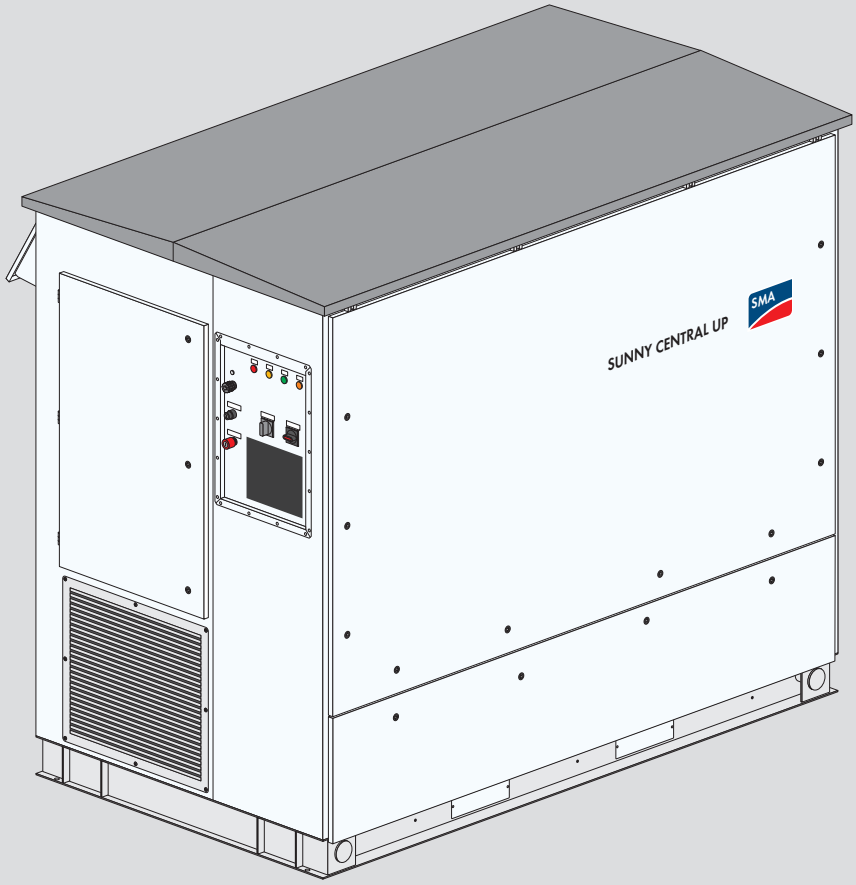
Service Manual for Installers

Test Instructions for the Power-Generating Unit Protection Test SUNNY CENTRAL UP / SUNNY CENTRAL STORAGE UP



ENGLISH

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SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal

Germany

Tel. +49 561 9522-0

Fax +49 561 9522-100

www.SMA.de

Email: info@SMA.de

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1 Information on this Document

1.1 Validity

This document is valid for:

- SC 4000 UP (Sunny Central 4000 UP)
- SC 4200 UP (Sunny Central 4200 UP)
- SC 4400 UP (Sunny Central 4400 UP)
- SC 4600 UP (Sunny Central 4600 UP)
- SCS 3450 UP (Sunny Central Storage 3450 UP)
- SCS 3600 UP (Sunny Central Storage 3600 UP)
- SCS 3800 UP (Sunny Central Storage 3800 UP)
- SCS 3950 UP (Sunny Central Storage 3950 UP)
- SCS 3450 UP-XT (Sunny Central Storage 3450 UP-XT)
- SCS 3600 UP-XT (Sunny Central Storage 3600 UP-XT)
- SCS 3800 UP-XT (Sunny Central Storage 3800 UP-XT)
- SCS 3950 UP-XT (Sunny Central Storage 3950 UP-XT)

1.2 Target Group

The tasks described in this document must only be performed by qualified persons. Qualified persons must have the following skills:

- Knowledge of how the product 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 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.

1.4 Symbols in the Document

Symbol	Explanation
	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates a requirement for meeting a specific goal
☑	Desired result
✖	A problem that might occur
	Example

1.5 Typographical Elements in the Document

Typography	Use	Example
bold	• Messages • Terminals • Elements on a user interface • Elements to be selected • Elements to be entered	• Connect the insulated conductors to the terminals **X703:1** to **X703:6**. • Enter **10** in the field **Minutes**.
>	• Connects several elements to be selected	• Select **Settings > Date**.
[**Button**] [**Key**]	• Button or key to be selected or pressed	• Select [**Enter**].
#	• Placeholder for variable components (e.g., parameter names)	• Parameter **WCtlHz.Hz#**

1.6 Designations in the Document

Complete designation	Designation in this document
Medium-voltage transformer	MV transformer
Sunny Central UP	Sunny Central or inverter

1.7 Additional Information

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

Title and information content	Type of information
"PUBLIC CYBER SECURITY - Guidelines for a Secure PV System Communication"	Technical information

For information on maintenance activities of the DC switchgear and AC disconnect unit please visit www.abb.com:

Component	Document number
DC switchgear: T-Max	1SDH000707R0001

2 Safety

2.1 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

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 electronical 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 cables are touched

High voltages are present in the conductive components or cables of the product. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Observe all safety information on components associated with the product.
- Disconnect the inverter from the power path and from the control path if no voltage is required for working on the product.
- After switching off the inverter, wait at least 25 minutes before opening the inverter to allow the capacitors to discharge completely.
- Wear suitable personal protective equipment of the corresponding hazard risk category for all work when the power transmission path is connected. The hazard risk categories of the various areas of the product are different.
- Always perform all work in accordance with the locally applicable standards, directives and laws.
- Observe all safety information on the product and in the documentation.
- The product must not be operated with open covers or doors.
- Cover or isolate all live components.

⚠ DANGER

Danger to life due to electric shock when operating a damaged product

Operating a damaged product can lead to hazardous situations since high voltages can be present on accessible product parts. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Only operate the product when it is in a flawless technical condition and safe to operate.
- Make sure that all external safety equipment is freely accessible at all times.
- Make sure that all safety equipment is in good working order.
- Wear suitable personal protective equipment of the corresponding hazard risk category for all work when the power transmission path is connected. The hazard risk categories of the various areas of the product are different.

⚠ DANGER

Danger to life due to electric shock in case of a ground fault

If there is a ground fault, components that are supposedly grounded may in fact be live and components that are normally ungrounded may be grounded. The PV field is not grounded when the inverter is disconnected or during the measurement of the insulation resistance. Touching live parts will result in death or serious injury due to electric shock.

- Disconnect the inverter from the power path and from the control path if no voltage is required for working on the product.
- Before working on the system, ensure that no ground fault is present.
- Wear suitable personal protective equipment of the corresponding hazard risk category for all work when the power transmission path is connected. The hazard risk categories of the various areas of the product are different.

⚠ WARNING

Danger to life from electric shock when the product is left unlocked

If the product is not locked, unauthorized persons will have access to components carrying lethal voltages. Touching live components can result in death or serious injury due to electric shock.

- Always close and lock the product.
- Ensure that unauthorized persons do not have access to the closed electrical operating area.

⚠ WARNING

Danger to life from electric shock when entering the PV power plant

Lethal ground currents due to damaged insulations of the PV field. Lethal electric shocks can result.

- Ensure that the insulation resistance of the PV array exceeds the minimum value. The minimum value of the insulation resistance is: 14 kΩ.
- Before entering the PV field, switch the PV power plants with ground fault monitoring to insulated operation.
- After entering the PV power plant, immediately ensure that the inverter does not display an insulation error.
- Disconnect the inverter from the power path and from the control path if no voltage is required for working on the product.
- Wear suitable personal protective equipment for all work on the product.
- Configure the PV power plant as a closed electrical operating area.

⚠ WARNING

Danger to life from electric shock when entering the PV power plant outside of the feed-in operation

With the order option "Backfeed Power", DC voltage can be applied to the inverter outside of the feed-in operation. Lethal electric shocks can result.

- Before entering the PV power plant, make sure via the user interface that the inverter is not in backfeed power mode.
- Always disconnect the inverter from the power transmission path and from the control path if no voltage is required for working on the PV power plant.
- Wear suitable personal protective equipment for all work on the product.
- Configure the PV power plant as a closed electrical operating area.

⚠ WARNING

Danger to life due to electric shock when the internal power supply is switched off

After switching off the internal power supply at the load-break switch **-Q62**, lethal voltages are still present in the cables to load-break switch **-Q62** Only after the power path has been enabled are all cables of the internal power supply de-energized. Touching live components can result in death or serious injury due to electric shock.

- Disconnect the inverter from the power path and ensure that it cannot be reconnected.
- Do not touch the orange cables in the inside of the product. These cables are used for connecting the external supply voltage and can be dangerous to touch.
- Wear suitable personal protective equipment of the corresponding hazard risk category for all work when the power transmission path is connected. The hazard risk categories of the various areas of the product are different.

⚠ WARNING

Danger to life due to electric shock if external supply voltage is not disconnected

When using an external supply voltage, even after disconnecting the inverter, there may still be lethal voltages present in cables. Touching live components can result in death or serious injury due to electric shock.

- Disconnect the external supply voltage.
- Do not touch the orange cables in the inside of the product. These cables are used for connecting the external supply voltage and can be dangerous to touch.
- Wear suitable personal protective equipment of the corresponding hazard risk category for all work when the power transmission path is connected. The hazard risk categories of the various areas of the product are different.

⚠ WARNING

Hearing impairment due to high-frequency noises of the product

The product generates high-frequency noises during operation. This can result in hearing impairment.

- Wear hearing protection.

⚠ WARNING

Danger to life due to electric arc if there are tools inside the product

When reconnecting or during operation, an electric arc can occur if there are tools in the product creating a conductive connection between the live components. This can result in death or serious injury.

- Before commissioning or reconnection, verify that no tools are inside the product.

⚠ CAUTION

Risk of burns due to hot components

Some components of the product can get very hot during operation. Touching these components can cause burns.

- Observe the warnings on all components.
- During operation, do not touch any components marked with such warnings.
- After switching off the product, wait until any hot components have cooled down sufficiently.
- Wear suitable personal protective equipment for all work on the product.

⚠ CAUTION

Risk of injury when using unsuitable tools

Using unsuitable tools can result in injuries.

- Ensure that the tools are suitable for the work to be carried out.
- Wear personal protective equipment for all work on the product.

⚠ CAUTION

Danger of crushing and collision when carelessly working on the product

Carelessly working on the product could result in crushing injuries or collisions with edges.

- Wear personal protective equipment for all work on the product.

NOTICE

Damage due to environmental disturbances

The product can be damaged by environmental disturbances e.g. earthquakes, storms or flooding. With a damaged product, a safe and trouble-free operation is not guaranteed. Considerable damages to the product and yield losses can result.

- Always disconnect the product from voltage sources as quickly as possible after large-scale environmental disturbances.
- Once disconnected from voltage sources, perform a thorough 24-month-maintenance check that is not subject to the maintenance schedule.
- After a dust or snow storm, ensure that the air inlets and outlets are not covered by any objects (e.g., sand).
- Only recommission the product once any damages have been rectified.

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.
- In case of interruption of work or after finishing work, mount all enclosure parts and close and lock all doors.
- Only operate the product when it is closed.
- Store the closed product in a dry and covered location. Observe storage conditions.
- The temperature at the storage location must be in the specified range. The temperature range is: –40°C to +70°C.

2.2 Personal Protective Equipment

i Always wear suitable protective equipment

When working on the product, always wear the appropriate personal protective equipment for the specific job.

The following personal protective equipment is regarded to be the minimum requirement:

- ☐ In a dry environment, safety shoes of category S3 with perforation-proof soles and steel toe caps
- ☐ During precipitation or on moist ground, safety boots of category S5 with perforation-proof soles and steel toe caps
- ☐ Tight-fitting work clothes made of 100% cotton
- ☐ Suitable work pants
- ☐ Proper hearing protection
- ☐ Safety gloves
- ☐ Proper head protection

Any other prescribed protective equipment must also be used.

When carrying out work on live parts of the inverter, protective equipment of the respective hazard risk category is required. The hazard risk category of the various areas of the inverter are different. The areas are identified with warning labels. The required protective equipment must comply with the national regulations.

3 Disconnecting and Reconnecting

3.1 Disconnecting the Inverter

To ensure that the DC side is de-energized before opening the inverter, the inverter is equipped with measuring points for determining the DC voltage. The voltage applied on the DC side is displayed in a ratio of 1:10.

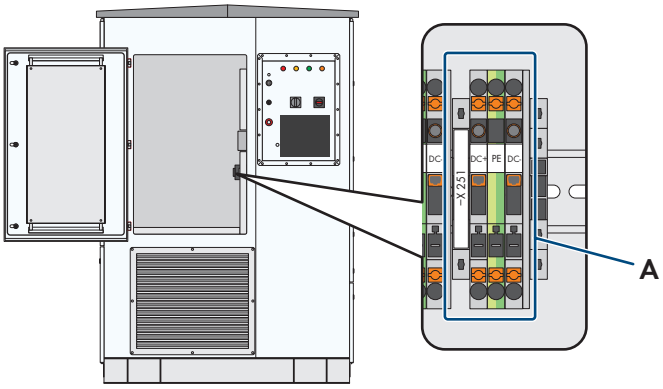


Figure 1: Position of measuring points in the customer installation location

Position	Designation
A	**-X251** for measuring the PV voltage

For the greatest possible safety during the disconnection process, the DC voltage must be measured before and after disconnecting the String-Combiners from voltage. Thus, a flawless measuring chain is ensured.

Measuring points	Measurement result
DC+ to DC-	10% of PV voltage present
DC+ to PE	10% of PV voltage present
DC- to PE	0 V

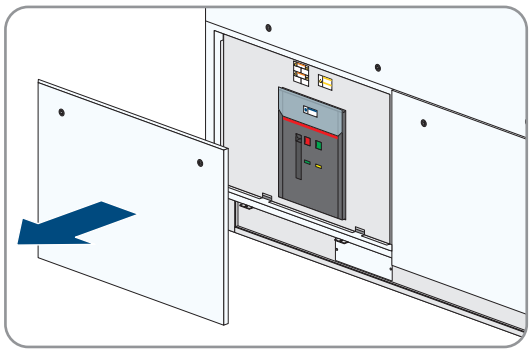
Additionally required material (not included in the scope of delivery):

☐ 2 padlocks. Diameter of the shackle: 5 mm to 8 mm.

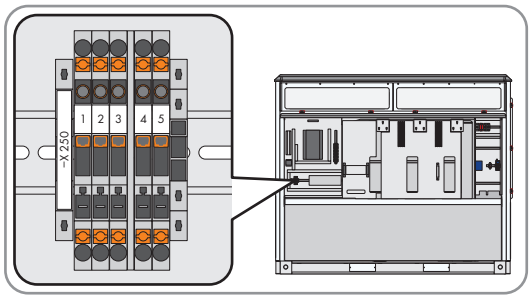
Procedure:

1. On the user interface make sure that error **6494** is not present .
2. Turn the key switch **-S1** to **Stop**.
3. Remove the key. This will protect the inverter from inadvertent reconnection.
4. Turn the DC load-break switch **-Q61** to the **OFF** position. Note that the cable to the load-break switch is still energized.
5. Pull the bracket out of the switch lever.
6. Hook a suitable padlock into the bracket and lock it. This will ensure that the switch lever cannot reconnect inadvertently.
7. To ensure the correct functioning of the measuring chain, measure the DC voltage at the terminal **-X251**. Measure DC+ against DC- and both poles against the grounding conductor.
8. Turn the load-break switch of the supply voltage **-Q62** to the **OFF** position. Note that the cable to the load-break switch is still energized.
9. Pull the bracket out of the switch lever.

10. Hook a suitable padlock into the bracket and lock it. This will ensure that the switch lever cannot reconnect inadvertently.
11. If external supply voltage is used, disconnect the supply voltage via upstream switching devices.
12. Disassemble the outer panel of the AC switch module Disassembling and Mounting the Panels.



13. Verify that the switch state display of the AC disconnection unit is in the **OPEN** position.
14. Mount the outer panel of the AC switch module Disassembling and Mounting the Panels.
15. Ensure that 25 minutes have passed after switching off the load-break switch **-Q61**.
16. Open the hatch on the AC side of the inverter Opening and Closing the Hatches.
17. Ensure that no voltage is present on the **-X250** terminal.



☑ The inverter must be disconnected from all voltage sources on the AC side.

18. Disconnect all poles of the String-Combiner from voltage sources, secure against reconnection and remove fuses.
19. Measure the DC voltage at the terminal **-X251**. Measure DC+ against DC- and both poles against the grounding conductor. The DC voltage must be 0 V.
20. Open the hatch on the DC side of the inverter Opening and Closing the Hatches.
21. Ensure that no voltage is present for each DC input. Use the measuring points on the bottom of the fuse holders. Tip: There are drill holes in the protective covers above the fuse holder. Through these drill holes you can determine the voltage-free status with suitable test probes without having to disassemble the protective covers.

☑ The inverter is completely disconnected from all voltage sources.

3.2 Disconnecting the Medium-Voltage Transformer

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

☐ 1 padlock. Diameter of the shackle: 5 mm to 8 mm

☐ Grounding and short-circuiting equipment

Procedure:

1. Ensure that the inverter is disconnected from all voltage sources (see Section 3.1, page 11).
2. Switch off the transformer panel of the medium-voltage switchgear (see manufacturer's documentation).
3. Ensure that no voltage is present.
4. Ground the transformer panel of the medium-voltage switchgear (see manufacturer's documentation).
5. Lock the circuit breaker for the medium-voltage switchgear using a padlock. This will protect the switch levers from inadvertent reconnection.

6. Attach magnetic signs indicating the name of the duly authorized person to the transformer panel.
7. Connect the grounding- and short-circuiting equipment to the AC busbars between the inverter and medium-voltage transformer.
8. Disconnect any additional external voltage.
9. Cover or isolate any adjacent live components.

3.3 Reconnecting the Medium-Voltage Transformer

Connecting and disconnecting medium voltage

Only a duly authorized person trained in electrical safety is allowed to connect and disconnect the medium voltage.

Requirements:

☐ The protective cover that protects the low-voltage area between the inverter and the MV transformer must be mounted.

☐ The cover at the medium-voltage connection area on the MV Transformer must be mounted.

Procedure:

1. Remove the grounding- and short-circuiting equipment from the AC busbars between the inverter and MV transformer.
2. Remove the magnetic signs indicating the name of the duly authorized person from the circuit breaker panel and the "Do not operate!" magnetic sign. varistor.
3. Remove the padlock from the circuit breaker for the MV switchgear.
4. Open the grounding switch at the transformer panel of the MV switchgear.
5. Close the circuit breaker for the transformer panel of the MV switchgear.
6. Restart the inverter (see Section 3.4, page 13).

3.4 Reconnecting the Inverter

⚠ DANGER

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

High voltages are present in the live parts of the product. Touching live parts will result in death or serious injury due to electric shock.

- Before reconnecting, make sure that the panels are mounted Disassembling and Mounting the Panels.
- Before reconnecting, make sure that the protective covers are mounted.
- Before reconnecting, make sure that the hatches are closed Opening and Closing the Hatches.

Procedure:

1. Actuate upstream switchpoint. Insert fuses in the String-Combiners or switch on the circuit breakers of the String-Combiners.
2. Switch on the disconnection unit of the battery.
3. Ensure that the panel is mounted in front of the AC disconnection unit.
4. Remove the padlocks from the brackets of the DC switches **-Q61** and **-Q62**.
5. Turn the DC load-break switch **-Q62** to the **ON** position.
6. Turn the DC load-break switch **-Q61** to the **ON** position.
7. Turn the key switch **-S1** to **Start**.

4 Power-Generating Unit Protection Test

The power-generating unit protection test is a fundamental part of PV system certification. For existing systems the protection test is part of the certificate, for new systems it is part of the declaration of conformity. The power-generating unit protection test helps grid operators and the certifying body to understand the proper parameterization and function of the protection concept. To this end, the test procedure must be documented completely. The parameterization specifications and the accuracy class requirements can be found in the grid connection guidelines or are specified by the grid operator.

4.1 Safety during the Power-Generating Unit Protection Test

⚠ DANGER

Danger to life from electric shock due to live voltage

High voltages are present in the live components of the product. Touching live components results in death or serious injury due to electric shock.

- Wear suitable personal protective equipment for all work on the product.
- Do not touch any live components.
- Observe all warning messages on the product and in the documentation.
- Observe all safety information of the module manufacturer.
- After switching off the inverter, wait at least 25 minutes before opening it to allow the capacitors to discharge completely (see Section 3.1, page 11).

4.2 Calculating the Reference Voltage

i Contractually agreed voltage V_C corresponds to parameter VolRtg

The contractually agreed voltage at the grid feed-in point V_C corresponds to the parameter **VolRtg**. V_C – the voltage contractually agreed on with the electric utility company – must be entered for the parameter **VolRtg** during commissioning and calculation of the reference voltage.

An appropriate reference voltage must be selected for the testing device when performing the protection test. The reference voltage can be calculated using the following formula.

$$V_0 = V_C \cdot \frac{1}{i} = VRtg \cdot \left(\frac{TrfVolExLo}{TrfVolExHi}\right)$$

Formula Symbol	Unit	Explanation
V_0	V	Reference voltage of testing device
V_C	V	Voltage at the grid feed-in point, contractually agreed with the grid operator
i	-	Transmission ratio of the MV transformer. The transmission ratio is the ratio of **TrfVolExLo** to **TrfVolExHi**.
VolRtg*	V	Nominal line voltage of the utility grid (parameter)
TrfVolExLo**	V	Voltage on the low-voltage side of the external transformer (parameter)

Formula Symbol	Unit	Explanation
TrfVolExHi**	V	Voltage on the high-voltage side of the external transformer (parameter)

* This parameter takes the level of the medium voltage into account. For For_{VolRtg}, the voltage at the grid feed-in point as contractually agreed with the grid operator, must be entered for **VRtg**.

** These parameters take the transformation ratio of the tap changer of the medium-voltage transformer into account. During commissioning, the tap changer is adjusted in such way that the terminal voltage of the medium-voltage transformer matches the nominal voltage of the inverter as closely as possible.

4.3 Saving the Test Parameters

The inverters have 6 relevant parameter pairs each for voltage increase protection and voltage drop protection and 1 relevant pair of parameters for frequency increase protection and frequency drop protection.

Test parameters		Set value / disconnection time
Voltage increase protection	1st level: V> / $t_{V>}$	VCtl.Hi1Lim / VCtl.Hi1LimTm
	2nd level: V>> / $t_{V>>}$	VCtl.Hi2Lim / VCtl.Hi2LimTm
	3rd level: V>>> / $t_{V>>>}$	VCtl.Hi3Lim / VCtl.Hi3LimTm
	4th level: V>>>> / $t_{V>>>>}$	VCtl.Hi4Lim / VCtl.Hi4LimTm
	5th level: V>>>>> / $t_{V>>>>}$	VCtl.Hi5Lim / VCtl.Hi5LimTm
	6th level: V>>>>> / $t_{V>>>>}$	VCtl.Hi6Lim / VCtl.Hi6LimTm
Voltage drop protection	1st level: V< / $t_{V<}$	VCtl.Lo1Lim / VCtl.Lo1LimTm
	2nd level: V<< / $t_{V<<}$	VCtl.Lo2Lim / VCtl.Lo2LimTm
	3rd level: V<<< / $t_{V<<<}$	VCtl.Lo3Lim / VCtl.Lo3LimTm
	4th level: V<<<< / $t_{V<<<<}$	VCtl.Lo4Lim / VCtl.Lo4LimTm
	5th level: V<<<<< / $t_{V<<<<<}$	VCtl.Lo5Lim / VCtl.Lo5LimTm
	6th level: V<<<<< / $t_{V<<<<<}$	VCtl.Lo6Lim / VCtl.Lo6LimTm
Frequency increase protection	1st level: f> / $t_{V>}$	HzCtl.Hi1Lim / HzCtl.Hi1LimTm
Frequency drop protection	1st level: f< / $t_{V<}$	HzCtl.Lo1Lim / HzCtl.Lo1LimTm

Access to parameters

The parameters needed for the power-generating unit protection test are only accessible after the installer password has been entered. The installer password is changed during the initial installation. You can obtain the changed installer password from the PV system operator.

Procedure:

1. Log into the user interface as an **Installer**.
2. In the main navigation, select and select **Parameter** from the drop-down list.
3. Save the test parameter values.

4.4 Performing the Power-Generating Unit Protection Test

Materials required for test:

☐ Three-phase testing device with the following properties:
- Trigger function for monitoring the potential-free contact
- Voltage range (depends on the power class, see operating manual) up to 759 V_{AC} (line-to-line) with accuracy better than 0.1%
- Logging function

☐ Laptop for changing the inverter parameters

☐ Data query sheet TR8

Requirements:

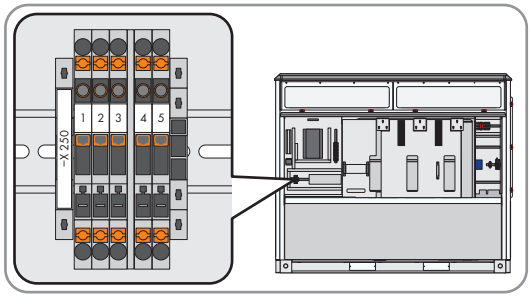
☐ The relevant test parameters have been saved (see Section 4.3, page 15).

☐ The tap changer setting on the MV transformer complies with the specifications of the grid operator or the PV system certificate.

☐ The parameter settings comply with the specifications of the grid operator or the PV system certificate.

Procedure:

1. Identify the measurement and disconnect terminal using the circuit diagram and reference designation.
2. Connect the outputs L1, L2 and L3 of the testing device to the measurement inputs P1, P2 and P3 on the measurement and disconnect terminal **-X250** of the voltage measurement unit.



3. Connect the binary input of the testing device to the measurement inputs P4 and P5 on the measurement and disconnect terminals of the voltage measurement unit.
4. Connect the testing device to the external voltage supply.
5. Connect the laptop to the service interface.
6. Log into the user interface as an installer.
7. Perform the power-generating unit protection test in accordance with the TR8 data request form. Set the test parameters in accordance with the specifications of the grid operator or the PV system certificate.
   - Voltage increase protection V> / $t_{V>}$ with the parameters **VCtl.Hi1Lim** and **VCtl.Hi1LimTm**
   - Voltage increase protection V>> / $t_{V>>}$ with the parameters **VCtl.Hi2Lim** and **VCtl.Hi2LimTm**
   - Voltage increase protection V>>> / $t_{V>>>}$ with the parameters **VCtl.Hi3Lim** and **VCtl.Hi3LimTm**
   - Voltage increase protection V>>>> / $t_{V>>>>}$ with the parameters **VCtl.Hi4Lim** and **VCtl.Hi4LimTm**
   - Voltage increase protection V>>>>> / $t_{V>>>>>}$ with the parameters **VCtl.Hi5Lim** and **VCtl.Hi5LimTm**
   - Voltage increase protection V>>>>>> / $t_{V>>>>>>}$ with the parameters **VCtl.Hi6Lim** and **VCtl.Hi6LimTm**
   - Voltage drop protection V< / $t_{V<}$ with the parameters **VCtl.Lo1Lim** and **VCtl.Lo1LimTm**
   - Voltage drop protection V<< / $t_{V<<}$ with the parameters **VCtl.Lo2Lim** and **VCtl.Lo2LimTm**
   - Voltage drop protection V<<< / $t_{V<<<}$ with the parameters **VCtl.Lo3Lim** and **VCtl.Lo3LimTm**
   - Voltage drop protection V<<<< / $t_{V<<<<}$ with the parameters **VCtl.Lo4Lim** and **VCtl.Lo4LimTm**
   - Voltage drop protection V<<<<< / $t_{V<<<<<}$ with the parameters **VCtl.Lo5Lim** and **VCtl.Lo5LimTm**

- Voltage drop protection V<<<<<< / $t_{V<<<<<<}$ with the parameters **VCtl.Lo6Lim** and **VCtl.Lo6LimTm**
- Frequency increase protection f> / $t_{V>}$ with the parameters **HzCtl.Hi1Lim** and **HzCtl.Hi1LimTm**
- Frequency drop protection f<< / $t_{V<<}$ with the parameters **HzCtl.Lo1Lim** and **HzCtl.Lo1LimTm**

8. Remove the measurement cables from the measurement and disconnect terminals.
9. Reconnect the inverter (see Section 3.4, page 13).

5 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
- Event message
- Type of communication
- Type and number of PV modules
- Type and size of additional energy sources
- Optional equipment, e.g. communication products
- Detailed description of the problem

Deutschland Österreich Schweiz	SMA Solar Technology AG Niestetal Sunny Boy, Sunny Mini Central, Sunny Tripower, Sunny Highpower: +49 561 9522-1499 Monitoring Systems, SMA EV Charger: +49 561 9522-2499 Hybrid Controller: +49 561 9522-3199 Sunny Island, Sunny Boy Storage, Sunny Backup: +49 561 9522-399 Sunny Central, Sunny Central Storage: +49 561 9522-299 SMA Online Service Center: www.SMA-Service.com
France	SMA France S.A.S. Lyon +33 472 22 97 00 SMA Online Service Center: www.SMA-Service.com
España Portugal	SMA Ibérica Tecnología Solar, S.L.U. Barcelona +34 935 63 50 99 SMA Online Service Center: www.SMA-Service.com
Belgien Belgique België Luxemburg Luxembourg Nederland	SMA Benelux BVBA/SPRL Mechelen +32 15 286 730 for Netherlands: +31 30 2492 000 SMA Online Service Center: www.SMA-Service.com
Česko Magyarország Slovensko	SMA Service Partner TERMS a.s +420 387 6 85 111 SMA Online Service Center: www.SMA-Service.com
Türkiye	SMA Service Partner DEKOM Telekomünikasyon A. Ş +90 24 22430605 SMA Online Service Center: www.SMA-Service.com
Ελλάδα Κύπρος	SMA Service Partner AKTOR FM. Αθήνα +30 210 8184550 SMA Online Service Center: www.SMA-Service.com
United Kingdom	SMA Solar UK Ltd. Milton Keynes +44 1908 304899 SMA Online Service Center: www.SMA-Service.com

Italia	SMA Italia S.r.l. Milano +39 02 8934-7299 SMA Online Service Center: www.SMA-Service.com	Australia	SMA Australia Pty Ltd. Sydney Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200
United Arab Emirates	SMA Middle East LLC Abu Dhabi +971 2234 6177 SMA Online Service Center: www.SMA-Service.com	India	SMA Solar India Pvt. Ltd. Mumbai +91 22 61713888
ไทย	Service Partner for String inverter: Solar Power Engineering Co., Ltd. 333/7,8,9 United Tower Building 4th floor. Soi Sukhumvit 55 (Thonglor 17), Klong-ton Nua, Wattana, 10110 Bangkok, Thailand +66 20598220 smaservice@spe.co.th Service Partner for Utility: Tirathai E & S Co., Ltd 516/1 Moo 4, Bangpoo Industrial Estate Sukhumvit Road, T. Praksa, A. Muang 10280 Samutprakarn, Thailand +63 1799866 servicepartner.sma@tirathai.co.th	대한민국	Enerone Technology Co., Ltd 4th Fl, Jungbu Bldg, 329, Yeongdong-daero, Gangnam-gu, Seoul, 06188, Korea +82-2-520-2666
		Argentina Brasil Chile Perú	SMA South America SPA Santiago de Chile +562 2820 2101
		South Africa	SMA Solar Technology South Africa Pty Ltd. Cape Town 08600SUNNY (08600 78669) International: +27 (0)21 826 0699 SMA Online Service Center: www.SMA-Service.com
Other countries	International SMA Service Line Niestetal 00800 SMA SERVICE (00800 762 7378423) SMA Online Service Center: www.SMA-Service.com		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