. As with all electrical or electronic devices, there are residual risks despite careful construction. To prevent personal injury and property damage and to ensure long-term operation of the product, read this section carefully and observe all safety information at all times.

DANGER

Danger to life due to electric shock when live components or DC cables are touched

When exposed to light, the PV modules generate high DC voltage which is present in the DC cables. Touching live DC cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Install external DC load-break switch (e.g., a PV junction box including a load-break switch) between the inverter and PV array.
- Disconnect the PV array from the inverter via an external DC load-break switch (e.g. via a PV junction including a load-break switch). Switch off and secure the DC load-break switch against reconnection.
- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- Wear suitable personal protective equipment for all work on the product.

⚠ DANGER**Danger to life due to electric shock from touching an ungrounded PV module or array frame**

Touching ungrounded PV modules or array frames results in death or lethal injuries due to electric shock.

- Connect and ground the frame of the PV modules, the array frame and the electrically conductive surfaces so that there is continuous conduction. Observe the applicable local regulations.

⚠ DANGER**Danger to life due to electric shock when touching live system components in case of a ground fault**

If a ground fault occurs, parts of the system may still be live. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- Only touch the cables of the PV modules on their insulation.
- Do not touch any parts of the substructure or frame of the PV array.
- Do not connect PV strings with ground faults to the inverter.
- Ensure that no voltage is present and wait five minutes before touching any parts of the PV system or the product.

⚠ DANGER**Danger to life due to electric shock in case of overvoltages and if surge protection is missing**

Overvoltages (e. g. in the event of a flash of lightning) can be further conducted into the building and to other connected devices in the same network via the network cables or other data cables if there is no surge protection. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Ensure that all devices in the same network are integrated in the existing overvoltage protection.
- When laying the network cable outdoors, ensure that there is suitable surge protection at the network cable transition from the product outdoors to the network inside the building.
- The Ethernet interface of the product is classified as "TNV-1" and offers protection against overvoltages of up to 1.5 kV.

⚠ WARNING**Danger to life due to fire or explosion**

In rare cases, an explosive gas mixture can be generated inside the product under fault conditions. In this state, switching operations can cause a fire inside the product or explosion.

Death or lethal injuries due to hot or flying debris can result.

- In the event of a fault, do not perform any direct actions on the product.
- Ensure that unauthorized persons have no access to the product.
- Disconnect the PV array from the inverter via an external disconnection device. If there is no disconnecting device present, wait until no more DC power is applied to the inverter.
- Disconnect the AC circuit breaker, or keep it disconnected in case it has already tripped, and secure it against reconnection.
- Only perform work on the product (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).

⚠ WARNING**Risk of injury due to toxic substances, gases and dusts.**

In rare cases, damages to electronic components can result in the formation of toxic substances, gases or dusts inside the product. Touching toxic substances and inhaling toxic gases and dusts can cause skin irritation, burns or poisoning, trouble breathing and nausea.

- Only perform work on the product (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).
- Ensure that unauthorized persons have no access to the product.

⚠ WARNING**Danger to life due to fire when failing to observe torque specifications on live bolted connections**

Failure to follow the specified torques reduces the ampacity of live bolted connections and the contact resistances increase. This can cause components to overheat and catch fire. Death or lethal injuries can result.

- Ensure that live bolted connections are always tightened with the exact torque specified in this document.
- Only use suitable tools when working on the device.
- Avoid repeated tightening of live bolted connections as this may result in inadmissibly high torques.

⚠ WARNING**Danger to life due to electric shock from destruction of the measuring device due to overvoltage**

Overvoltage can damage a measuring device and result in voltage being present in the enclosure of the measuring device. Touching the live enclosure of the measuring device results in death or lethal injuries due to electric shock.

- Only use measuring devices with a measurement ranges designed for the maximum AC and DC voltage of the inverter.

⚠ CAUTION**Risk of burns due to hot enclosure parts**

Some parts of the enclosure can get hot during operation. Touching hot enclosure parts can result in burn injuries.

- During operation, do not touch any parts other than the enclosure lid of the inverter.
- Wait until the inverter has cooled down before touching the enclosure.

⚠ CAUTION**Risk of injury due to weight of product**

Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

- Transport and lift the product carefully. Take the weight of the product into account.
- Wear suitable personal protective equipment for all work on the product.
- Transport the product using the carrying handles or hoist. Take the weight of the product into account.
- Use all carrying handles provided during transport with carrying handles.
- Do not use the carrying handles as attachment points for hoist equipment (e.g. straps, ropes, chains). Insert eye bolts into threads provided on top of the product to attach the hoist system.

NOTICE**Damage to the enclosure seal in subfreezing conditions**

If you open the product when temperatures are below freezing, the enclosure seals can be damaged. Moisture can penetrate the product and damage it.

- Only open the product if the ambient temperature is not below -5°C (23°F).
- If a layer of ice has formed on the enclosure seal when temperatures are below freezing, remove it prior to opening the product (e.g. by melting the ice with warm air).

NOTICE**Damage to the product due to sand, dust and moisture ingress**

Sand, dust and moisture penetration can damage the product and impair its functionality.

- Only open the product if the humidity is within the thresholds and the environment is free of sand and dust.
- Do not open the product during a dust storm or precipitation.
- Close tightly all enclosure openings.
- Only use listed rain-tight or liquid-tight conduit fittings to attach the conduits to the product.

NOTICE**Damage to the inverter due to electrostatic discharge**

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Ground yourself before touching any component.

NOTICE**Damage to the inverter due to switching operations on the transformer**

If voltages are present in the inverter, switching operations on the transformer can lead to large fluctuations in the voltage in the inverter. Large fluctuations in voltage can damage components in the inverter.

- Disconnect the inverter from voltage sources before performing any switching operations on the transformer.

NOTICE**Damage to the product due to cleaning agents**

The use of cleaning agents may cause damage to the product and its components.

- Clean the product and all its components only with a cloth moistened with clear water.

i Electrical installations (for North America)

All installations must conform with the laws, regulations, codes and standards applicable in the jurisdiction of installation (e.g. *National Electrical Code*® ANSI/NFPA 70 or *Canadian Electrical Code*® CSA-C22.1.).

- Before connecting the product to the utility grid, contact your local grid operator. The electrical connection of the product must be carried out by qualified persons only.
- Ensure that the cables or conductors used for electrical connection are not damaged.

3 Scope of Delivery

Check the scope of delivery for completeness and any externally visible damage. Contact your distributor if the scope of delivery is incomplete or damaged.

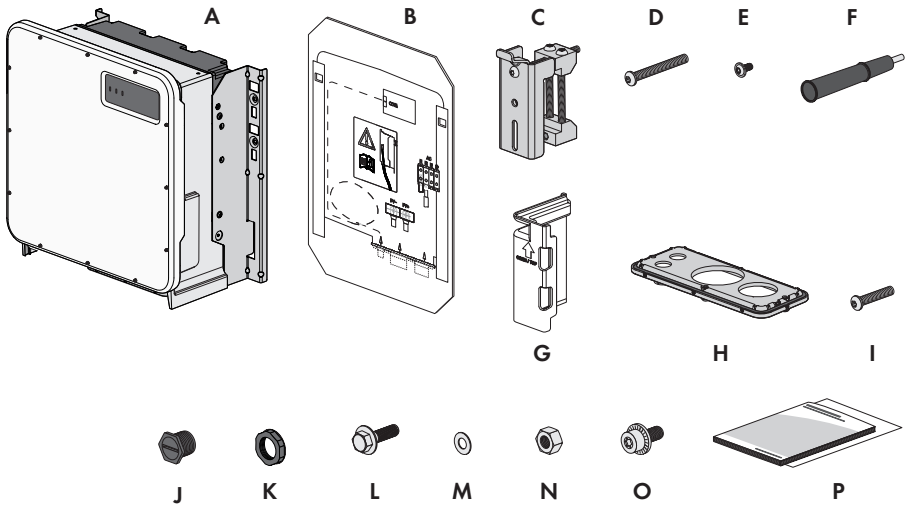


Figure 1: Components included in the scope of delivery

Position	Quantity	Designation
A	1	Inverter
B	1	Mounting template
C	2	Mounting bracket
D	2	Button head screw M8x105
E	2	Button head screw M8x16
F	4	Carry handle
G	4	Touch protection for DC connection
H	1	Connecting plate
I	3	Button head screw M8x70
J	1	Sealing plug (21 mm (0.75 in))
K	1	Counter nut for sealing plug (21 mm (0.75 in))
L	2	M10x40 combination hexagon head screw
M	2	Washer M10
N	2	Hexagon nut M10

Position	Quantity	Designation
O	2	M6x16 combined screw
P	1	Quick reference guide, production test report, supplementary sheet with the default settings

4 Additionally Required Materials and Equipment

Material or equipment	Quantity	Explanation
Profile rail (length: min. 770 mm (30.3 in), depth: max. 60 mm (2.4), height: 50 mm to 80 mm (2 in to 3 in))	2	For mounting the product
Conduit (trade size: 76.2 mm (3 in) or smaller with suitable reducer bush) for the DC connection	1	Only necessary if DC cables must be laid in one conduit
Raintight or liquidtight conduit fitting (trade size: 76.2 mm (3 in) or smaller with suitable reducer bush) for DC connection	1	Only necessary if DC cables must be laid in one conduit
Conduit (trade size: 63.5 mm (2.5 in) or smaller with suitable reducer bush) for DC connection	1	Only necessary if AC cables must be laid in one conduit
Raintight or liquidtight conduit fitting (trade size: 63.5 mm (2.5 in) or smaller with suitable reducer bush) for AC connection	1	Only necessary if AC cables must be laid in one conduit
Conduit (trade size: 19.05 mm (0.75 in) or smaller with suitable reducer bush) for network connection	1	Only necessary if network cables must be laid in one conduit
Raintight or liquidtight conduit fitting (trade size: 19.05 mm (0.75 in) or smaller with suitable reducer bush) for network connection	1	Only necessary if network cables must be laid in one conduit
Terminal lugs (flange hole: M10)	2	Used for positive and negative DC cable
Terminal lugs (flange hole: M6)	1	Used for equipment grounding conductor
RJ45 plugs, field assembly	1-2	Only required if the network cables are not equipped with RJ45 plugs
Means of transport (e.g. pallet truck)	1	Used to transport packed product to mounting location
Eye bolt (M10)	2	Only required if the product is to be transported with a hoist
Hoist	1	Only required if the product is to be transported with a hoist
Utility knife	1	Used to unpack the product
Torx screwdriver (TX25)	1	Used to attach and remove transport handles and enclosure lid

Material or equipment	Quantity	Explanation
Torx screwdriver (TX40)	1	Used to attach mounting brackets, inverters to mounting brackets, connecting plate to inverter; used to connect equipment grounding conductor of PV array
Allen key (AF5)	1	Used for connecting grounding conductor
Allen key (AF8)	1	Used for connecting L1, L2 an L3
Measuring device with a measurement range designed for the maximum AC and DC voltage of the inverter	1	For verifying that no voltage is present
Current clamp	1	For verifying that no voltage is present
Press tool	1	Used to attach terminal lugs to DC cables
Clean cloth	1	Used to clean terminal lugs
Ethanol cleaning agent	1	Used to clean terminal lugs
Brush	1	Used to clean aluminum conductor (only necessary if cable is made of aluminum)
Protective grease	1	Used to apply to aluminum conductor (only necessary if cable is made of aluminum)

5 Product Overview

5.1 Product Description

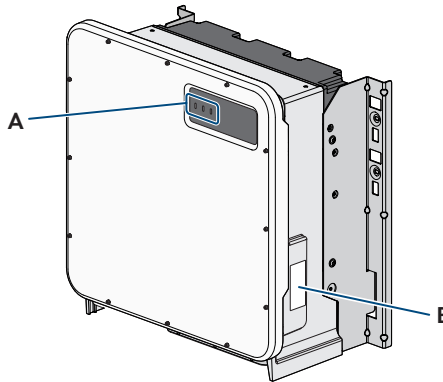










Figure 2: Design of the product

Position	Designation
A	<p>LEDs</p> <p>The LEDs indicate the operating state of the product.</p>
B	<p>Type label</p> <p>The type label clearly identifies the product. The type label must remain permanently attached to the product. You will find the following information on the type label:</p> <ul style="list-style-type: none"> • Device type (Model) • Serial number (Serial No. or S/N) • Date of manufacture • Device-specific characteristics

5.2 Symbols on the Product

Symbol	Explanation
	<p>Beware of electrical voltage</p> <p>The product operates at high voltages.</p>
	<p>Beware of hot surface</p> <p>The product can get hot during operation.</p>

Symbol	Explanation
	Observe the documentation Observe all documentation supplied with the product.
	Inverter Together with the green LED, this symbol indicates the operating state of the inverter.
	Observe the documentation Together with the red LED, this symbol indicates an error.
	Data transmission Together with the blue LED, this symbol indicates the status of the network connection.
	FCC designation The product complies with the requirements of the applicable FCC standards.
	UL 62109-1 and CAN/CSA-C22.2 No. 62109-1:16 are the standards applied by Underwriters Laboratories to the product to certify that it meets the requirements of the <i>National Electrical Code</i> [®] , the <i>Canadian Electrical Code</i> [®] and IEEE 1547.

5.3 Interfaces and Functions

The inverter can be equipped or retrofitted with the following interfaces and functions:

User interface for configuration and monitoring

The product is equipped as standard with an integrated webserver, which provides a user interface for configuring and monitoring the product.

The product user interface can be called up via the web browser if there is an existing connection to an end device (e.g. computer, tablet PC or smartphone).

Smart Inverter Screen

The Smart Inverter Screen enables you to view the status display and to display the current power and consumption on the user interface login page. This gives you an overview of the most important inverter data without having to log into the user interface.

The Smart Inverter Screen is deactivated by default. The Smart Inverter Screen can be activated via the user interface once the inverter has been commissioned.

SMA Speedwire

The product is equipped with SMA Speedwire as standard. SMA Speedwire is a type of communication based on the Ethernet standard. SMA Speedwire is designed for a data transfer rate of 100 Mbps and enables optimum communication between Speedwire devices within systems.

The products supports the encrypted system communication with SMA Speedwire Encrypted Communication. In order to be able to use the Speedwire encryption in the system, all Speedwire devices, except for the SMA Energy Meter, must support the function SMA Speedwire Encrypted Communication.

Modbus

The product is equipped with a Modbus interface. The Modbus interface is deactivated by default and must be configured as needed.

The Modbus interface of the supported SMA products is designed for industrial use – via SCADA systems, for example – and has the following tasks:

- Remote query of measured values
- Remote setting of operating parameters
- Setpoint specifications for system control

Grid Management Services

The inverter is a grid support interactive inverter.

The inverter was tested in accordance with the UL 1741 SA (2016-09-07) to be compliant with the source requirements documents of the states available at the time. For connecting the inverter to the utility grid, no additional grid monitoring equipment is necessary. A description of the tested functions and instructions on the activation and setting of functions can be found in the technical information "Grid Support Utility Interactive Inverters" at www.SMA-Solar.com.

SMA Smart Connected

SMA Smart Connected is the free monitoring of the product via the SMA Sunny Portal. Thanks to SMA Smart Connected, the operator and qualified person will be informed automatically and proactively about product events that occur.

SMA Smart Connected is activated during registration in Sunny Portal. In order to use SMA Smart Connected, it is necessary that the product is permanently connected to Sunny Portal and the data of the operator and qualified person is stored in Sunny Portal and up-to-date.

5.4 LED Signals

The LEDs indicate the operating state of the product.

LED signal	Explanation
The green LED is flashing (two seconds on and two seconds off)	Waiting for feed-in conditions The conditions for feed-in operation are not yet met. As soon as the conditions are met, the inverter will start feed-in operation.
The green LED flashes quickly	Update of central processing unit The central processing unit of the inverter is being updated.

LED signal	Explanation
The green LED is glowing	Feed-in operation The inverter feeds in with a power of at least 90%.
The green LED is pulsing	Feed-in operation The inverter is equipped with a dynamic power display via the green LED. Depending on the power, the green LED pulses fast or slow. If necessary, you can switch off the dynamic power display via the green LED.
The green LED is off	The inverter is not feeding into the utility grid.
The red LED is glowing	Event occurred If an event occurs, a distinct event message and the corresponding event number will be displayed in addition on the product user interface or in the communication product (e.g. SMA Data Manager).
The blue LED flashes slowly for approx. 1 minute	Communication connection is being established The product is establishing a connection to a local network or is establishing a direct connection to an end device via Ethernet (e.g. computer, tablet PC or smartphone).
The blue LED is glowing	Communication active There is an active connection with a local network or there is a direct connection with an end device via Ethernet (e.g. computer, tablet PC or smartphone).

6 Mounting and Preparing the Connection

6.1 Requirements for Mounting

Requirements for the mounting location:

WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires. This can result in death or serious injury.

- Do not mount the product in areas containing highly flammable materials or gases.
- Do not mount the product in potentially explosive atmospheres.

Requirements:

- Do not mount the inverter in living areas.
- The installation site can be exposed to direct solar irradiation. There is, however, the possibility that the product reduces its power output to avoid overheating due to high temperatures.
- All ambient conditions must be met (see Section 15, page 93).
- At least two profile rails must be available for mounting.
- The support surface of the frame to which the profile rails are attached should be firm and level (e.g. concrete). Non-fulfillment of these criteria may restrict servicing.

Requirements for the profile rails:

- The profile rails must be designed for the load and orientation of the inverters in the PV system. The profile rails might need to be reinforced.
- The spacing of the profile rails must be designed for the spacing of the holes in the bracket parts for the mounting bracket.
- The profile rails must be designed for the clamping range of the mounting bracket.

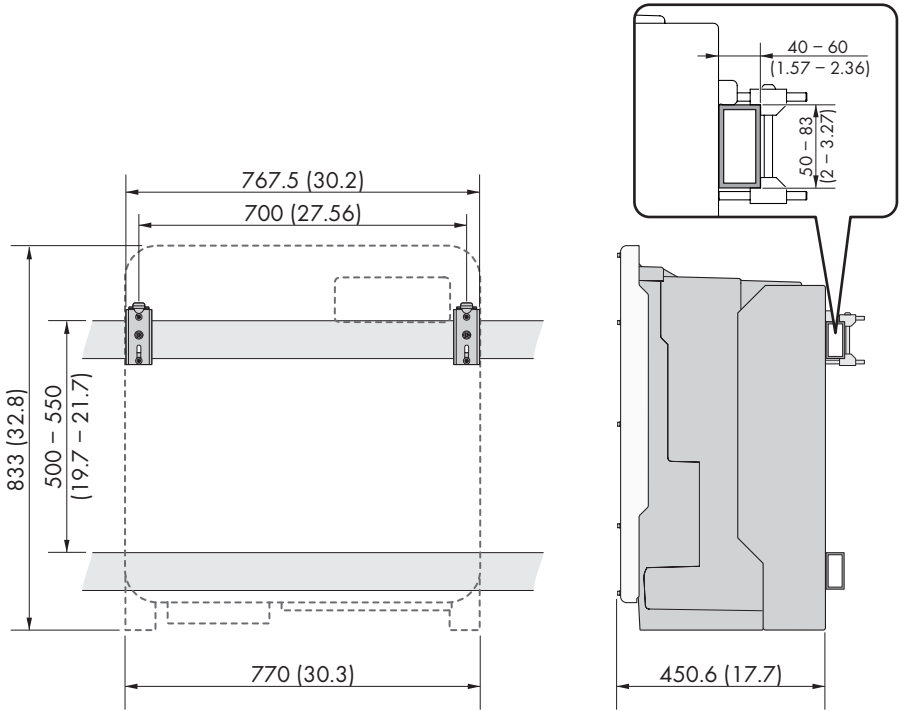


Figure 3: Dimensions of the profile rails and the clamping range of the mounting bracket (dimensions in mm (in))

Center of gravity:

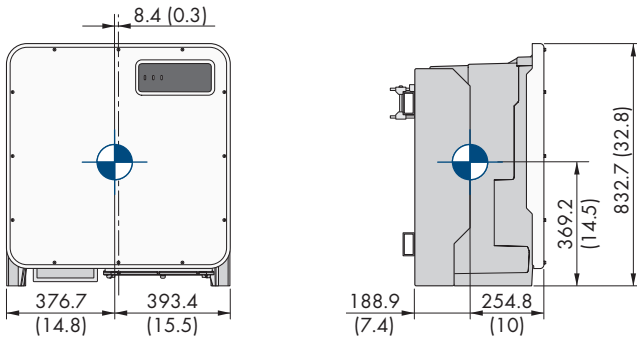


Figure 4: Dimensions of the center of gravity of the product (dimensions in mm (in))

Permitted and prohibited mounting positions:

- The product may only be mounted in a permitted position. This will ensure that no moisture can penetrate the product.
- The product should be mounted such that the LED signals can be read off without difficulty.

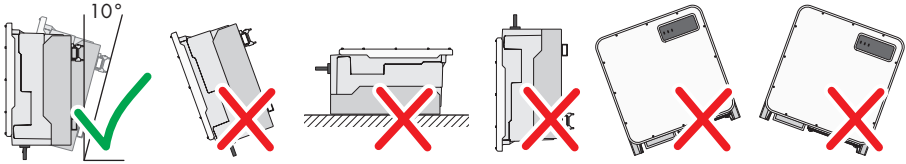


Figure 5: Permitted and prohibited mounting positions

Recommended clearances:

To guarantee optimal operation and adequate heat dissipation for the inverter, the following requirements for clearances should be observed. This will prevent the inverter power output from being reduced due to excessive temperatures. However, smaller clearances are permitted without causing any risk.

i **Prescribed clearances in accordance with the *National Electrical Code*[®] or *Canadian Electrical Code*[®] CSA C22.1**

Under certain conditions, the *National Electrical Code*[®] or the *Canadian Electrical Code*[®] CSA C22.1 specify greater clearances.

- Ensure that the prescribed clearances in accordance with the *National Electrical Code*[®] or *Canadian Electrical Code*[®] CSA C22.1 are adhered to.
- Maintain the recommended clearances to walls as well as to other inverters or objects.

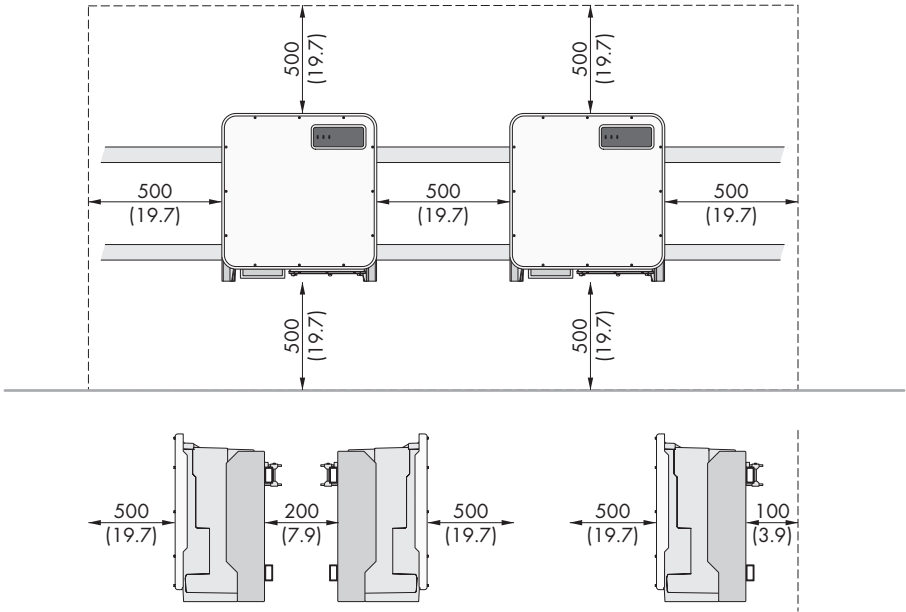
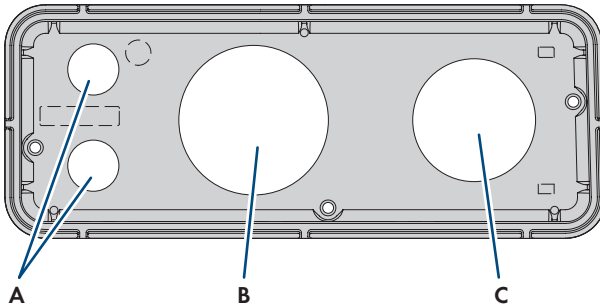


Figure 6: Recommended clearances(Dimensions in mm (in))

6.2 Overview of Connecting Plate



Position	Designation
A	Entry for the network cables (for 19.05 mm (0.75 in) trade size conduits))
B	Entry for the DC cables (for 76.2 mm (3 in) trade size conduits))
C	Entry for the AC cables (for 63.5 mm (2.5 in) trade size conduits))

6.3 Mounting the Product and Preparing the Connection

⚠ QUALIFIED PERSON

⚠ DANGER

Danger to life due to electric shock when live cables are touched

High voltages are present on the AC and DC cables. Touching live cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the AC circuit breaker and secure it against reconnection.
- Disconnect the PV array from the inverter via an external DC load-break switch (e.g. via a PV junction including a load-break switch). Switch off and secure the DC load-break switch against reconnection.
- Ensure that all cables to be connected are de-energized.
- Wear suitable personal protective equipment for all work on the product.

⚠ CAUTION

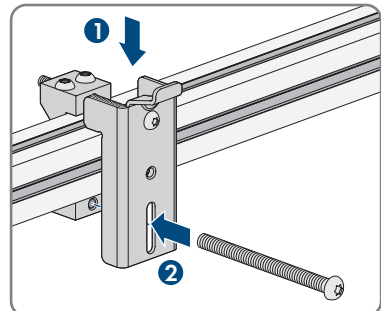
Risk of injury due to weight of product

Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

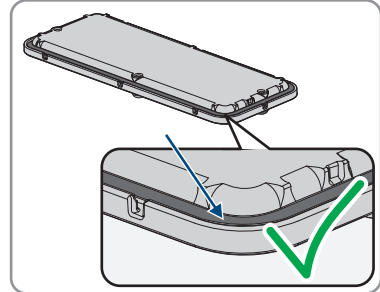
- Transport and lift the product carefully. Take the weight of the product into account.
- Wear suitable personal protective equipment for all work on the product.
- Transport the product using the carrying handles or hoist. Take the weight of the product into account.
- Use all carrying handles provided during transport with carrying handles.
- Do not use the carrying handles as attachment points for hoist equipment (e.g. straps, ropes, chains). Insert eye bolts into threads provided on top of the product to attach the hoist system.

Procedure:

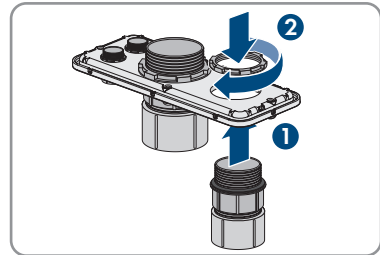
1. Mark the position for the mounting brackets.
2. Hook each mounting bracket onto the mounting rail and insert the screw (M8x105).



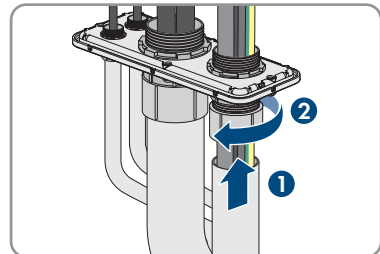
3. Fasten all four screws of each mounting bracket hand-tight (TX40).
4. Ensure the correct position of the mounting brackets by hooking in the mounting template. If the position is incorrect, move the mounting brackets to the correct position.
5. Tighten all four screws of each mounting bracket (TX40, torque: $12 \text{ Nm} \pm 2 \text{ Nm}$ (106 in-lb \pm 17.7 in-lb)).
6. Clip the mounting template into the mounting brackets.
7. Align the cable conduits by means of the mounting template and shorten if necessary. Take the product depth of 400 mm (15.8 in) into account.
8. Check on the connection plate whether the seal is present and undamaged.



9. Attach the conduit fittings for attachment of the conduits to the connecting plate.

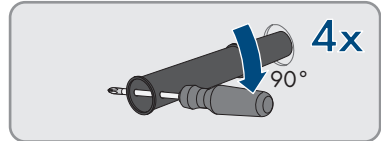
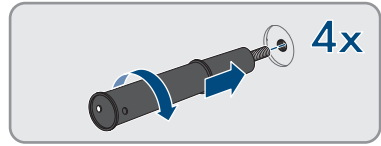


10. Lead the cables through the conduit fittings in the connecting plate and align the connecting plate using the mounting template.

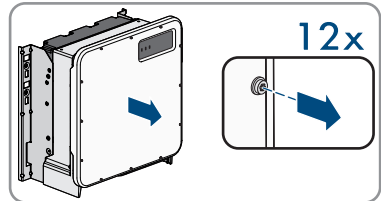


11. Remove the mounting template.

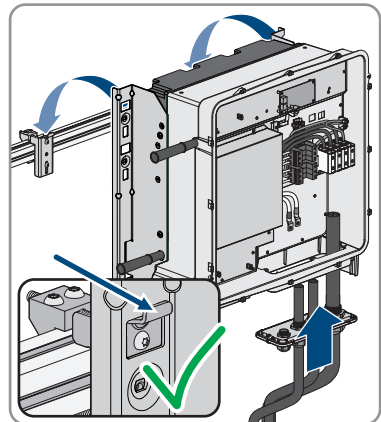
12. Screw the transport handles as far as they will go into the taps on the right- and left-hand side until they lie flush with the enclosure. When doing so, ensure that the transport handles are screwed into the taps so that they are perfectly straight. If the transport handles are not screwed in straight, this can make it more difficult or even impossible to unscrew them later on and can damage the taps to the extent that transport handles can no longer be screwed into them.
13. Insert a screwdriver into the holes in the transport handle and turn the screwdriver through 90°. This ensures that the transport handles are securely tightened.



14. If the inverter is to be hooked into the mounting brackets by means of a hoist, screw the eye bolts into the threads on the top of the inverter and attach the hoist to them. The hoist must be suitable to take the weight of the inverter.
15. Unscrew all screws of the enclosure lid (TX25) and remove it.

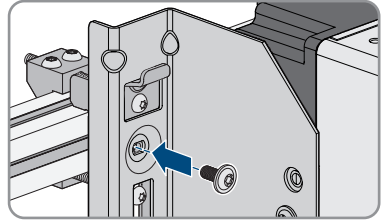


16. Set the screws and the enclosure lid aside and store safely.
17. Hook the product into the mounting brackets. To do this, guide the product over the cables and the connecting plate so that the cables protrude through the opening into the product and the connecting plate sits under the opening. The bracket must protrude through the upper opening.

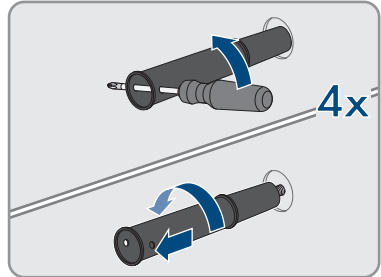


18. Align the cables according to the corresponding terminals and shorten the cables if necessary.

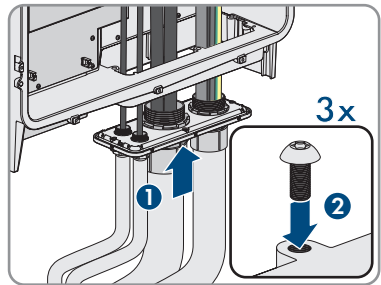
19. Secure the product with one screw each on the right and left on the mounting bracket (M8x16, TX40, 12 Nm \pm 2 Nm (106 in-lb \pm 17.7 in-lb)).



20. Remove all four transport handles from the threaded holes. If necessary, insert a screwdriver into the holes on the transport handle and use the screwdriver to remove the transport handle.



21. Fasten the connecting plate to the enclosure using three screws (M8x70, TX40, torque: 8 Nm \pm 0.5 Nm (71 in-lb \pm 4 in-lb)).



7 Electrical Connection

7.1 Overview of the Connection Area

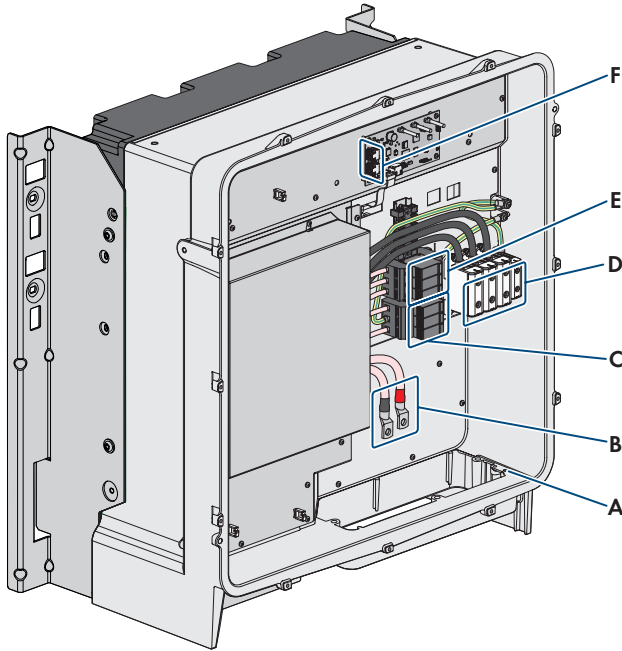


Figure 7: Connection areas in the interior of the product

Position	Designation
A	Equipment grounding terminal for the equipment grounding conductor of the PV array
B	Cable for DC connection with tin-plated copper terminal lugs
C	DC overvoltage protection elements
D	Terminal blocks for AC connection
E	AC overvoltage protection elements
F	Network Ports

7.2 AC Connection

7.2.1 Requirements for the AC Connection

AC cable requirements:

- Aluminum or copper cables must be used.
- The conductors must be solid, stranded or fine-stranded. When using fine-stranded wire, bootlace ferrules must be used.
- The maximum permitted temperature for the terminal block of the AC connection of 90 °C must be observed.
- Cable cross-section L1, L2, L3: 50 mm² to 150 mm² (300 kcmil to 1 AWG)
- Cable cross-section grounding conductor when using copper cable: 10 mm² to 50 mm² (1/0 AWG to 6 AWG)
- Cable cross section grounding conductor when using aluminium cable: 25 mm² to 50 mm² (1/0 AWG to 4 AWG)
- Maximum permissible temperature: 90 °C

Residual-current monitoring unit (RCMU):

The inverter is equipped with an all-pole sensitive residual-current monitoring unit in accordance with IEC/EN 62109-2 and VDE 0126-1-1. The all-pole sensitive residual-current monitoring unit monitors AC and DC residual currents. It disconnects the inverter redundantly from the utility grid in the event of residual current jumps of > 30 mA. If the residual current monitoring unit malfunctions, the inverter is immediately disconnected from the utility grid at all poles. If the protection by automatic disconnection of the power supply according to DIN VDE 0100-410 is fulfilled by an appropriate overcurrent protective device, the inverter does not require an external residual-current device for safe operation. If local regulations require the use of a residual-current device, the following must be observed:

- The inverter is compatible with type B residual-current devices. For SHP 125-US-20 the rated residual current must be 1250 mA and for SHP 150-US-20 the rated residual current must be 1500 mA or higher (for information on selecting a residual-current device, see Technical Information "Criteria for Selecting a Residual-Current Device" under www.SMA-Solar.com). Each inverter in the system must be connected to the utility grid via a separate residual-current device.
- When using residual-current device with a lower rated residual current, there is a risk of false tripping of the residual-current device, depending on the system design.

Overvoltage category:

The inverter can be used in grids of overvoltage category III or lower in accordance with IEC 60664-1. That means that the inverter can be permanently connected to the grid-connection point of a building. In case of installations with long outdoor cabling routes, additional measures to reduce overvoltage category IV to overvoltage category III are required (see the Technical Information "Overvoltage Protection" at www.SMA-Solar.com).

7.2.2 Connecting the AC Cable

⚠ QUALIFIED PERSON

Requirements:

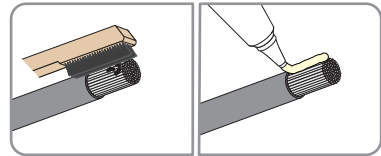
- A suitable medium-voltage transformer must be available.

Required material (not included in the scope of delivery):

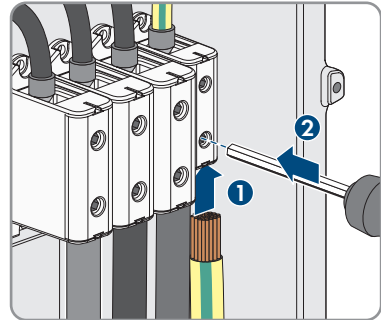
- Protective grease (only for conductors made of aluminum)

Procedure:

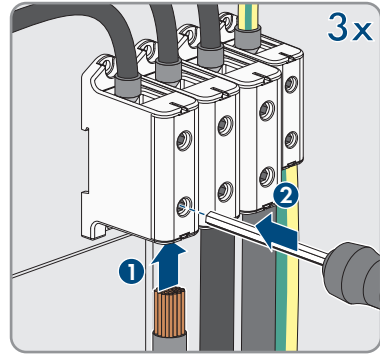
1. Ensure that the AC circuit breaker is switched off and that it cannot be reconnected.
2. Shorten the cable if necessary.
3. Strip the cable.
4. Strip off the insulation of L1, L2, L3, and PE by 30 mm (1.2 in).
5. Remove any cable remnants from the product.
6. For conductors made of aluminum, remove any oxide film and apply protective grease to the conductors.



7. Connect the grounding conductor to the terminal Ⓢ as labeled. To do so, position the conductor as far as it will go into the corresponding terminal and tighten the screw of the terminal (AF5, torque for a conductor cross-section of 10 mm² to 50 mm²: 12 Nm; torque for a cable cross-section of 1/0 AWG to 6 AWG: 10 Nm (90 in-lb)).



8. Connect L1, L2 and L3 to the terminals according to the label. To do so, position each conductor as far as they will go into the corresponding terminal and tighten the screw of the terminal (AF 8, torque for a conductor cross-section of 50 mm² to 95 mm²: 20 Nm; torque for a cable cross-section of 120 mm² to 150 mm²: 30 Nm; torque for a cable cross-section of 300 kcmil to 1 AWG: 24 Nm (21.6 in-lb)).



9. Ensure that the correct conductors are assigned to the terminals.
 10. Make sure that all conductors are securely in place.

7.3 Connecting the Network Cables

⚠ QUALIFIED PERSON

⚠ DANGER

Danger to life due to electric shock in case of overvoltages and if surge protection is missing

Overvoltages (e. g. in the event of a flash of lightning) can be further conducted into the building and to other connected devices in the same network via the network cables or other data cables if there is no surge protection. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Ensure that all devices in the same network are integrated in the existing overvoltage protection.
- When laying the network cable outdoors, ensure that there is suitable surge protection at the network cable transition from the product outdoors to the network inside the building.
- The Ethernet interface of the product is classified as "TNV-1" and offers protection against overvoltages of up to 1.5 kV.

Additionally required material (not included in the scope of delivery):

- Network cables
- Where required: Field-assembly RJ45 connector.

Network cable requirements:

The cable length and quality affect the quality of the signal. Observe the following cable requirements:

- Cable type: 100BaseTx
- Cable category: minimum CAT5e
- Plug type: RJ45 of Cat5, Cat5e or higher

- Shielding: SF/UTP, S/UTP, SF/FTP or S/FTP
- Number of insulated conductor pairs and insulated conductor cross-section: at least 2 x 2 x 0.22 mm² (2 x 2 x 24 AWG)
- Maximum cable length between two nodes when using patch cables: 50 m (164 ft)
- Maximum cable length between two nodes when using installation cables: 100 m (328 ft)
- UV-resistant for outdoor use.

Laying the cables:

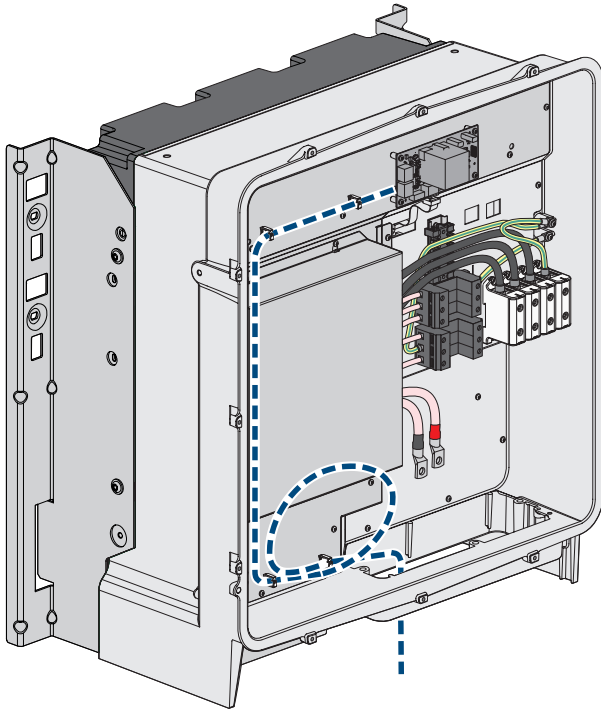


Figure 8: Interior view of the product with laying plan for network cables

Procedure:

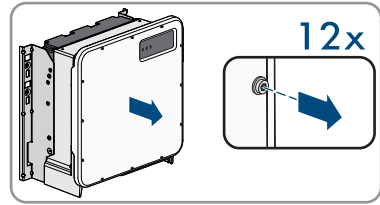
1.

⚠ DANGER

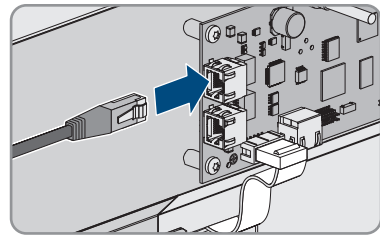
Danger to life due to electric shock

- Disconnect the inverter from all voltage sources (see Section 10, page 62).

- If the enclosure lid is closed, remove the screws of the enclosure lid (TX 25) and remove the enclosure lid.



- When using a self-assembly network cable, assemble the RJ45 connectors and connect them to the network cable (see connector documentation).
- For each cable attach a conduit fitting for attachment of the conduits to the connecting plate.
- Lead each cable through a conduit fitting in the connection plate up to the network jacks. Lay each cable according to the installation plan and attach to the brackets.
- Put the RJ45 plug of the cable into one of the network sockets of the communication assembly.



- Ensure that the RJ45 plug is securely in place by pulling slightly on the cable.
- If the inverter is installed outdoors, install overvoltage protection for all components in the network.
- Either connect the other end of the network cable directly to the local network (e.g. via a router) or connect all present inverters in the system to each other in line topology and connect the first or last inverter in the line to the local network.

7.4 Connecting the PV Array

⚠ QUALIFIED PERSON

NOTICE

Damage to the inverter due to ground fault on DC side during operation

Due to the transformerless topology of the product, the occurrence of ground faults on DC side during operation can lead to irreparable damage. Damages to the product due to a faulty or damaged DC installation are not covered by warranty. The product is equipped with a protective device that checks whether a ground fault is present during the starting sequence. The product is not protected during operation.

- Ensure that the DC installation is carried out correctly and no ground fault occurs during operation.

DC cable requirements:

- Aluminum or copper wires must be used.
- Cable cross-section: 95 mm² to 300 mm² (600 kcmil to 3/0 AWG)
- The cables must be equipped with suitable terminal lugs for DC connection in the inverter. The DC cables in the inverter are equipped with terminal lugs made of tinned copper.

Requirements:

- One PV combiner box must be available.
- There must be an external DC load-break switch between the PV inverter and the PV array (e.g., a PV combiner box including a load-break switch).
- The DC cables have been inserted into the product.

Additionally required material (not included in the scope of delivery):

- Two terminal lugs for connection of DC+ and DC- (flange hole: M10, cross-section: appropriate to DC cables used)
- One terminal lug for connection of equipment grounding conductor of PV array (flange hole: M6, cross-section: appropriate to equipment grounding conductor)
- Clean cloth
- Ethanol cleaning agent
- Press tool

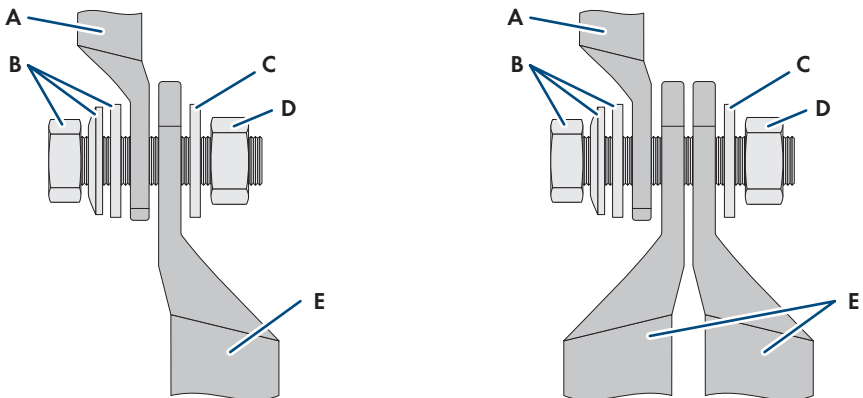
DC connection overview:

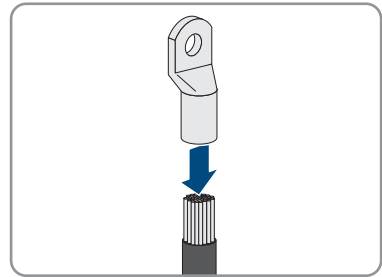
Figure 9: DC connection overview for the connection of 1 DC cable or of 2 DC cables

Position	Designation
A	DC cable with tin-plated copper terminal lugs (installed in the product)
B	M10x40 combination hexagon head screw (AF16)
C	Washer M10

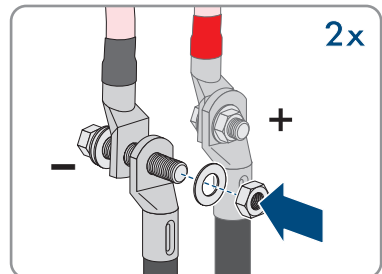
Position	Designation
D	Hex nut M10
E	DC cable with terminal lug (to be provided by the customer)

Procedure:

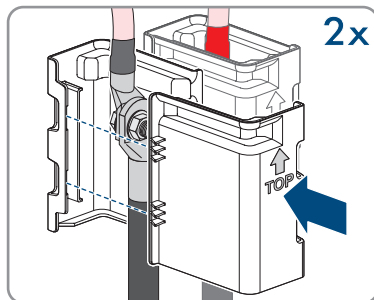
1. Ensure that no voltage is present on the DC cables.
2. Connect the equipment grounding conductor of the PV array to the equipment grounding terminal:
 - Dismantle the equipment grounding conductor.
 - Attach equipment grounding conductor to terminal lug.
 - Clean the contact surfaces of the terminal lug using a clean cloth and ethanol cleaning agent and do not touch the contact surfaces after cleaning.
 - Connect the equipment grounding conductor to the equipment grounding terminal using the hexagon socket screw (M6x16, TX20, torque: 6 Nm \pm 0.3 Nm (53 in-lb \pm 2.65 in-lb)).
3. Dismantle the DC cables.
4. Fit terminal lugs to the DC conductors.



5. Remove any cable remnants from the product.
6. Remove the fixing of the pre-harnessed DC cables from the product.
7. Clean the contact surfaces of all terminal lugs using a clean cloth and ethanol cleaning agent and do not touch the contact surfaces after cleaning.
8. Connect the DC cables with each other. To do this, insert the screw and washer assembly (M10x40) from the back through the round holes of the terminal lugs and from the front tighten with the washer (M10) and the hex nut (AF16, torque: 24 Nm \pm 2 Nm (212 in-lb)). Ensure correct polarity.



9. Place the touch protection elements around the terminal lugs and plug together until they audibly click into place.



8 Commissioning

8.1 Commissioning Procedure

QUALIFIED PERSON

Commissioning an inverter that is captured in a communication device

When the inverter is captured in a communication device, the communication device (e.g. SMA Data Manager) is the unit for configuring the total system. The configuration is transferred to all inverters in the system. The system password assigned via the communication device is also the password for the user interface of the inverter.

- Commission the inverter (see Section 8.2, page 40).
- The initial configuration of the inverter is made via the communication device. The configuration is transferred to the inverter and the settings of the inverter are overwritten.
- Deactivate the Webconnect function of the inverter via the Sunny Portal. This prevents unnecessary connection attempts of the inverter with Sunny Portal.

This section describes the commissioning procedure and gives an overview of the steps you must perform in the prescribed order.

Procedure	See
1. Commission the inverter.	Section 8.2, page 40
2. Establish a connection to the user interface of the inverter. There are various connection options to choose from for this: <ul style="list-style-type: none"> • Direct connection via Ethernet • Connection via Ethernet in the local network 	Section 9.1, page 48
3. Log into the user interface.	Section 9.2, page 49
4. Select the inverter configuration option. Please note that the SMA Grid Guard code for changing the grid-relevant parameters must be available after completion of the first ten feed-in hours or installation assistant (see "Application for the SMA Grid Guard code" available at www.SMA-Solar.com).	Section 8.3, page 41
5. If necessary, set the parameters for voltage and frequency monitoring.	Section 8.4, page 43
6. Ensure that the country data set has been configured correctly.	Section 9.8, page 57
7. Make further inverter settings as needed.	Section 9, page 48

8.2 Commissioning the Inverter

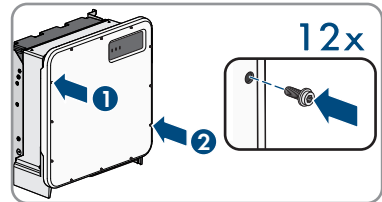
⚠ QUALIFIED PERSON

Requirements:

- A means of disconnecting the inverter from the PV array must be present.
- The AC circuit breaker must be correctly rated and mounted.
- The product must be correctly mounted.
- All cables must be correctly connected.

Procedure:

1. Position the enclosure lid and first tighten the upper-left and lower-right screws, and then the remaining screws crosswise (TX25, torque: 6 Nm \pm 0.3 Nm (53 in-lb \pm 2.65 in-lb)).



2. Switch on the transformer.
3. Switch on DC via the PV combiner box or the external DC switch.
4. Switch on the AC miniature circuit breaker.
 - All 3 LEDs light up. The start-up phase begins.
 - All 3 LEDs go out again after approximately 90 seconds.
 - Depending on the available power, the green LED pulses or is continuously illuminated. The inverter is feeding in.
5. If the green LED is still flashing, the conditions for activating feed-in operation are not yet met. As soon as the conditions for feed-in operation are met, the inverter starts with feed-in operation and, depending on the available power, the green LED will light up continuously or it will pulse.
6. If the red LED lights up, an event has occurred. Find out which event has occurred and, if necessary, initiate countermeasures.

8.3 Selecting a configuration option

⚠ QUALIFIED PERSON

After having assigned the password to the **Installer** or **User**, the **Configuring the Inverter** page opens.

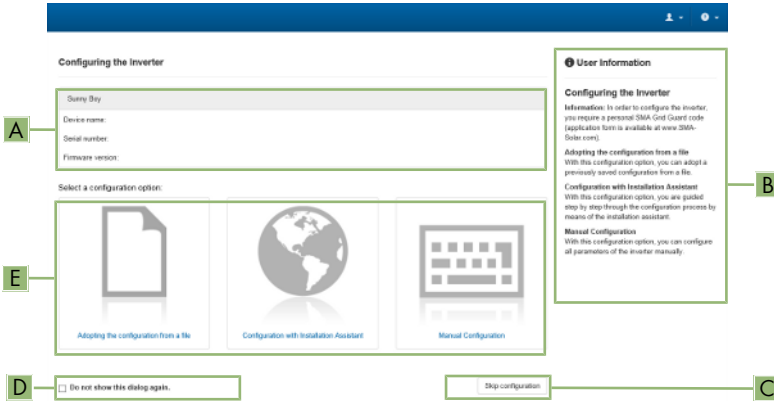


Figure 10: Layout of the **Configuring the Inverter** page

Position	Designation	Description
A	Device information	Provides the following information: <ul style="list-style-type: none"> • Device name • Inverter serial number • Inverter firmware version
B	User information	Provides brief information on the listed configuration options
C	Skip configuration	Offers the option of skipping the inverter configuration and go directly to the user interface (not recommended)
D	Checkbox	Allows you to choose not to have the displayed page displayed again when the user interface is called up again
E	Configuration options	Provides a selection of the various configuration options

Configuration options:

On the **Configuring the Inverter** page, different configuration options are available to choose from. Select one of the options and proceed for the selected option as described below. SMA Solar Technology AG recommends carrying out the configuration with the installation assistant. This way, you ensure that all relevant parameters are set for optimal inverter operation.

- Adoption of configuration from a file
- Configuration with the installation assistant (recommended)
- Manual configuration

Accepting the settings

Saving the made settings is indicated by an hourglass symbol on the user interface. If the DC voltage is sufficient, the data is transferred directly to the inverter and accepted. If the DC voltage is too low (e. g. in the evening), the settings are saved, but they cannot be directly transferred to or accepted by the inverter. As long as the inverter has not yet received and accepted the settings, the hourglass symbol will continue to be displayed on the user interface. The settings will be accepted when there is sufficient DC voltage applied and the inverter restarts. As soon as the hourglass symbol appears on the user interface, the settings have been saved. The settings will not be lost. You can log off of the user interface and leave the system.

Adopting the Configuration from a File

You can adopt the inverter configuration from a file. To do this, there must be an inverter configuration saved to a file.

Procedure:

1. Select the configuration option **Adopting configuration from a file**.
2. Select [**Browse...**] and select the desired file.
3. Select [**Import file**].

Configuring the Installation Assistant (Recommended)

Procedure:

1. Select the configuration option **Configuration with Installation Assistant**.
 - The installation assistant will open.
2. Follow the installation assistant steps and make the settings appropriate for your system.
3. For every setting made in a step, select [**Save and next**].
 - In the last step, all made settings are listed in a summary.
4. To correct settings you made, select [**Back**], navigate to the desired step, correct settings and select [**Save and continue**].
5. Once all settings are correct, select [**Next**] in the summary.
6. To save the settings to a file, select [**Export a summary**] and save the file on your end device.
7. To export all parameters and their settings, select [**Export all parameters**]. This exports all parameters and their settings into an HTML file.
 - The start page of the user interface opens.

Manual configuration

You can configure the inverter manually by setting the desired parameters.

Procedure:

1. Select the configuration option **Manual Configuration**.
 - The **Device Parameters** menu on the user interface will open and all available parameter groups of the inverter will be displayed.
 2. Select [**Edit parameters**].
 3. Select the desired parameter group.
 - All available parameters of the parameter group will be displayed.
 4. Set the desired parameters.
 5. Select [**Save all**].
- The inverter parameters are set.

8.4 Adjustable Parameters

You can set the following parameters for voltage and frequency monitoring via the user interface of the inverter.

The basic procedure for changing operating parameters is explained in another section (see Section 9.7 "Changing Operating Parameters", page 56).

SHP 125-US-20

Parameter name	Value/range	Default value
Voltage monitoring upper maximum threshold	624 V to 917 V	832 V
Voltage monitoring upper maximum threshold, tripping time	0.1 s to 5 ms	0.312 ms
Voltage monitoring of upper maximum threshold as RMS value	408 V to 638.4 V	576 V
Voltage monitoring of upper max. thresh. as RMS value for tripping time	50 ms to 59000 ms	160 ms
Voltage monitoring median maximum threshold (Overvoltage/Fast)	408 V to 638.4 V	576 V
Voltage monitoring median max. threshold trip.time (Overvoltage/Fast, maximum time)	50 ms to 59000 ms	160 ms
Voltage monitoring lower maximum threshold (Overvoltage/Slow)	408 V to 638.4 V	528 V

Parameter name	Value/range	Default value
Voltage monitoring lower max. threshold trip. time (Overvoltage/Slow, maximum time)	100 ms to 60000 ms	1000 ms
Voltage monitoring upper minimum threshold (Under-voltage/Slow)	216 V to 480 V	422 V
Voltage monitoring upper min. threshold trip. time (Under-voltage/Slow, maximum time)	100 ms to 60000 ms	2000 ms
Voltage monitoring of median minimum threshold (Under-voltage/Fast)	216 V to 480 V	240 V
Voltage monitoring median min. threshold trip.time (Under-voltage/Fast, maximum time)	100 ms to 60000 ms	160 ms
Voltage monitoring of lower minimum threshold as RMS value	216 V to 480 V	240 V
Voltage monitoring of lower min.threshold as RMS value for tripping time	100 ms to 60000 ms	160 ms
Frequency monitoring median maximum threshold	50 Hz to 66 Hz	66 Hz
Frequency monitoring median maximum threshold, tripping time (Overfrequency, maximum time)	0 ms to 1000000 ms	1000 ms
Frequency monitoring lower maximum threshold (Overfrequency)	50 Hz to 66 Hz	60.5 Hz
Frequency monitoring lower maximum threshold, tripping time	0 ms to 1000000 ms	160 ms
Frequency monitoring upper minimum threshold (Underfrequency)	44 Hz to 60 Hz	59.3 Hz

Parameter name	Value/range	Default value
Frq. monitoring upper min. threshold trip. time (Underfrequency, maximum time)	0 ms to 300000 ms	160 ms
Frequency monitoring median minimum threshold	44 Hz to 60 Hz	57 Hz
Frequency monitoring median minimum threshold, tripping time	0 ms to 300000 ms	160 ms
Voltage increase protection	480 V to 638 V	576 V
Voltage increase protection tripping time	40 ms to 10000 ms	1000 ms
Min. voltage for reconnection	216 V to 480 V	424 V
Max. voltage for reconnection	480 V to 638 V	508 V
Grid nominal voltage	422 V to 528 V	480 V

SHP 150-US-20

Parameter name	Value/range	Default value
Voltage monitoring upper maximum threshold	780 V to 1146 V	1040 V
Voltage monitoring upper maximum threshold, tripping time	0.1 s to 5 ms	0.312 ms
Voltage monitoring of upper maximum threshold as RMS value	510 V to 798 V	720 V
Voltage monitoring of upper max. thresh. as RMS value for tripping time	50 ms to 59000 ms	160 ms
Voltage monitoring median maximum threshold (Overvoltage/Fast)	510 V to 798 V	720 V
Voltage monitoring median max. threshold trip.time (Overvoltage/Fast, maximum time)	50 ms to 59000 ms	160 ms

Parameter name	Value/range	Default value
Voltage monitoring lower maximum threshold (Overvoltage/Slow)	510 V to 720 V	660 V
Voltage monitoring lower max. threshold trip. time (Overvoltage/Slow, maximum time)	100 ms to 60000 ms	1000 ms
Voltage monitoring upper minimum threshold (Undervoltage/Slow)	270 V to 600 V	528 V
Voltage monitoring upper min. threshold trip. time (Undervoltage/Slow, maximum time)	100 ms to 60000 ms	2000 ms
Voltage monitoring of median minimum threshold (Undervoltage/Fast)	270 V to 600 V	300 V
Voltage monitoring median min. threshold trip.time (Undervoltage/Fast, maximum time)	100 ms to 60000 ms	160 ms
Voltage monitoring of lower minimum threshold as RMS value	270 V to 600 V	300 V
Voltage monitoring of lower min.threshold as RMS value for tripping time	100 ms to 60000 ms	160 ms
Frequency monitoring median maximum threshold	50 Hz to 66 Hz	66 Hz
Frequency monitoring median maximum threshold, tripping time (Overfrequency, maximum time)	0 ms to 1000000 ms	1000 ms
Frequency monitoring lower maximum threshold (Overfrequency)	50 Hz to 66 Hz	60.5 Hz
Frequency monitoring lower maximum threshold, tripping time	0 ms to 1000000 ms	160 ms

Parameter name	Value/range	Default value
Frequency monitoring upper minimum threshold (Under-frequency)	44 Hz to 60 Hz	59.3 Hz
Frq. monitoring upper min. threshold trip. time (Underfrequency, maximum time)	0 ms to 300000 ms	160 ms
Frequency monitoring median minimum threshold	44 Hz to 60 Hz	57 Hz
Frequency monitoring median minimum threshold, tripping time	0 ms to 300000 ms	160 ms
Voltage increase protection	480 V to 638 V	576 V
Voltage increase protection tripping time	40 ms to 10000 ms	1000 ms
Min. voltage for reconnection	270 V to 600 V	530 V
Max. voltage for reconnection	600 V to 798 V	635 V
Grid nominal voltage	480 V to 690 V	600 V

9 Operation

9.1 Establishing a connection to the user interface

9.1.1 Establishing a Direct Connection via Ethernet

Requirements:

- The product must be commissioned.
- An end device (e.g. computer) with an Ethernet interface must be available.
- The product must be connected directly to the end device.
- The respective latest version of one of the following web browsers must be installed: Chrome, Edge, Firefox or Safari.
- The SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten feed-in hours or installation assistant (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

i IP address of the inverter

- Standard inverter IP address for the direct connection via Ethernet: **169.254.12.3**

Procedure:

1. Open the web browser of your end device, enter the IP address **169.254.12.3** in the address bar and press the enter key.
 2. **i** **Web browser signals a security vulnerability**

After the IP address has been entered, a message might appear indicating that the connection to the user interface of the product is not secure. SMA Solar Technology AG guarantees the security of the user interface.

 - Continue loading the user interface.
- The login page of the user interface opens.

9.1.2 Establishing a Connection via Ethernet in the local network

i New IP address for connecting with a local network

If the product is connected to a local network (e.g. via a router), the product will receive a new IP address. Depending on the type of configuration, the new IP address will be assigned automatically by the DHCP server (router) or manually by you. Upon completion of the configuration, the product can only be reached via the following access addresses:

- Generally applicable access address: IP address manually assigned or assigned by the DHCP server (router) (identification via network scanner software or network configuration of the router).
- Access address for Apple and Linux systems: **SMA[serial number].local** (e.g. SMA0123456789.local)
- Access address for Windows and Android systems: **https://SMA[serial number]** (e.g. https://SMA0123456789)

Requirements:

- The product must be connected to the local network via a network cable (e.g. via a router).
- The product must be integrated into the local network. Tip: There are various methods of integrating the product into the local network with the aid of the installation assistant.
- An end device (e.g. computer, tablet PC or smartphone) must be available.
- The end device must be in the same local network as the product.
- The respective latest version of one of the following web browsers must be installed: Chrome, Edge, Firefox or Safari.
- The SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten feed-in hours or installation assistant (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

Procedure:

1. Open the web browser of your end device. Enter the IP address of the product in the address bar of the web browser. Then press Enter key.

2. **i** **Web browser signals a security vulnerability**

After the IP address has been entered, a message might appear indicating that the connection to the user interface of the product is not secure. SMA Solar Technology AG guarantees the security of the user interface.

- Continue loading the user interface.
- The login page of the user interface opens.

9.2 Logging In and Out of the User Interface

After a connection to the user interface of the inverter has been established, the login page opens. Log onto the user interface as described below.

Usage of cookies

For the correct display of the user interface, cookies are required. The cookies are used for convenience only. By using this user interface you agree to the placement of cookies.

Log in as Installer or User for the First Time

Password assignment for user and installer

The passwords for the user groups **Installer** and **User** must be assigned when accessing the user interface for the first time. If the inverter was registered in a communication device (e.g., SMA Data Manager) and the system password was assigned, the system password is also the installer password. In this case, only the user password must be assigned.

- If you as a specialist assign the user password, only pass the password on to persons to access the inverter data via the user interface.
- If you as a user assign the installer password, only pass the password on to persons to receive access to the system.

Installer password for inverters registered in a communication device or in Sunny Portal

To be able to register the inverter in a communication device (e.g., SMA Data Manager) or in a Sunny Portal system, the password for the user group **Installer** must match the system password. If you assign a password for the user group **Installer** via the user interface of the inverter, the same password must also be used as the system password.

- Assign a uniform installer password to all SMA devices in the system.

Procedure:

1. In the drop-down list **Language**, select the desired language.
 2. In the **Password** field, enter a password for the **User** user group.
 3. In the **Repeat password** field, enter the password again.
 4. Click on **Save**.
 5. In the **New password** field, enter a password for the **Installer** user group. Assign a uniform password to all SMA devices to be registered in a system. The installer password is also the system password.
 6. In the **Repeat password** field, enter the password again.
 7. Click on **Save and log in**.
- The **Configuring the Inverter** page opens.

Log in as the User or Installer

1. In the drop-down list **Language**, select the desired language.
 2. In the **User group** drop-down list, select the entry **Installer** or **User**.
 3. Enter the password in the field **Password**.
 4. Select **Login**.
- The start page of the user interface opens.

Log Out as the User or Installer

1. On the right-hand side of the menu bar, select the menu **User Settings**.
 2. In the subsequent context menu, select [**Logout**].
- The login page of the user interface opens. The logout was successful.

9.3 Start Page Design of the User Interface

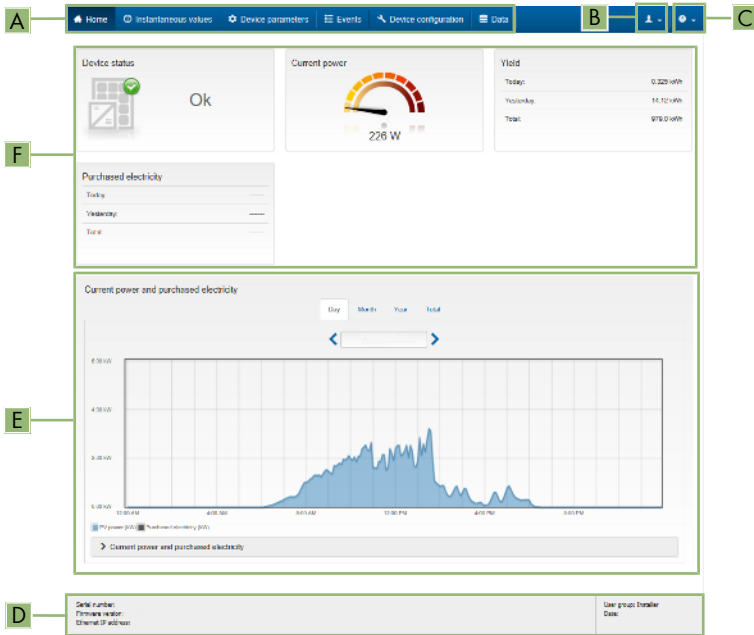


Figure 11: Design of the user interface's home page (example)

Position	Designation	Description
A	Menu	<p>Provides the following functions:</p> <ul style="list-style-type: none"> • Home Opens the user interface homepage • Instantaneous values Current measured values of the inverter • Device Parameters The various operating parameters of the inverter can be viewed and configured here depending on the user group. • Events All events that have occurred in the selected time period are displayed here. The event types are Information, Warning and Error. Currently existing events of the types Error and Warning will be additionally displayed in the Device status viewlet. However, only the higher-priority event is displayed. If, for example, there is a Warning and an Error present at the same time, only the Error will be displayed. • Device configuration Various settings for the inverter can be made here. The selection available is dependent on which user group you are logged in as and the operating system of the device with which the user interface has been called up. • Data You will find all data that is saved in the internal memory of the inverter on this page.
B	User settings	<p>Provides the following functions, depending on the user group logged in:</p> <ul style="list-style-type: none"> • Starting the installation assistant • SMA Grid Guard login • Logout
C	Help	<p>Provides the following functions:</p> <ul style="list-style-type: none"> • Displaying information on Open Source licenses used • Link to the website of SMA Solar Technology AG

Position	Designation	Description
D	Status bar	<p>Displays the following information:</p> <ul style="list-style-type: none"> • Inverter serial number • Inverter firmware version • IP address of the inverter in the local network • User group logged in • Date and device time of the inverter
E	Current power and current consumption	<p>Temporal progression of the PV power and the power consumption of the household over the selected time period. Please note, the power consumption will only be displayed if an energy meter is installed in the PV system.</p>
F	Status display	<p>The various areas display information on the current status of the PV system.</p> <ul style="list-style-type: none"> • Device status Displays whether the inverter is currently in a fault-free operating state or whether there is an Error or Warning present. • Current power Displays the power currently being generated by the inverter. • Yield Displays the energy yield of the inverter. • Grid supply Displays the energy supply from the utility grid. • Power at the grid-connection point Indicates which power is currently fed in or obtained at the grid-connection point.

9.4 Starting the Installation Assistant

QUALIFIED PERSON

The installation assistant leads you step-by-step through the steps necessary for the initial configuration of the inverter.

Layout of the installation assistant

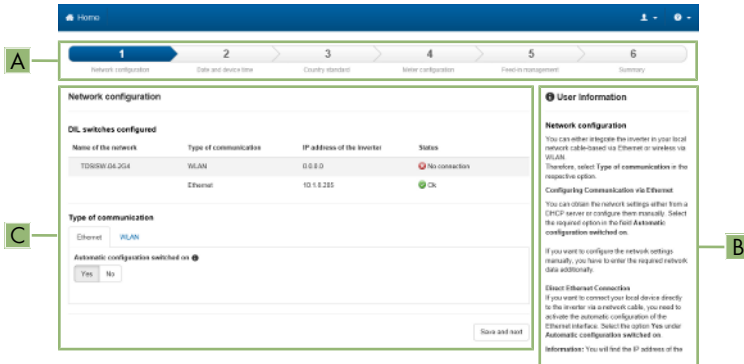


Figure 12: Layout of the installation assistant (example)

Position	Designation	Description
A	Configuration steps	Overview of the installation assistant steps. The number of steps depends on the type of device and the additionally installed modules. The current step is highlighted in blue.
B	User information	Information about the current configuration step and the setting options of the configuration step.
C	Configuration field	You can make settings in this field.

Requirement:

- When configuring after completion of the first ten feed-in hours or after exiting the installation assistant, the SMA Grid Guard code must be available in order to change the grid-relevant parameters (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

Procedure:

1. Open the user interface (see Section 9.1, page 48).
 2. Log in as **Installer**.
 3. Select the menu **User Settings** (see Section 9.3, page 52) on the start page of the user interface.
 4. In the context menu, select [**Starting the installation assistant**].
- The installation assistant will open.

9.5 Switching the Dynamic Power Display Off

As standard, the inverter signals its power dynamically via the pulsing of the green LED. When doing so, the LED flashes on and off uniformly or is permanently lit at full power. The various gradations are related here to the set active power limit of the inverter. If this display is not desired, switch this function off in accordance with the following procedure. Once this has been done, the green LED is lit permanently to signalize feed-in operation.

The basic procedure for changing operating parameters is explained in another section (see Section 9.7 "Changing Operating Parameters", page 56).

Procedure:

- In the parameter group **Device > Operation**, select the parameter **Dynamic power display via green LED** and set this to **Off**.

9.6 Changing the Password

The password for the inverter can be changed for both user groups. Furthermore, the user group **Installer** can change the password for the user group **User** as well as its own password.

PV systems registered in a communication product

With PV systems that are registered in a communication product (e.g. Sunny Portal, Cluster Controller), you can also assign a new password for the user group **Installer** via the communication product. The password for the user group **Installer** is also the system password. If you assign a password for the user group **Installer** via the user interface of the inverter that does not correspond to the system password in the communication product, the inverter can no longer be reached by the communication product.

- Ensure that the password for the user group **Installer** is the same as the system password in the communication product.

Procedure:

1. Activate the user interface (see Section 9.1, page 48).
2. Log into the user interface (see Section 9.2, page 49).
3. Call up the menu **Device Parameters**.
4. Select **[Edit parameters]**.
5. In the parameter group **User Rights > Access Control** change the password of the desired user group.
6. Select **[Save all]** to save the changes.

9.7 Changing Operating Parameters

The operating parameters of the inverter are set to certain values by default. You can change the operating parameters to optimize the performance of the inverter.

This section describes the basic procedure for changing operating parameters. Always change operating parameters as described in this section. Some function-sensitive parameters can only be viewed by qualified persons and can only be changed by qualified persons by entering the personal SMA Grid Guard code.

Requirements:

- Changes to grid-relevant parameters must be approved by the responsible grid operator.

Procedure:

1. Open the user interface (see Section 9.1, page 48).
 2. Log into the user interface (see Section 9.2, page 49).
 3. Call up the menu **Device Parameters**.
 4. Click on [**Edit parameters**].
 5. Log in using the SMA Grid Guard code to change those parameters designated by a lock (only for installers):
 - Select the menu **User Settings** (see Section 9.3, page 52).
 - In the subsequent context menu, select [**SMA Grid Guard login**].
 - Enter the SMA Grid Guard code and select [**Login**].
 6. Expand the parameter group that contains the parameter which is to be configured.
 7. Change the desired parameters.
 8. Select [**Save all**] to save the changes.
- The inverter parameters are set.

i Accepting the settings

Saving the made settings is indicated by an hourglass symbol on the user interface. If the DC voltage is sufficient, the data is transferred directly to the inverter and accepted. If the DC voltage is too low (e. g. in the evening), the settings are saved, but they cannot be directly transferred to or accepted by the inverter. As long as the inverter has not yet received and accepted the settings, the hourglass symbol will continue to be displayed on the user interface. The settings will be accepted when there is sufficient DC voltage applied and the inverter restarts. As soon as the hourglass symbol appears on the user interface, the settings have been saved. The settings will not be lost. You can log off of the user interface and leave the system.

9.8 Configuring the Country Data Set

⚠ QUALIFIED PERSON

By default, the inverter is set to a universally valid country data set. You must adjust the country data set for the installation site.

i The country data set must be set correctly.

If you select a country data set which is not valid for your country and purpose, it can cause a disturbance in the PV system and lead to problems with the grid operator. When selecting the country data set, you must always observe the locally applicable standards and directives as well as the properties of the PV system (e.g. PV system size, grid-connection point).

- If you are not sure which standards and directives are valid for your country or purpose, contact the grid operator.

The basic procedure for changing operating parameters is explained in another section (see Section 9.7 "Changing Operating Parameters", page 56).

Procedure:

- In the parameter group **Grid monitoring > Grid monitoring** select the parameter **Set country standard** and set the required country data set.

9.9 Configuring Q on Demand 24/7

With the "Q on Demand 24/7" function, the inverter remains connected to the utility grid overnight and is supplied with power via the utility grid in order that it can provide reactive power. When connected overnight, the inverter only draws an insignificant amount of active power from the utility grid to supply its internal assemblies. Depending on grid conditions and PV array characteristics, the inverter can provide up to 100% of its nominal power as reactive power. The provision of reactive power during feed-in operation leads to a reduction of the feed-in power. This means that at 100% reactive power, the feed-in power is 0%. If the inverter is disconnected from the utility grid outside of feed-in operation, the "Q on Demand 24/7" function is not active. The "Q on Demand 24/7" function can only be restarted once there is sufficient PV power at the DC inputs of the inverter, meaning that the inverter can briefly switch back to feed-in operation at least once.

The general setting of the grid management services (e.g. cos phi setpoint or Q(V) characteristic curve) can not be fully set independently of the "Q on Demand 24/7" function via the relevant parameters - "Q on Demand 24/7" only permits Q specifications. It is to be noted here that certain settings can have an influence on other grid-support settings and functions.

This means that if the "Q on Demand 24/7" function" is active, no other grid-supporting functions (e.g., cos phi) are possible between day and night operation of the inverter. Should an independent reactive power provision be desired between day- and night operation, the reactive power provision must be communicated to the inverter via a superordinate control unit.

Currently, the provision of reactive power can only be read off via the phase currents and phase voltages in the instantaneous values (**Instantaneous values > AC Side > Phase currents / Phase voltage**) or requested via Modbus.

The basic procedure for changing operating parameters is explained in another section (see Section 9.7 "Changing Operating Parameters", page 56).

Procedure:

1. Select the parameter **Reactive power mode in case of active power output** and set the desired procedure. When doing so, note that for "Q on Demand 24/7", the modes **Cos Phi(P) characteristic curve** or **Cos Phi(U) characteristic curve** may not be selected.
2. Select the parameter **Reactive power mode in case of zero active power** and set the desired procedure.
3. Set the parameters associated with the reactive power mode.

9.10 Configuring the Modbus Function

QUALIFIED PERSON

The Modbus interface is deactivated by default and the communication ports 502 set.

In order to access SMA inverters with SMA Modbus® or SunSpec® Modbus®, the Modbus interface must be activated. After activating the interface, the communication ports of both IP protocols can be changed. For information on commissioning and configuration of the Modbus interface, see the technical information "SMA and SunSpec Modbus® Interface" at www.SMA-Solar.com.

For information on which Modbus registers are supported, see the technical information "Modbus® parameters and measured values" at www.SMA-Solar.com.

i Measures for data security during activated Modbus interface

If you activate the Modbus interface, there is a risk that unauthorized users may access and manipulate the data or devices in your PV system.

To ensure data security, take appropriate protective measures such as:

- Set up a firewall.
- Close unnecessary network ports.
- Only enable remote access via VPN tunnel.
- Do not set up port forwarding at the communication port in use.
- In order to deactivate the Modbus interface, reset the inverter to the default settings or deactivate the activated parameter again.

Procedure:

- Activate the Modbus interface and adjust the communication ports if necessary (see the technical information "SMA and SunSpec Modbus® Interface" at www.SMA-Solar.com).

9.11 Saving the Configuration in a File

You can save the current configuration of the inverter in a file. You can use this file as a data backup for this inverter and then import this file into this inverter again or another inverter from the same type or device family to configure the inverter. When saving, only the device parameters will be saved, not any passwords.

Procedure:

1. Activate the user interface (see Section 9.1, page 48).
2. Log into the user interface (see Section 9.2, page 49).
3. Select the menu **Device Configuration**.
4. Select [**Settings**].
5. In the context menu, select [**Saving the configuration in a file**].
6. Follow the instructions in the dialog.

9.12 Adopting a Configuration from a File

⚠ QUALIFIED PERSON

To configure the inverter, you can adopt the configuration from a file. To be able to do this, you must first save the configuration of another inverter from the same type or device family in a file (see Section 9.11 "Saving the Configuration in a File", page 59). When saving, only the device parameters will be adopted, not any passwords.

Requirements:

- Changes to grid-relevant parameters must be approved by the responsible grid operator.
- The SMA Grid Guard code must be available (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

Procedure:

1. Open the user interface (see Section 9.1, page 48).
2. Log into the user interface as an **Installer** (see Section 9.2, page 49).
3. Select the menu **Device Configuration**.
4. Select [**Settings**].
5. In the context menu, select [**Adopting the configuration from a file**].
6. Follow the instructions in the dialog.

9.13 Updating the Firmware

⚠ QUALIFIED PERSON

If no automatic update is set for the inverter in the communication product (e.g. SMA Data Manager, Cluster Controller, Sunny Portal) or via the user interface of the inverter, you have the option of carrying out a manual firmware update.

You have the following options to update the firmware:

- Update the firmware with the existing update file via the user interface of the inverter.
- Search and install the firmware via the user interface of the inverter.

Update the firmware with the existing update file via the user interface of the inverter.**Requirements:**

- An update file with the desired inverter firmware must be available. The update file is, for example, available for download on the product page of the inverter at www.SMA-Solar.com.

Procedure:

1. Open the user interface (see Section 9.1, page 48).
2. Log into the user interface as an **Installer** (see Section 9.2, page 49).
3. Click on [**Edit parameters**].
4. Select the menu **Device Configuration**.
5. In the inverter row, click on the gear icon and select **Update firmware**.
6. Select [**Browse**] and select the update file for the inverter.
7. Select **Update firmware**.
8. Follow the instructions in the dialog.
9. Call up the user interface of the inverter and check the events to see whether a firmware update has been successfully completed.

Search and install the firmware via the user interface of the inverter.

Requirements:

- The inverter must be connected to the Internet.

Procedure:

1. Open the user interface (see Section 9.1, page 48).
 2. Log into the user interface as an **Installer** (see Section 9.2, page 49).
 3. Click on [**Edit parameters**].
 4. Go to **Device > Update**.
 5. Select the parameter **Check for update and install it** and set it to **Execute**.
 6. Click on [**Save all**].
- The firmware is updated in the background.

10 Disconnecting the Inverter from Voltage Sources

⚠ QUALIFIED PERSON

Prior to performing any work on the inverter, always disconnect it from all voltage sources as described in this section. Always adhere to the prescribed sequence.

⚠ WARNING

Danger to life due to electric shock from destruction of the measuring device due to overvoltage

Overvoltage can damage a measuring device and result in voltage being present in the enclosure of the measuring device. Touching the live enclosure of the measuring device results in death or lethal injuries due to electric shock.

- Only use measuring devices with a measurement ranges designed for the maximum AC and DC voltage of the inverter.

NOTICE

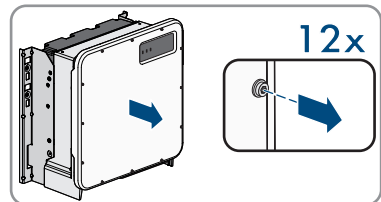
Damage to the inverter due to switching operations on the transformer

If voltages are present in the inverter, switching operations on the transformer can lead to large fluctuations in the voltage in the inverter. Large fluctuations in voltage can damage components in the inverter.

- Disconnect the inverter from voltage sources before performing any switching operations on the transformer.

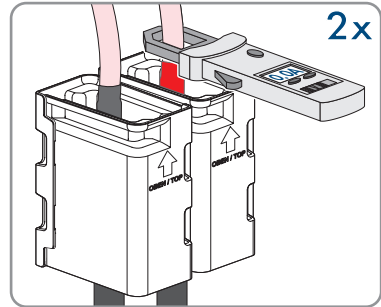
Procedure:

1. Disconnect the AC miniature circuit breaker and secure against reconnection.
2. Disconnect the DC terminal of the inverter via the PV combiner box or the external DC switch.
3. Wait 5 minutes.
4. Wait until the LEDs have gone out.
5. Unscrew the screws of the enclosure lid (TX25) and remove it.

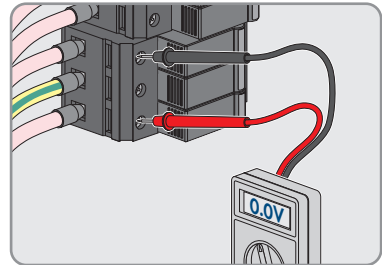


6. Set the screws and the enclosure lid aside and store safely.

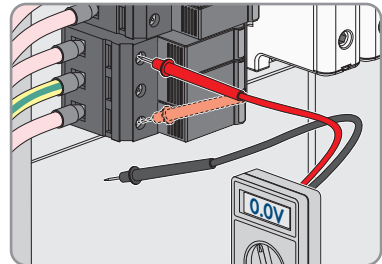
7. Use a current clamp to ensure that no current is present in the DC cables. As a result, a possible residual current can be detected.



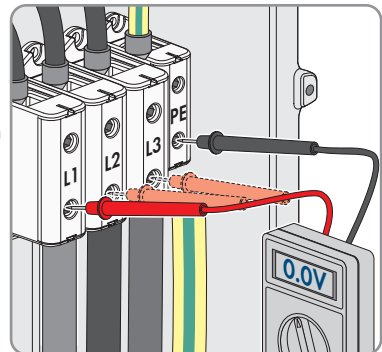
8. Ensure that no voltage is present between the positive terminal and negative terminal on the DC surge protection devices using a suitable measuring device. To do so, insert the test probe (maximum diameter: 2.5 mm (0.078 in)) into the measuring points of the DC surge protection devices.



9. Ensure that no voltage is present between the positive terminal and ground as well as between the negative terminal and ground on the DC surge protection devices using a suitable measuring device. To do so, insert a test probe (maximum diameter: 2.5 mm (0.078 in)) into the measuring points of the DC surge protection devices and hold the other one, for example, on the enclosure.



10. Ensure that no voltage is present on the AC terminal block between L1 and grounding conductor, L2 and grounding conductor, and L3 and grounding conductor using a suitable measuring device. To do so, insert the test probe (maximum diameter: 2.5 mm (0.078 in)) into the measuring points of the respective terminal blocks.



11. Optional: Switch off the transformer.

11 Clean the product

NOTICE

Damage to the product due to cleaning agents

The use of cleaning agents may cause damage to the product and its components.

- Clean the product and all its components only with a cloth moistened with clear water.

Procedure:

- Ensure that the product is free of dust, foliage and other dirt.

12 Troubleshooting

12.1 Forgotten Password

If you have forgotten the password for the inverter, you can unlock the inverter with a Personal Unlocking Key (PUK). For each inverter, there is one PUK for each user group (**User** and **Installer**).
Tipp: With PV systems that are registered in a communication product, you can also assign a new password for the user group **Installer** via the communication product. The password for the user group **Installer** is the same as the system password in the communication product.

Procedure:

1. Request PUK (application form available at www.SMA-Solar.com).
2. Open the user interface (see Section 9.1, page 48).
3. Enter the PUK instead of the password into the field **Password**.
4. Select **Login**.
5. Call up the menu **Device Parameters**.
6. Click on [**Edit parameters**].
7. In the parameter group **User Rights > Access Control** change the password of the desired user group.
8. Select [**Save all**] to save the changes.

i Password assignment for inverters that are registered in a communication product

The password for the user group **Installer** is also the system password for the system in the communication product. Changing the password of the user group **Installer** can lead to the inverter no longer being able to be reached by the communication product.

- In the communication product, assign the changed password of the user group **Installer** as the new system password (see the manual of the communication product).

12.2 Event Messages

Event number	Message, cause and corrective measures
101	<p>⚠ QUALIFIED PERSON</p> <p>Grid incident</p> <p>The grid voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. <p>If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.</p> <p>If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.</p>
102	
103	
105	
202	
203	
206	
301	<p>⚠ QUALIFIED PERSON</p> <p>Grid incident</p> <p>The ten-minute average value of the grid voltage is no longer within the permissible range. The grid voltage or grid impedance at the connection point is too high. The inverter disconnects from the utility grid to maintain power quality.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> During the feed-in operation, check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. <p>If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.</p> <p>If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.</p>

Event number	Message, cause and corrective measures
302	<p data-bbox="311 188 582 220">⚠ QUALIFIED PERSON</p> <p data-bbox="288 236 593 263">Active power limit AC voltage</p> <p data-bbox="288 271 974 327">The inverter has reduced its power due to a too-high grid voltage to ensure grid stability.</p> <p data-bbox="288 335 504 359">Corrective measures:</p> <ul data-bbox="311 367 1008 510" style="list-style-type: none"> <li data-bbox="311 367 1008 510">• If possible, check the grid voltage and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.
401 404	<p data-bbox="311 531 582 563">⚠ QUALIFIED PERSON</p> <p data-bbox="288 579 425 606">Grid incident</p> <p data-bbox="288 614 1008 670">The inverter has disconnected from the utility grid. A stand-alone grid or a very large change in the grid frequency was detected.</p> <p data-bbox="288 678 504 702">Corrective measures:</p> <ul data-bbox="311 710 1008 742" style="list-style-type: none"> <li data-bbox="311 710 1008 742">• Check the grid connection for significant short-term frequency fluctuations.
501	<p data-bbox="311 754 582 786">⚠ QUALIFIED PERSON</p> <p data-bbox="288 802 425 829">Grid incident</p> <p data-bbox="288 837 1008 893">The grid frequency is not within the permissible range. The inverter has disconnected from the utility grid.</p> <p data-bbox="288 901 504 925">Corrective measures:</p> <ul data-bbox="311 933 1008 1149" style="list-style-type: none"> <li data-bbox="311 933 1008 1149">• If possible, check the power frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.

Event number	Message, cause and corrective measures
507	<p data-bbox="311 185 596 220">⚠ QUALIFIED PERSON</p> <p data-bbox="288 236 622 263">Active power limit AC frequency</p> <p data-bbox="288 272 997 327">The inverter has reduced its power due to a too-high grid frequency to ensure grid stability.</p> <p data-bbox="288 336 508 360">Corrective measures:</p> <ul data-bbox="311 370 1006 539" style="list-style-type: none"> <li data-bbox="311 370 1006 539">• If possible, check the power frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.
601	<p data-bbox="311 552 596 587">⚠ QUALIFIED PERSON</p> <p data-bbox="288 603 426 630">Grid incident</p> <p data-bbox="288 639 978 694">The inverter has detected an excessively high proportion of direct current in the grid current.</p> <p data-bbox="288 703 508 727">Corrective measures:</p> <ul data-bbox="311 737 967 826" style="list-style-type: none"> <li data-bbox="311 737 967 766">• Check the grid connection for direct current. <li data-bbox="311 775 967 826">• If this message is displayed frequently, contact the grid operator and check whether the monitoring threshold on the inverter can be raised.
701	<p data-bbox="311 839 596 874">⚠ QUALIFIED PERSON</p> <p data-bbox="288 890 743 917">Frequency not permitted > Check parameter</p> <p data-bbox="288 927 1003 981">The grid frequency is not within the permissible range. The inverter has disconnected from the utility grid.</p> <p data-bbox="288 991 508 1015">Corrective measures:</p> <ul data-bbox="311 1024 997 1240" style="list-style-type: none"> <li data-bbox="311 1024 997 1240">• If possible, check the power frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.

Event number	Message, cause and corrective measures
1302	<p data-bbox="311 183 596 220">⚠ QUALIFIED PERSON</p> <p data-bbox="288 231 1001 295">Waiting for grid voltage > Installation failure grid connection > Check grid and fuses</p> <p data-bbox="288 300 460 327">L is not connected.</p> <p data-bbox="288 335 508 362">Corrective measures:</p> <ul data-bbox="311 367 930 491" style="list-style-type: none"> <li data-bbox="311 367 757 394">• Ensure that the line conductors are connected. <li data-bbox="311 402 835 429">• Ensure that the miniature circuit breaker is switched on. <li data-bbox="311 437 930 491">• Ensure that the AC cable is not damaged and that it is connected correctly.
1501	<p data-bbox="311 502 596 539">⚠ QUALIFIED PERSON</p> <p data-bbox="288 550 529 577">Reconnection fault grid</p> <p data-bbox="288 582 994 678">The changed country data set or the value of a parameter you have set does not correspond to the local requirements. The inverter cannot connect to the utility grid.</p> <p data-bbox="288 686 508 713">Corrective measures:</p> <ul data-bbox="311 718 1006 778" style="list-style-type: none"> <li data-bbox="311 718 1006 778">• Ensure that the country data set has been configured correctly. To do this, select the parameter Set country standard and check the value.
3302 3303	<p data-bbox="311 790 596 826">⚠ QUALIFIED PERSON</p> <p data-bbox="288 837 490 865">Unstable operation</p> <p data-bbox="288 869 1003 933">There is not enough power at the DC input of the inverter for stable operation. The inverter cannot connect to the utility grid.</p> <p data-bbox="288 941 508 968">Corrective measures:</p> <ul data-bbox="311 973 969 1066" style="list-style-type: none"> <li data-bbox="311 973 787 1000">• Ensure that the PV array is dimensioned correctly. <li data-bbox="311 1008 969 1035">• Ensure that the PV array is not covered by snow or otherwise shaded. <li data-bbox="311 1043 715 1066">• Ensure that the PV array is free of defects.

Event number	Message, cause and corrective measures
3401	<p data-bbox="311 183 593 215">⚠ QUALIFIED PERSON</p> <p data-bbox="288 231 688 263">DC overvoltage > Disconnect PV array</p> <p data-bbox="288 271 823 295">Overvoltage at the DC input. This can destroy the inverter.</p> <p data-bbox="288 303 918 327">This message is signaled additionally by rapid flashing of the LEDs.</p> <p data-bbox="288 335 509 359">Corrective measures:</p> <ul data-bbox="311 367 996 614" style="list-style-type: none"> <li data-bbox="311 367 901 391">• Immediately disconnect the inverter from all voltage sources. <li data-bbox="311 399 996 486">• Check whether the DC voltage is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC cables to the inverter. <li data-bbox="311 494 996 582">• If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array. <li data-bbox="311 590 828 614">• If this message is repeated frequently, contact Service.
3501	<p data-bbox="311 630 593 662">⚠ QUALIFIED PERSON</p> <p data-bbox="288 678 649 710">Insulation failure > Check PV array</p> <p data-bbox="288 718 800 742">The inverter has detected a ground fault in the PV array.</p> <p data-bbox="288 750 509 774">Corrective measures:</p> <ul data-bbox="311 782 688 805" style="list-style-type: none"> <li data-bbox="311 782 688 805">• Check the PV system for ground faults.
3601	<p data-bbox="311 821 593 853">⚠ QUALIFIED PERSON</p> <p data-bbox="288 869 694 901">High leakage current > Check PV array</p> <p data-bbox="288 909 963 965">The leakage current of the inverter and the PV array is too high. There is a ground fault, a residual current or a malfunction.</p> <p data-bbox="288 973 996 1061">The inverter interrupts feed-in operation immediately after exceeding a threshold. When the fault is eliminated, the inverter automatically reconnects to the utility grid.</p> <p data-bbox="288 1069 509 1093">Corrective measures:</p> <ul data-bbox="311 1101 688 1125" style="list-style-type: none"> <li data-bbox="311 1101 688 1125">• Check the PV system for ground faults.
3701	<p data-bbox="311 1141 593 1173">⚠ QUALIFIED PERSON</p> <p data-bbox="288 1189 733 1220">Residual current too high > Check PV array</p> <p data-bbox="288 1228 996 1284">The inverter has detected a residual current through brief grounding of the PV array.</p> <p data-bbox="288 1292 509 1316">Corrective measures:</p> <ul data-bbox="311 1324 688 1348" style="list-style-type: none"> <li data-bbox="311 1324 688 1348">• Check the PV system for ground faults.

Event number	Message, cause and corrective measures
3901 3902	<p data-bbox="314 188 594 220">⚠ QUALIFIED PERSON</p> <p data-bbox="292 236 871 263">Waiting for DC start conditions > Start conditions not met</p> <p data-bbox="292 272 829 300">The feed-in conditions for the utility grid are not yet fulfilled.</p> <p data-bbox="292 309 508 336">Corrective measures:</p> <ul data-bbox="311 344 975 555" style="list-style-type: none"> <li data-bbox="311 344 969 371">• Ensure that the PV array is not covered by snow or otherwise shaded. <li data-bbox="311 376 580 403">• Wait for higher irradiation. <li data-bbox="311 408 956 496">• If this message is displayed frequently in the morning, increase the voltage limit for starting grid feed-in. Change the parameter Critical voltage to start feed-in. <li data-bbox="311 501 975 555">• If this message is displayed frequently with medium irradiation, ensure that the PV array is correctly rated.
6001-6438	<p data-bbox="314 574 594 606">⚠ QUALIFIED PERSON</p> <p data-bbox="292 622 652 649">Self-diagnosis > Device disturbance</p> <p data-bbox="292 659 708 686">The cause must be determined by the Service.</p> <p data-bbox="292 695 508 722">Corrective measures:</p> <ul data-bbox="311 730 486 758" style="list-style-type: none"> <li data-bbox="311 730 486 758">• Contact Service.
6501 6502	<p data-bbox="314 770 594 802">⚠ QUALIFIED PERSON</p> <p data-bbox="292 818 637 845">Self-diagnosis > Overtemperature</p> <p data-bbox="292 855 826 882">The inverter has switched off due to excessive temperature.</p> <p data-bbox="292 892 508 919">Corrective measures:</p> <ul data-bbox="311 927 983 1050" style="list-style-type: none"> <li data-bbox="311 927 983 981">• Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush. <li data-bbox="311 986 770 1013">• Ensure that the inverter has sufficient ventilation. <li data-bbox="311 1018 919 1050">• Ensure that the inverter is not exposed to direct solar irradiation.
6511	<p data-bbox="314 1069 594 1101">⚠ QUALIFIED PERSON</p> <p data-bbox="292 1117 471 1144">Overtemperature</p> <p data-bbox="292 1153 818 1181">An overtemperature has been detected in the choke area.</p> <p data-bbox="292 1190 508 1217">Corrective measures:</p> <ul data-bbox="311 1225 983 1348" style="list-style-type: none"> <li data-bbox="311 1225 983 1279">• Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush. <li data-bbox="311 1284 770 1311">• Ensure that the inverter has sufficient ventilation. <li data-bbox="311 1316 919 1348">• Ensure that the inverter is not exposed to direct solar irradiation.
6512	<p data-bbox="292 1361 757 1388">Minimum operating temperature not reached</p> <p data-bbox="292 1398 949 1445">The inverter will only recommence grid feed-in once the temperature has reached at least -25°C.</p>

Event number	Message, cause and corrective measures
6701 6702	<p data-bbox="311 183 596 220">⚠ QUALIFIED PERSON</p> <p data-bbox="288 236 524 260">Communication failure</p> <p data-bbox="288 272 986 325">Error in the communication processor, the inverter continues feeding in, however. The cause must be determined by the Service.</p> <p data-bbox="288 336 508 360">Corrective measures:</p> <ul data-bbox="311 368 871 392" style="list-style-type: none"> <li data-bbox="311 368 871 392">• If this message is displayed frequently, contact the Service.
7001 7002 7015	<p data-bbox="288 411 628 435">Fault sensor interior temperature</p> <p data-bbox="288 443 708 467">The cause must be determined by the Service.</p> <p data-bbox="288 480 508 504">Corrective measures:</p> <ul data-bbox="311 512 486 536" style="list-style-type: none"> <li data-bbox="311 512 486 536">• Contact Service.
7102	<p data-bbox="311 555 596 592">⚠ QUALIFIED PERSON</p> <p data-bbox="288 608 667 632">Parameter file not found or defective</p> <p data-bbox="288 644 978 697">The parameter file was not found or is defective. Loading the parameter file has failed. The inverter continues to feed in.</p> <p data-bbox="288 708 508 732">Corrective measures:</p> <ul data-bbox="311 740 804 764" style="list-style-type: none"> <li data-bbox="311 740 804 764">• Copy the parameter file to the correct folder again.
7106	<p data-bbox="288 778 505 802">Update file defective</p> <p data-bbox="288 815 986 868">The update file is defective. The update failed. The inverter continues to feed in.</p>
7112	<p data-bbox="288 882 605 906">Update file successfully copied</p>
7113	<p data-bbox="288 922 721 946">The memory card is full or write-protected</p>
7201 7202	<p data-bbox="288 962 555 986">Data storage not possible</p>
7303	<p data-bbox="311 1042 596 1078">⚠ QUALIFIED PERSON</p> <p data-bbox="288 1094 585 1118">Host computer update failed</p> <p data-bbox="288 1131 708 1155">The cause must be determined by the Service.</p> <p data-bbox="288 1168 508 1192">Corrective measures:</p> <ul data-bbox="311 1200 486 1224" style="list-style-type: none"> <li data-bbox="311 1200 486 1224">• Contact Service.
7320	<p data-bbox="288 1241 667 1265">The device was successfully updated</p> <p data-bbox="288 1278 742 1302">The firmware update was completed successfully.</p>

Event number	Message, cause and corrective measures
7324	<p>⚠ QUALIFIED PERSON</p> <p>Wait for update conditions</p> <p>The testing of the update conditions was not successful. The firmware update package is not suitable for this inverter.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Retry update. • Ensure that the selected update file is suitable for this inverter. • If this message is displayed again, contact the Service.
7330	<p>Condition test failed</p> <p>The testing of the update conditions was not successful. The firmware update package is not suitable for this inverter.</p>
7331	<p>Update transport started</p> <p>Update file is being copied.</p>
7332	<p>Update transport successful</p> <p>Update file was copied successfully to the inverter's internal memory.</p>
7333	<p>⚠ QUALIFIED PERSON</p> <p>Update transport failed</p> <p>Update file could not be copied to the inverter's internal memory.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Retry update. • If this message is displayed again, contact the Service.
7340	<p>Update communication failed</p>
7347	<p>⚠ QUALIFIED PERSON</p> <p>Incompatible file</p> <p>The configuration file is not suitable for this inverter.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the selected configuration file is suitable for this inverter. • Retry import.

Event number	Message, cause and corrective measures
7348	<p data-bbox="292 181 596 220">⚠ QUALIFIED PERSON</p> <p data-bbox="292 236 493 260">Incorrect file format</p> <p data-bbox="292 272 885 296">The configuration file is not of the required format or is damaged.</p> <p data-bbox="292 309 508 333">Corrective measures:</p> <ul data-bbox="311 341 997 429" style="list-style-type: none"> <li data-bbox="311 341 997 397">• Ensure that the selected configuration file is of the required format and is not damaged. <li data-bbox="311 405 452 429">• Retry import.
7349	<p data-bbox="292 442 717 466">Incorrect login rights for configuration file</p> <p data-bbox="292 478 986 534">The user group logged in does not have the user rights necessary to be able to import a configuration.</p> <p data-bbox="292 547 508 571">Corrective measures:</p> <ul data-bbox="311 579 620 639" style="list-style-type: none"> <li data-bbox="311 579 508 603">• Log in as Installer. <li data-bbox="311 611 620 639">• Import configuration file again.
7350	<p data-bbox="292 649 721 673">Transfer of a configuration file has started</p> <p data-bbox="292 686 669 710">The configuration file is being transferred.</p>
7353	<p data-bbox="292 729 577 753">Update time zone database</p> <p data-bbox="292 766 729 790">The inverter is updating the time zone database.</p>
7619	<p data-bbox="292 801 596 839">⚠ QUALIFIED PERSON</p> <p data-bbox="292 855 1003 879">Communication fault with meter unit > Check communication to meter</p> <p data-bbox="292 892 841 916">The inverter is not receiving any data from the energy meter.</p> <p data-bbox="292 928 508 952">Corrective measures:</p> <ul data-bbox="311 960 1006 1015" style="list-style-type: none"> <li data-bbox="311 960 1006 1015">• Ensure that the energy meter is correctly integrated into the same network as the inverter (see energy meter manual).
7702 7703	<p data-bbox="292 1024 596 1062">⚠ QUALIFIED PERSON</p> <p data-bbox="292 1078 652 1102">Self-diagnosis > Device disturbance</p> <p data-bbox="292 1115 708 1139">The cause must be determined by the Service.</p> <p data-bbox="292 1152 508 1176">Corrective measures:</p> <ul data-bbox="311 1184 486 1208" style="list-style-type: none"> <li data-bbox="311 1184 486 1208">• Contact Service.

Event number	Message, cause and corrective measures
7801	<p data-bbox="311 183 593 215">⚠ QUALIFIED PERSON</p> <p data-bbox="288 231 571 263">Fault overvoltage protector</p> <p data-bbox="288 271 991 327">One or more surge arresters have tripped or one or more surge arresters are not inserted correctly.</p> <p data-bbox="288 335 509 359">Corrective measures:</p> <ul data-bbox="311 367 980 454" style="list-style-type: none"> <li data-bbox="311 367 789 391">• Ensure that the surge arrester is inserted correctly. <li data-bbox="311 399 980 454">• If surge arresters have tripped, replace the tripped surge arresters with new surge arresters.
8003	<p data-bbox="311 470 593 502">⚠ QUALIFIED PERSON</p> <p data-bbox="288 518 610 550">Active power limit temperature</p> <p data-bbox="288 558 1002 614">The inverter has reduced its power output for more than 10 minutes due to excessive temperature.</p> <p data-bbox="288 622 509 646">Corrective measures:</p> <ul data-bbox="311 654 980 774" style="list-style-type: none"> <li data-bbox="311 654 980 710">• Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush. <li data-bbox="311 718 767 742">• Ensure that the inverter has sufficient ventilation. <li data-bbox="311 750 918 774">• Ensure that the inverter is not exposed to direct solar irradiation.
8101 8102 8103 8104	<p data-bbox="311 798 593 829">⚠ QUALIFIED PERSON</p> <p data-bbox="288 845 520 869">Communication failure</p> <p data-bbox="288 877 711 901">The cause must be determined by the Service.</p> <p data-bbox="288 917 509 941">Corrective measures:</p> <ul data-bbox="311 949 487 973" style="list-style-type: none"> <li data-bbox="311 949 487 973">• Contact Service.
8708	<p data-bbox="311 989 593 1021">⚠ QUALIFIED PERSON</p> <p data-bbox="288 1037 834 1069">Timeout in communication for active power limitation</p> <p data-bbox="288 1077 1002 1165">Communication to the system control absent. Depending on the fallback setting, either the last received values will be retained or the active power will be limited to the set percentage value of the inverter nominal power.</p> <p data-bbox="288 1173 509 1197">Corrective measures:</p> <ul data-bbox="311 1204 974 1260" style="list-style-type: none"> <li data-bbox="311 1204 974 1260">• Ensure that the connection to the system manager is intact and that no cables are damaged or that no plugs have been pulled.

Event number	Message, cause and corrective measures
8709	<p>⚠ QUALIFIED PERSON</p> <p>Timeout in communication for reactive power setpoint Communication to the system control absent.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the connection to the system manager is intact and that no cables are damaged or that no plugs have been pulled.
8710	<p>⚠ QUALIFIED PERSON</p> <p>Timeout in communication for cos phi setpoint Communication to the system control absent.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the connection to the system manager is intact and that no cables are damaged or that no plugs have been pulled.
9002	<p>⚠ QUALIFIED PERSON</p> <p>SMA Grid Guard code invalid The SMA Grid Guard code entered is incorrect. The operating parameters are still protected and cannot be changed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Enter the correct SMA Grid Guard code.
9003	<p>Grid parameters locked Changes to the grid parameters are now blocked. In order to be able to make changes to the grid parameters, from now on you must log in using the SMA Grid Guard code.</p>
9007	<p>⚠ QUALIFIED PERSON</p> <p>Abort self-test The self-test (Italy only) was terminated.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the AC connection is correct. • Restart the self-test.
9107	<p>⚠ QUALIFIED PERSON</p> <p>Self-diagnosis > Device disturbance The cause must be determined by the Service.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact Service.
10108	<p>Time adjusted / old time</p>

Event number	Message, cause and corrective measures
10109	Time adjusted / new time
10110	<p>⚠ QUALIFIED PERSON</p> <p>Time synchronization failed: [xx] No time information could be called up from the set NTP server.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the NTP server was configured correctly. • Ensure that the inverter is integrated into a local network with Internet connection.
10118	<p>Parameter upload complete The configuration file was loaded successfully.</p>
10248	<p>⚠ QUALIFIED PERSON</p> <p>[Interface]: network busy The network is busy. Data exchange between the devices is not at an optimum and is greatly delayed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Increase the query intervals. • If necessary, reduce the number of devices in the network.
10249	<p>⚠ QUALIFIED PERSON</p> <p>[Interface]: network overloaded The network is overloaded. There is no data exchange between the devices.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Reduce the number of devices in the network. • If necessary, increase the data query intervals.
10250	<p>⚠ QUALIFIED PERSON</p> <p>[Interface]: package error rate [ok / high] The package error rate has changed. If the package error rate is high, the network is overloaded or the connection to the network switch or DHCP server (router) is impaired.</p> <p>Corrective measures if the package error rate is high:</p> <ul style="list-style-type: none"> • Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged. • If necessary, increase the data query intervals. • If necessary, reduce the number of devices in the network.

Event number	Message, cause and corrective measures
10251	<p>[Interface]: communication status goes to [OK / Warning / Error / Not connected]</p> <p>The communication status to the network switch or DHCP server (router) has changed. An additional error message may be displayed.</p>
10252	<p>⚠ QUALIFIED PERSON</p> <p>[Interface]: communication disrupted</p> <p>There is no valid signal on the network line.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged. • Ensure that the DHCP server (router) and any network switches are signaling correct operation.
10253	<p>⚠ QUALIFIED PERSON</p> <p>[Interface]: connection speed goes to [100 Mbit / 10 Mbit]</p> <p>The data transfer rate has changed. The cause for the status [10 Mbit] can be a defective plug, a defective cable or the pulling or plugging of the network connector.</p> <p>Corrective measures if the status is [10 Mbit]:</p> <ul style="list-style-type: none"> • Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged. • Ensure that the DHCP server (router) and any network switches are signaling correct operation.
10254	<p>⚠ QUALIFIED PERSON</p> <p>[Interface]: duplex mode goes to [Full / Half]</p> <p>The duplex mode (data transfer mode) has changed. The cause for the status [Half] can be a defective plug, a defective cable or the pulling or plugging of the network connector.</p> <p>Corrective measures if the status is [Half]:</p> <ul style="list-style-type: none"> • Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged. • Ensure that the DHCP server (router) and any network switches are signaling correct operation.

Event number	Message, cause and corrective measures
10255	<p>⚠ QUALIFIED PERSON</p> <p>[Interface]: Network load OK The network load has returned to a normal range after being busy.</p>
10282	<p>[User group]-Login via [protocol] locked After several incorrect login attempts, login has been blocked for a limited time. In this case, the User login will be blocked for 15 minutes, the Grid Guard login for 12 hours.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Wait until the given time has expired and then retry login.
10339	Webconnect enabled
10340	Webconnect disabled
10341	Webconnect error: no connection
10343	Webconnect error: Default gateway not configured
10344	Webconnect error: DNS server not configured
10345	Webconnect error: No reply to DNS request xx
10346	Webconnect error: Unknown SIP proxy xx
10347	Webconnect error: Unknown STUN server xx
10348	Webconnect error: No reply to request to STUN server
10349	Webconnect error: No reply to SIP option packs
10350	Webconnect error: Registration rejected by SIP registrar
10351	Webconnect error: Unknown SIP registrar xx
10352	Webconnect error: Faulty communication
10353	Webconnect error: registration of the SIP registry has not responded
10502	Active power limit AC frequency
10517	Dynamic active power limitation started.
10518	Dynamic active power limitation terminated.
10520	Supplied power: xx W (permitted value: xx W)
10521	Active power was limited today for xx minutes.
10525	Inverter does not respond to active power limitation.
10528	System password of the connected device xx invalid
10901	Start self-test xx
10902	Current disconnection limit for voltage increase protection xxx V

Event number	Message, cause and corrective measures
10903	Current disconnection limit for voltage monitoring lower maximum threshold xxx V
10904	Current disconnection limit for voltage monitoring upper minimum threshold xxx V
10905	Current disconnection limit for voltage monitoring middle minimum threshold xxx V
10906	Current disconnection limit for frequency monitoring switchable maximum threshold xxx Hz
10907	Current disconnection limit for frequency monitoring switchable minimum threshold xxx Hz
10908	Current disconnection limit for frequency monitoring lower maximum threshold xxx Hz
10909	Current disconnection limit for frequency monitoring upper minimum threshold xxx Hz
10910	Measured disconnection threshold for the running test point xxx xx
10911	Standard value for the running test point xxx xx
10912	Measured disconnection time for the running test point xx s
27103	Set parameter The parameter changes are being adopted.
27104	Parameters set successfully The parameter changes were successfully adopted.
27107	Update file OK The update file found is valid.
27301	Update communication The inverter is updating the communication component.
27302	Update main CPU The inverter is updating the inverter component.
27312	Update completed The inverter has successfully completed the update.
27329	Condition test successful

Event number	Message, cause and corrective measures
29001	<p>Inst. code valid</p> <p>The entered Grid Guard code is valid. Protected parameters have now been unlocked and you can adjust the parameters. The parameters will be automatically locked again after 10 feed-in hours.</p>
29004	<p>Grid parameter unchanged</p> <p>Changing the grid parameters is not possible.</p>

12.3 Checking the PV System for Ground Faults

QUALIFIED PERSON

If the red LED is glowing and the event number 3501, 3601 or 3701 is being displayed in the **Results** menu on the inverter user interface, there may be a ground fault present. The electrical insulation from the PV system to ground is defective or insufficient.

DANGER

Danger to life due to electric shock when touching live system components in case of a ground fault

If a ground fault occurs, parts of the system may still be live. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Disconnect the product from voltage sources and make sure it cannot be reconnected before working on the device.
- Only touch the cables of the PV modules on their insulation.
- Do not touch any parts of the substructure or frame of the PV array.
- Do not connect PV strings with ground faults to the inverter.
- Ensure that no voltage is present and wait five minutes before touching any parts of the PV system or the product.

WARNING

Danger to life due to electric shock from destruction of the measuring device due to overvoltage

Overvoltage can damage a measuring device and result in voltage being present in the enclosure of the measuring device. Touching the live enclosure of the measuring device results in death or lethal injuries due to electric shock.

- Only use measuring devices with a measurement ranges designed for the maximum AC and DC voltage of the inverter.

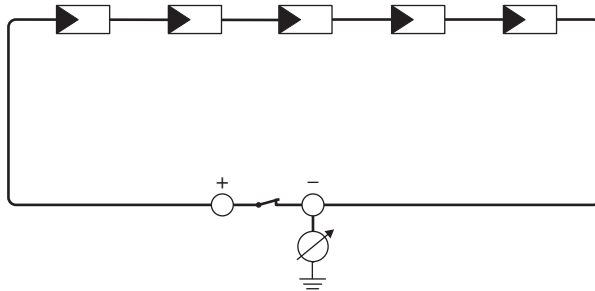


Figure 13: Schematic diagram of the measurement

i Calculating the insulation resistance

The expected total resistance of the PV system or of an individual string can be calculated using the following formula:

$$\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

The exact insulation resistance of a PV module can be obtained from the module manufacturer or the datasheet.

For the resistance of a PV module an average value can be assumed: for thin-film PV modules approximately 40 MOhm and for polycrystalline and monocrystalline PV modules approximately 50 MOhm per PV module (for further information on calculating the insulation resistance see the Technical Information "Insulation Resistance (Riso) of Non-Galvanically Isolated PV Systems" at www.SMA-Solar.com).

Required devices:

- Suitable device for safe disconnection and short-circuiting
- Measuring device for insulation resistance

i Device required for safe disconnection and short-circuiting of the PV array

The insulation resistance can only be measured with a suitable device for safe disconnection and short-circuiting of the PV array. If no suitable device is available, the insulation measurement must not be carried out.

Procedure:

1. Calculate the expected insulation resistance per string.

2.

⚠ DANGER

Danger to life due to high voltages

- Disconnect the inverter from all voltage sources (see Section 10, page 62).

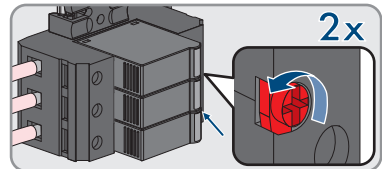
3. Install the short circuit device.
4. Connect the measuring device for insulation resistance.
5. Short-circuit the first string.

6. Set the test voltage. The test voltage should be as close as possible to the maximum system voltage of the PV modules but must not exceed it (see datasheet of the PV modules).
7. Measure the insulation resistance.
8. Eliminate the short circuit.
9. Measure the remaining strings in the same manner.
 - ☑ If the insulation resistance of a string deviates considerably from the theoretically calculated value, there is a ground fault present in that string.
10. Reconnect to the inverter only those strings from which the ground fault has been eliminated.
11. Reconnect all other strings to the inverter.
12. Recommission the inverter.
13. If the inverter still displays an insulation error, contact the Service (see Section 17, page 99). The PV modules might not be suitable for the inverter in the present quantity.

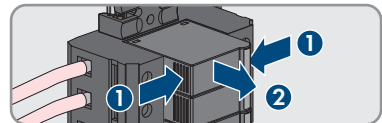
12.4 Replacing the Surge Arrester

⚠ QUALIFIED PERSON

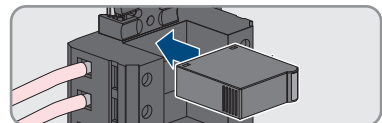
1. Disconnect the inverter from all voltage sources (see Section 10, page 62).
2. Unlock the surge arresters by turning the latch to the open position with a screwdriver.



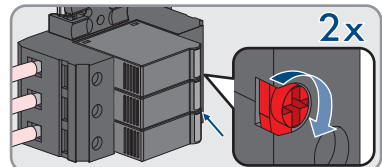
3. Pull all surge arresters out of the slots.



4. Dispose of all surge arresters in accordance with the locally applicable disposal regulations for electronic waste.
5. Insert new surge arresters.



6. Lock the surge arresters by turning the latch to the closed position with a screwdriver.



7. Ensure that each surge arrester is securely inserted into its slot.
8. Recommission the inverter (see Section 8.2, page 40).

12.5 Activate the diagnostic function in the event of a defective Speedwire communication

If several Speedwire devices in line topology are connected to each other in the system and the Speedwire communication does not function properly, you have the option of activating diagnostic functions for simple troubleshooting.

The following diagnostic functions are available:

- Activate Speedwire communication display on the inverter
- Test Speedwire communication via SMA Data Manager

Activating the Speedwire Communication Display on the Inverter

By activating this diagnostic function, the inverter can signal that one network cable is connected by the blue LED flashing. This allows you to quickly check whether the network cable is plugged in for inverters where only one network cable is to be connected, and whether only one rather than two network cables are connected for inverters where two network cables are to be connected.

Procedure:

1. In the parameter group **Device > Operation**, select the parameter **Ethernet link diagnostic via LED** and set this to **On**.
 - Blue LED flashes (2 s on and 250 ms off): one network cable is connected to the inverter.
 - Blue LED is not flashing: No network cable is connected.
2. Check whether for the inverters where the blue LED is flashing there really should only be one network cable connected or whether two network cables should be connected here.
3. Check whether for the inverters where the blue LED is not flashing there really should not be a network cable connected.

Testing the Speedwire Communication via SMA Data Manager

If there is a SMA Data Manager in the system, the inverter can indicate signal whether the Speedwire communication is working properly or if there is a problem by the red LED flashing. The diagnostic function can only be activated via the user interface of the SMA Data Manager.

Procedure:

1. Select the **Communication diagnostic** parameter via the SMA Data Manager user interface and set it to **On**.
 - The red LED of the inverter flashes (250 ms on and 250 ms off): The communication of the Speedwire devices connected in line topology is working perfectly.
2. If the inverter's red LED does not flash, the Speedwire communication is defective. The communication path must be checked.

12.6 Cleaning the Fans

⚠ QUALIFIED PERSON

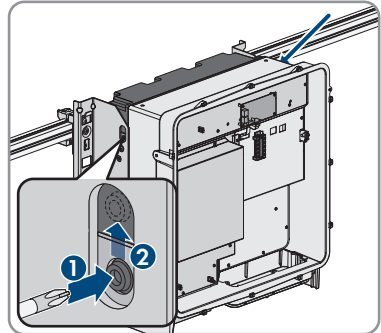
1.

⚠ DANGER

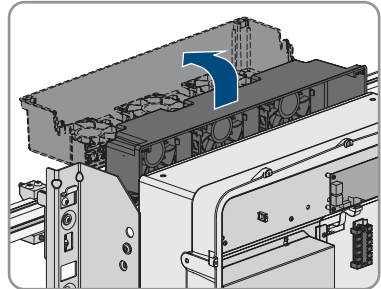
Danger to life due to high voltages

- Disconnect the inverter from all voltage sources (see Section 10, page 62).

2. Release the fan bracket on the right and left of the inverter. To do so, press in the locking tabs and push them upwards.



3. Move the fan bracket upwards and fold it backwards. Note that the fan bracket cannot be removed completely because it is connected to the inverter by the fan cable.



4.

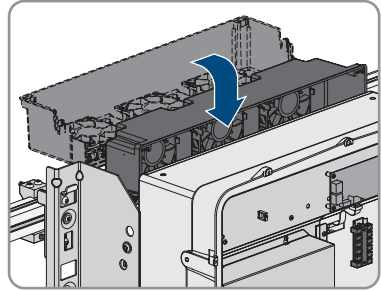
NOTICE

Damage to the fans due to compressed air

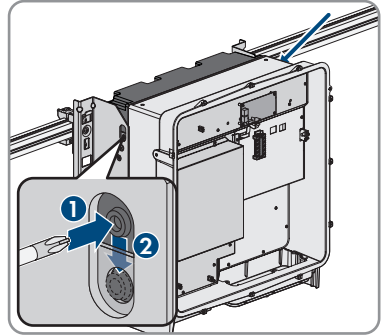
- Clean the fans with a soft brush, a paint brush, or a damp cloth.

5. If the cooling fins are dirty, clean them using a soft brush.

6. Insert the locking tabs on the left and right of the fan bracket into the recesses and the top into the suspensions.



7. Press the fan bracket firmly downwards so that the locking tabs engage on the right and left.



8. Recommission the inverter (see Section 8.2, page 40).

13 Decommissioning the Inverter

QUALIFIED PERSON

To decommission the inverter completely upon completion of its service life, proceed as described in this Section.

CAUTION

Risk of injury due to weight of product

Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

- Transport and lift the product carefully. Take the weight of the product into account.
- Wear suitable personal protective equipment for all work on the product.
- Transport the product using the carrying handles or hoist. Take the weight of the product into account.
- Use all carrying handles provided during transport with carrying handles.
- Do not use the carrying handles as attachment points for hoist equipment (e.g. straps, ropes, chains). Insert eye bolts into threads provided on top of the product to attach the hoist system.

Requirements:

- Original packaging or packaging suitable for the weight and dimensions of the product must be available.
- A pallet must be available.
- Mounting material for attaching the packaging on the pallet must be available (e.g. tie-down straps).
- All transport handles must be in place.

Procedure:

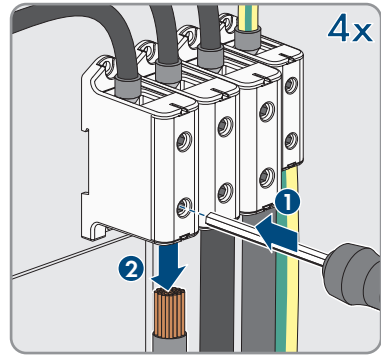
1.

DANGER

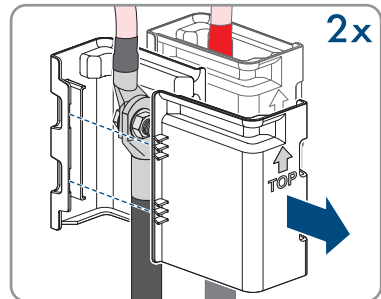
Danger to life due to high voltages

- Disconnect the inverter from all voltage sources (see Section 10, page 62).

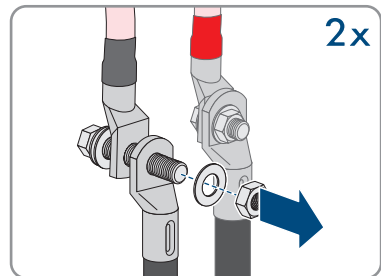
2. Remove the AC cable from the inverter. Loosen the screws of the terminals L1, L2 and L3 (AF8) and the screws of the terminal \ominus (AF5).



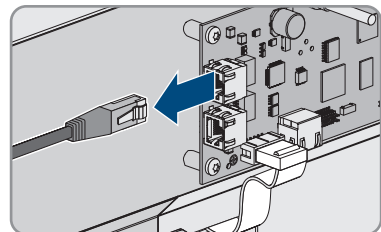
3. Remove the AC cable from the inverter.
4. Remove the protection elements against contact from the terminal lugs for the DC connection. To do so, unlock the side brackets.



5. Remove the DC cable connection. Loosen the hex nuts (AF10) and remove the combined hexagon head screw (AF16).

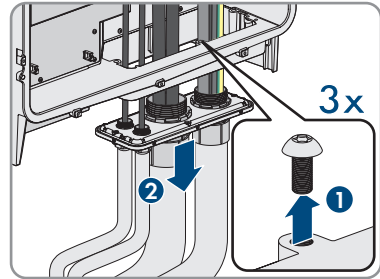


6. Remove the DC cables from the inverter.
7. Remove the network cables from the network ports and remove them from the inverter.

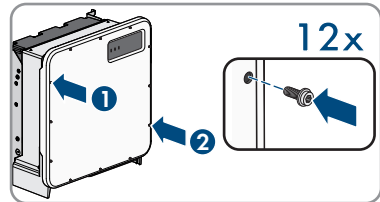


8. Remove all cable conduits from the connecting plate. To do this, screw the conduit fittings out of the openings from the inside.

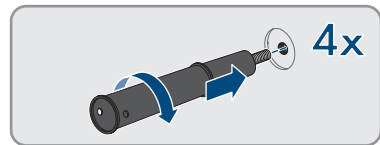
9. Dismantle the connecting plate. To do so, unscrew the three screws (TX40).



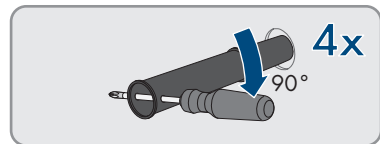
10. Position the enclosure lid and first tighten the upper-left and lower-right screws, and then the remaining screws crosswise (TX25, torque: $6 \text{ Nm} \pm 0.3 \text{ Nm}$ ($53 \text{ in-lb} \pm 2.65 \text{ in-lb}$)).



11. Screw the transport handles as far as they will go into the taps on the right- and left-hand side until they lie flush with the enclosure. When doing so, ensure that the transport handles are screwed into the taps so that they are perfectly straight. If the transport handles are not screwed in straight, this can make it more difficult or even impossible to unscrew them later on and can damage the taps to the extent that transport handles can no longer be screwed into them.

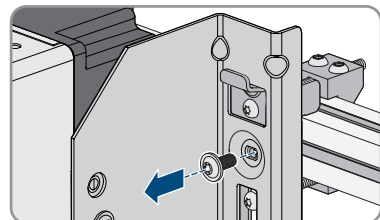


12. Insert a screwdriver into the holes in the transport handle and turn the screwdriver through 90° . This ensures that the transport handles are securely tightened.

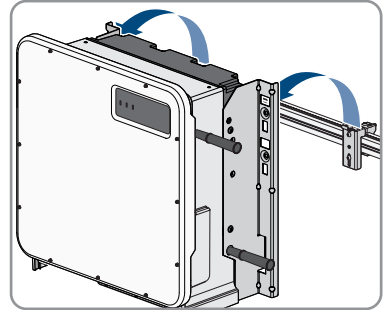


13. If the inverter is to be hooked into the mounting brackets by means of a hoist, screw the eye bolts into the threads on the top of the inverter and attach the hoist to them. The hoist must be suitable to take the weight of the inverter.

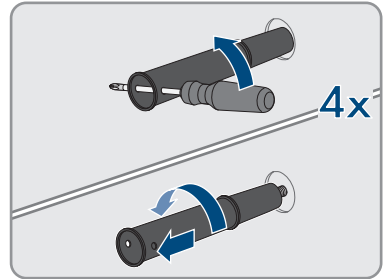
14. Unscrew the screw for securing the product to the mounting brackets on the right and left (TX40).



15. Remove the inverter from the mounting lugs of the mounting brackets by moving it upward.



16. Remove all four transport handles from the threaded holes. If necessary, insert a screwdriver into the holes on the transport handle and use the screwdriver to remove the transport handle.



17. If the inverter is to be stored or shipped, pack the inverter and the mounting bracket. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter and secure with tie-down straps on the pallet.
18. Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

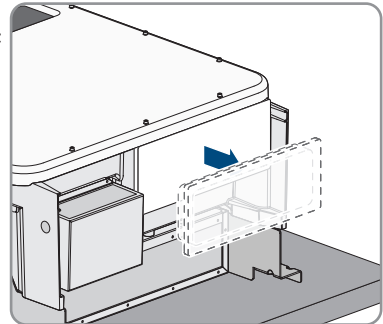
14 Procedure for Receiving a Replacement Device

⚠ QUALIFIED PERSON

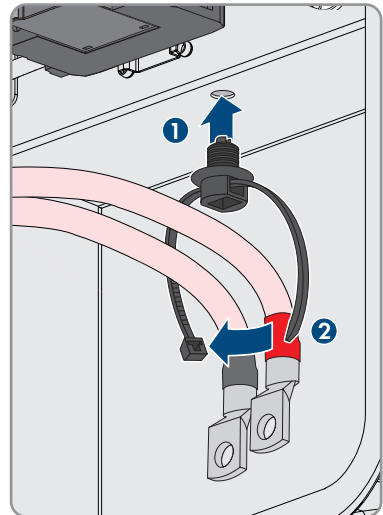
Under fault conditions, the product may need to be replaced. If this is the case, you will receive a replacement device from SMA Solar Technology AG. If you received a replacement device, replace the defective product with the replacement device as described below.

Procedure:

1. To simplify the configuration of the replacement device, save the configuration data of the defective product to a file (see Section 9.11, page 59).
2. Decommission the defective product (see Section 13, page 87).
3. Remove the transport cover, which is located in the enclosure opening of the replacement unit instead of the connecting plate, and use it for the defective product.



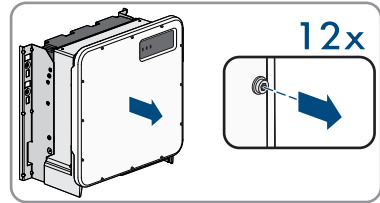
4. Secure the pre-configured DC connection cables in the defective product for transport. To do so, screw the supplied cable tie into the hole below the DC surge protection devices and place and tighten the cable tie around the DC connection cables.



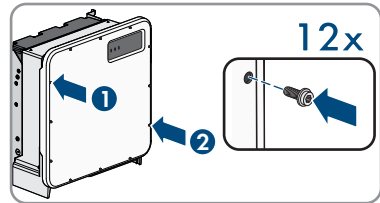
5. Mount the replacement device and make the electrical connections as described in this document. Use the connection plate and the DC protection elements against contact of the defective product.

6. If the enclosure lid of the replacement device is a transport lid (see information on the enclosure lid), replace the transport lid of the replacement device with the enclosure lid of the defective inverter:

- Unscrew the screws of the enclosure lid (TX25) and remove it.



- Position the enclosure lid and first tighten the upper-left and lower-right screws, and then the remaining screws crosswise (TX25, torque: $6 \text{ Nm} \pm 0.3 \text{ Nm}$ (53 in-lb \pm 2.65 in-lb)).



7. Commission the replacement device (see Section 8.2, page 40).

8. Establish a connection to the user interface (see Section 9.1, page 48).

9. On the **Configure inverter** page, select the **Adopt configuration from file** configuration option and load the saved configuration file of the defective product (see Section 8.3, page 41).

10. If the defective inverter had been registered by a communication product, replace it with the new product in the communication product.

11. Pack the defective product in the packaging of the replacement device.

12. Fasten the packaging to the pallet on which the replacement device was supplied using the reusable lashing straps.

13. Arrange for pick-up with SMA Solar Technology AG.

15 Technical Data

DC input

	SHP 125-US-20	SHP 150-US-20
Maximum power of PV array	187500 Wp	225000 Wp
Maximum input voltage	1500 V	1500 V
MPP voltage range	705 V to 1450 V	880 V to 1450 V
Rated input voltage	830 V	960 V
Minimum input voltage	684 V	855 V
Initial input voltage	780 V	940 V
Maximum input current	180 A	180 A
Maximum short-circuit current	325 A	325 A
Maximum reverse current into the PV modules*	0 A	0 A
Number of independent MPP trackers	1	1
Number of inputs	1	1

* The topology prevents a reverse current from the inverter in the system

AC output

	SHP 125-US-20	SHP 150-US-20
Rated power at nominal AC voltage, 60 Hz	125000 W	150000 W
Maximum apparent AC power	125000 VA	150000 VA
Rated grid voltage	480 V	600 V
Nominal AC voltage	480 V	600 V
AC voltage range*	422 V to 582 V	480 V to 690 V
Nominal AC current at nominal AC voltage	151 A	145 A
Maximum output current	151 A	151 A
Total harmonic distortion (THD)	< 3 %	< 3 %
Maximum residual output current	662.8 A	662.8 A
Duration of the maximum residual output current	446.7 ms	446.7 ms

	SHP 125-US-20	SHP 150-US-20
Line synchronization characteristics	Method 2	Method 2
Rated grid frequency	60 Hz	60 Hz
Operating range at AC grid frequency 60 Hz	54 Hz to 66 Hz	54 Hz to 66 Hz
Operating range at AC grid frequency 50 Hz	44 Hz to 56 Hz	44 Hz to 56 Hz
Limits of accuracy of voltage measurement	2% of the AC voltage	2% of the AC voltage
Limits of accuracy of frequency measurement	±0.1 Hz	±0.1 Hz
Limits of accuracy of time measurement at nominal trip time	± 0.1 %	± 0.1 %
Limits of accuracy of current measurement	1% of the AC current	1% of the AC current
Limits of accuracy of power (active/reactive) measurement	5% of the nominal AC power	5% of the nominal AC power
Limits of accuracy of power factor measurement	0.01	0.01
Limits of accuracy of time measurement	0.001 s	0.001 s
Output power at +60 °C (+140 °F) at minimum MPP voltage, 60 Hz	98 kW	125 kW
Output power at +60 °C (+140 °F) at maximum MPP voltage, 60 Hz	96 kW	123 kW
Power factor at rated power	1	1
Range of the displacement power factor (adjustable)	0.0 overexcited to 0.0 underexcited	0.0 overexcited to 0.0 underexcited
Compatible transformer-winding configuration	Wye connection with grounded neutral point	Wye connection with grounded neutral point
Output phases	3	3
Line conductor	3 grounding conductor	3 grounding conductor
Surge category in accordance with UL 62109	III	III

* Depending on the configured country data set

Efficiency

	SHP 125-US-20	SHP 150-US-20
Maximum efficiency, η_{\max}	99.0 %	99.1 %
CEC weighted efficiency, η_{CEC}	98.5 %	99.0 %

Protective devices

DC reverse polarity protection	Available
DC overvoltage protection	Surge arrester type 2
AC overvoltage protection"	Surge arrester type 2
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 4
Maximum overcurrent protection	250 A
Ground fault monitoring*	Insulation monitoring: $R_{\text{iso}} > 32.2 \text{ k}\Omega$
All-pole sensitive residual-current monitoring unit	Available

* The specified value is the default value. The value can be configured via parameters %.

General Data

Width x height x depth without feet and without disconnectors	770 mm x 833 mm x 444 mm (30.3 in x 32.8 in x 17.5 in)
Weight with enclosure lid and connecting plate	98 kg (216 lbs)
Weight without enclosure lid and connecting plate	90 kg (198.4 lbs)
Length x width x height of the packaging	1150 mm x 850 mm x 630 mm (45.3 in x 33.5 in x 24.8 in)
Transport weight (including pallet)	115 kg (254 lbs)
Operating temperature range	-25°C to +60°C (-13°F to +140°F)
Storage temperature	-40°C to +70°C (-40°F to +158°F)
Maximum permissible value for relative humidity, condensing	100 %
Maximum operating altitude above mean sea level (MSL)	3000 m (9843 ft)
Typical noise emission	69 dB(A)
Power loss in night mode	5.58 W
Topology	Transformerless
Cooling method	SMA OptiCool

Number of fans	3
Enclosure degree of protection according to UL 50	Type 4X
Protection class	I
National standards and approvals, as per 03/2019	UL 62109-1, IEEE 1547, CAN/CSA-C22.2 No. 62109, FCC Part 15 (Class A)

Climatic conditions

Installation in accordance with IEC 60721-3-4, Class 4K4H

Extended temperature range	-25°C to +60°C (-13°F to +140°F)
Extended humidity range	0 % to 100 %
Threshold for relative humidity, non-condensing	100 %
Extended air pressure range	79.5 kPa to 106 kPa

Transport in accordance with IEC 60721-3-4, Class 2K3

Temperature range	-40°C to +70°C (-40°F to +158°F)
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Equipment

DC terminal	Terminal lug
AC terminal	Screw terminals

Torques

Screws of mounting bracket (M8x105, TX40)	12 Nm ± 2 Nm (106 in-lb ± 17.7 in-lb)
Screws for attaching the inverter to the mounting brackets (M8x16, TX40)	12 Nm ± 2 Nm (106 in-lb ± 17.7 in-lb)
Screws for attaching the connecting plate to the inverter (M8x70, TX40)	8 Nm ± 0.5 Nm (71 in-lb ± 4 in-lb)
Screws AC terminals L1, L2 and L3 (AF8)	24 Nm (216 in-lb)
Screws AC terminal of grounding conductor (AF5)	10 Nm (90 in-lb)
Screws for attaching equipment grounding conductor of PV modules	6 Nm ± 0.3 Nm (53 in-lb ± 2.65 in-lb)
Screws for attaching terminal lugs of DC connection (AF16)	24 Nm ± 2 Nm (212 in-lb)
Enclosure lid screws (TX25)	6 Nm ± 0.3 Nm (53 in-lb ± 2.65 in-lb)

Data Storage Capacity

Daily energy yields	63 days
Daily yields	30 years
Event messages for users	1024 events
Event messages for installers	1024 events

16 Compliance Information

FCC Compliance

This device complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications made to this equipment not expressly approved by SMA Solar Technology AG may void the FCC authorization to operate this equipment.

17 Contact

If you have technical problems with our products, please contact the SMA Service Line. The following data is required in order to provide you with the necessary assistance:

- Device type
- Serial number
- Firmware version
- Mounting location and mounting height
- Type and number of PV modules
- Use the name of the system in Sunny Portal (if available)
- Access data for Sunny Portal (if available)
- Special country-specific settings (if available)
- Detailed description of the problem

United States	SMA Solar Technology America LLC Rocklin, CA	Toll free for USA and US Territories +1 877-MY-SMATech (+1 877-697-6283) International: +1 916 625-0870
Canada	SMA Solar Technology Canada Inc. Mississauga	Toll free for Canada / Sans frais pour le Canada : +1 877-MY-SMATech (+1 877-697-6283)
México	SMA Solar Technology de México Mexico City	Internacional: +1 916 625-0870

