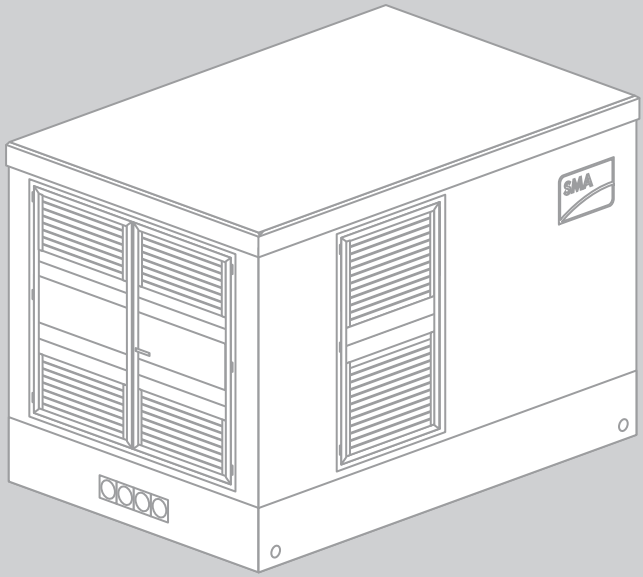
Accessories for Central Inverters

TRANSFORMER COMPACT STATION 500SC / 630SC / 800SC / 900SC / 1000SC / 1250SC /1600SC / 1800SC

Maintenance manual



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EN

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1 Information on this Document

Validity

This document is valid for the following device types:

- TCS-500-SC
- TCS-630-SC
- TCS-800-SC
- TCS-900-SC
- TCS-1000-SC
- TCS-1250-SC
- TCS-1600-SC
- TCS-1800-SC
- TCS-500-SC-ES
- TCS-630-SC-ES
- TCS-800-SC-ES
- TCS-1000-SC-ES
- TCS-1250-SC-ES
- TCS-1600-SC-ES
- TCS-500-SC-RO
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- TCS-1800-SC-RO
- TCS-500-SC-IN
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- TCS-800-SC-IN
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- TCS-630-SC-UK
- TCS-800-SC-UK
- TCS-1000-SC-UK
- TCS-1250-SC-UK
- TCS-1600-SC-UK
- TCS-500-SC-GR
- TCS-630-SC-GR
- TCS-800-SC-GR
- TCS-900-SC-GR
- TCS-1000-SC-GR
- TCS-1250-SC-GR
- TCS-1600-SC-GR
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- TCS-630-SC-IT
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- TCS-500-SC-AU
- TCS-630-SC-AU
- TCS-800-SC-AU
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- TCS-1600-SC-AU
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- TCS-900-SC-ZA
- TCS-1000-SC-ZA
- TCS-1250-SC-ZA
- TCS-1600-SC-ZA
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- TCS-500-SC-EX
- TCS-630-SC-EX
- TCS-800-SC-EX
- TCS-900-SC-EX
- TCS-1000-SC-EX
- TCS-1250-SC-EX
- TCS-1600-SC-EX
- TCS-1800-SC-EX

Target Group

This manual is intended for skilled persons. Only persons with the appropriate skills are allowed to perform the tasks described in this manual (see Section 2.2 "Qualifications of Skilled Persons", page 8).

Additional Information

For additional information on third-party components, please contact the relevant manufacturer.

A maintenance report is enclosed with each Transformer Compact Station. The maintenance report describes the pending maintenance work and the maintenance interval recommended by SMA Solar Technology AG.

Symbols

Symbol	Explanation
⚠ 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, could result in property damage
i	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates an essential requirement for achieving a specific goal
☑	Desired result
✖	A problem that might occur

Abbreviations

Abbreviation	Designation	Explanation
AC	Alternating Current	-
MV	Medium Voltage	-
PV	Photovoltaics	-

2 Safety

2.1 Safety Precautions

Electric Shock

High voltages are present in the Transformer Compact Station. Failure to adhere to the safety messages will lead to death or serious injuries as a result of electric shock.

- All work must be carried out as described in this manual. Observe all safety precautions. Observe all safety precautions included in this document and the documentation of the components.
- Do not touch any live components of the Transformer Compact Station or the medium-voltage grid. Comply with all applicable safety regulations for handling electrical installations and the medium-voltage grid.
- When electrical work is being carried out, a second person must be present at all times. In the event of an unforeseen accident involving electricity, this person must be able to switch off the electricity supply and provide assistance.

In the event of an earth fault, remember that plant components which are presumed earthed may still be live. Failure to adhere to the safety messages will lead to death or serious injuries as a result of electric shock.

- Ensure that no voltage is present before touching any part of the plant.
- Wear personal protective equipment.

Operating a damaged Transformer Compact Station can lead to hazardous situations that result in death or serious injuries due to electric shock.

- Operate the Transformer Compact Station only if it is in safe and good working order.
- Regularly check the Transformer Compact Station for visible damage.
- Operate the Transformer Compact Station only if there is no visible damage.
- Make sure that all external safety equipment is freely accessible at all times.
- Make sure that all safety equipment is in good working order.

Environmental Hazard

Ensure that escape routes are not blocked.

- The escape routes must be dimensioned sothat the persons working on the Transformer Compact Station can escape quickly in dangerous situations.
- Escape routes must not be blocked.
- The minimum passage width of the escape route must comply with national standards. In Germany, the minimum passage width is 800 mm.

Moisture and dust penetration can damage the Transformer Compact Station.

- Do not open the low-voltage area of the Transformer Compact Station if it is raining.
- Only perform maintenance in a dry and dust-free environment.

Mechanical Hazards

Failure to observe the torque specifications reduces the ampacity of the screw connections. This can cause components to overheat and catch fire. Adhere to the torque specifications in the circuit diagram and documentation.

- Observe the specified torque.
- Contact the SMA Service Line if torque specifications are not given.

Storing Documentation

This documentation must be accessible to service and maintenance personnel at all times.

- Keep this documentation within the immediate vicinity of the Transformer Compact Station.

Warning Signs

Warning signs must be clearly legible at all times.

- Replace warning signs if damaged.
- Clean warning signs if dirty.

2.2 Qualifications of Skilled Persons

The work described in this document must be performed by skilled persons only. Skilled persons must have the following qualifications:

- Knowledge of how a Transformer Compact Station works and is operated
- Training in how to deal with dangers and risks associated with operating and maintaining electrical devices and plants
- Training in the maintenance of electrical devices and plants
- Knowledge of all applicable standards and directives
- Knowledge of and compliance with this document and the component documents with all the safety precautions
- Authorisation to connect and disconnect medium-voltage sources if maintenance activities are required for medium-voltage components

2.3 Personal Protective Equipment

After the control voltage, low voltage or medium voltage has been switched on, personal protective equipment is required for all work performed. The protective equipment must comply with Directive 89/686/EEC. Any protective equipment that is stipulated by law or otherwise required must also be used.

3 Maintenance Schedule

3.1 Overview of Maintenance-Relevant Components

Maintenance of the Transformer Compact Station depends on the country option and the components used. In the following table, depending on the country option, you can determine:

- for which component maintenance must be carried out,
- for which component maintenance must be carried out if option is present.

Component	Country option							
	Concrete station				Steel station			
	TCS-DE (V.2)/CZ/ES BG/RO/UK	TCS-DE (V.1)	TCS-FR	TCS-IT	TCS-EX	TCS-AU/ZA/IN	TCS-DE	TCS-GR
Concrete station	x	x	x	x	–	–	–	–
Steel station	–	–	–	–	x	x	x	x
Enclosure openings	x	x	x	x	–	–	–	–
LV/HRC fuse switch-disconnector	x	x	–	x	x	x	x	x
AC circuit breaker	o	o	x	o	o	o	o	o
Low-voltage meter (GSE)	–	–	–	x	–	–	–	–
Transformer for auxiliary power supply	o	o	o	o	o	o	o	o
Interlocking	–	–	x	o	–	–	–	–
Station sub-distribution	x	x	x	x	x	x	x	x
Medium-voltage transformer	x	x	x	x	x	x	x	x
Contact thermometer of medium-voltage transformer	o	o	o	o	o	o	o	o
Medium-voltage transformer protection device	o	o	o	o	o	o	o	o
MV transformer fan	–	o	–	o	o	–	o	x
Medium-voltage switchgear	o	o	o	o	o	o	o	o

x Maintenance must be carried out

o Maintenance must be carried out if option exists

– Maintenance not required

3.2 Maintenance Intervals

Logging damage

Any damage found during maintenance must be logged and reported to SMA Solar Technology AG (see Section 7 "Contact", page 23).

Shorter maintenance intervals

The maintenance intervals can be shorter depending on local conditions. Reasons for shorter maintenance intervals include:

- High stress through pollution, e. g. when installed in agricultural businesses
- Vibrations, e.g. when placed in the vicinity of a railway line
- High, low or strongly fluctuating ambient temperatures, e.g. in desert locations
- High humidity

Determining components

The Transformer Compact Station can contain components from different manufacturers for which the maintenance activities and the maintenance intervals differ. Prior to any maintenance work, check which components have been used.

The following table lists the components of various manufacturers, their maintenance intervals, and the maintenance activities to be carried out.

Interval	Component	Activity
If required	Concrete station	• Clean air inlets and outlets
	Steel station	• Clean air inlets and outlets
	Station sub-distribution	• Test residual-current device before using the socket • Check the lighting
	Medium-voltage transformer	• Check sealing joints of the transformer and tighten screws slightly if necessary • Clean insulators • Remove any rust stains and repaint • Drain and refill oil • Take oil samples
	MV switchgear*	• Clean interior • Clean enclosure • Clean surfaces • Check screw connections • Check cable connections • Check fuses or circuit breakers • Check measuring instruments
	MV transformer protection device from Automation 2000	• Take oil samples • Carry out a gas discharge • Carry out an overpressure test • Test thermostat
	Low-voltage meter (GSE) from Landis+Gyr AG**	• Change battery
Interval depends on national regulations and standards	Low-voltage meter (GSE) from Landis+Gyr AG	• Check optical test output • Carry out creep test • Check active power measurement • Check reactive power measurement

Interval	Component	Activity
1 year	Medium-voltage transformer	• Check oil level • Check oil temperature • Check transformer for oil leaks • You should switch the tap changer to a voltage-free state at least once per year with ten switching cycles in each case across the entire range. This will prevent oil and carbon deposits from accumulating on the converter contacts • Check the paint and the sealing joints of transformers not currently in operation • Carry out a check for leaks, rust stains and damage • Check cable entries, protective devices, and control elements for dirt • Check for local warming as a result of transition resistance at the overvoltage and undervoltage connections • Check the ambient temperature and the room ventilation • Check the transformer for operating noise • Check the transformer protective devices/contact thermometers and accessories – Functionality – Set and check the contacts – Cabling • Check the test device

Interval	Component	Activity
1 year	Concrete station	• Carry out leakage tests – Enclosure openings – Covers – Paint • Clean air inlets and outlets • Check doors and locking systems • Check insulated conduit • Check exterior for concrete damage • Check covers • Check that the cable vault is watertight, if necessary seal with bitumen • Check support structure for damage, e. g. exposed steel, and apply rust protection if required and cover with layer of cement • Check that enclosure openings are intact and replace if not tight
	Concrete station / steel station	• Check doors and locks – Carry out function test – Apply lubricants – Make repairs to silicone sealing – Reset hinges • Check paint cover on exterior and roof • Check paint cover on interior walls and on station floor • Repair damage to paintwork
2 years	Steel station	• Check exterior of steel station for corrosion
	LV/HRC fuse switch-disconnector	• Check LV/HRC fuses for discolouration
	AC circuit breaker	• Check the AC circuit breaker for functionality
	Transformer for auxiliary power supply	• Check torque of screw connections
	Interlocking	• Check that interlocking works
	Transformer fan	• Check that transformer fan works
5 years	MV switchgear Ringmaster	• Check safety system

Interval	Component	Activity
6 years	Medium-voltage switchgear Flusarc or FBX	• Check existence and condition of accessories (handle, etc.) • Carry out visual inspection of general condition (cleanliness, corrosion, etc.) • Carry out cleaning of external elements with a clean, dry cloth • Carry out check of compliance of position indicators (OFF and ON) • Carry out check of mechanical drive function using electronic circuits • Carry out check of general condition of the electric connections
6 years / as required	Medium-voltage transformer	• Take oil sample and carry out oil treatment, if necessary
10 years	Low-voltage meter (GSE) from Landis+Gyr AG**	• Change battery

* The maintenance intervals for cleaning the Ringmaster medium-voltage switchgear are dependent on the ambient conditions. You can find a definition of the ambient conditions in the documentation of the medium-voltage switchgear.

** If required, after ten years at the latest.

4 Disconnecting from and Reconnecting to Voltage Sources

4.1 Safety

⚠ DANGER

High voltages are present in the Transformer Compact Station. Failure to adhere to the safety messages will lead to death or serious injuries as a result of electric shock.

- Do not touch any live components of the Transformer Compact Station or the medium-voltage grid.
- Comply with all applicable safety regulations for handling medium-voltage grids.

Disconnecting the AC voltage of the medium-voltage transformer

Only a duly authorised person may connect or disconnect the AC voltage of the medium-voltage transformer.

4.2 Disconnecting the Low Voltage

1. In case of a Transformer Compact Station with AC circuit breaker, switch off the AC circuit breaker.
2. In case of a Transformer Compact Station without AC circuit breaker, switch off the AC circuit breaker in the inverter and switch off the inverter.
3. Ensure that the AC circuit breaker and inverter cannot be accidentally switched on again.
4. Ensure that all poles are free of voltage.
5. Earth and short-circuit.
6. Cover or shield any adjacent live components.

4.3 Disconnecting the Medium Voltage

☐ Low voltage is disconnected.

1. Switch off the medium voltage using the medium-voltage switchgear (see the documentation for the medium-voltage switchgear).
2. Ensure that the medium-voltage switchgear cannot be accidentally switched on again (see the documentation for the medium-voltage switchgear). With some switchgear, it may be necessary to first earth and short-circuit the medium-voltage switchgear.
3. Ensure that all poles are free of voltage.
4. Earth and short-circuit.
5. Cover or shield any adjacent live components.

4.4 Disconnecting the Control Voltage

1. Open station sub-distribution.
2. Switch off all miniature circuit-breakers and all residual-current devices.
3. Ensure that all miniature circuit-breakers and all residual-current devices cannot be accidentally reconnected.
4. Disconnect the self-supply transformer if there is one.
5. Ensure that all poles are free of voltage.
6. Cover or shield any adjacent live components.
7. Close station sub-distribution.

4.5 Reconnecting the Medium Voltage

- Switch on the medium voltage using the medium-voltage switchgear (see the documentation for the medium-voltage switchgear).

4.6 Reconnecting the Low Voltage

☐ Medium voltage is connected.

1. In case of a Transformer Compact Station with AC circuit breaker, switch on the AC circuit breaker.
2. In case of a Transformer Compact Station without AC circuit breaker, switch on the AC circuit breaker in the inverter and switch on the inverter.

4.7 Reconnecting the Control Voltage

1. Open station sub-distribution.
2. Switch on all miniature circuit-breakers and all residual-current devices.
3. Switch on the transformer for auxiliary power supply, if present.
4. Close station sub-distribution.

5 Maintenance After Disconnection

5.1 Checking Tightness of Enclosure Openings

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

☐ You should use suitable foam to seal the enclosure openings. Observe the relevant instructions of the foam manufacturer.

Procedure:

1. **⚠ DANGER**

   High voltages are present in the Transformer Compact Station. Failure to adhere to the safety messages will lead to death or serious injuries as a result of electric shock.

   - Disconnect the low voltage (see Section 4.2).
   - Disconnect the medium voltage (see Section 4.3).
   - Disconnect the control voltage (see Section 4.4).

2. Ensure that the enclosure openings are sealed. If enclosure openings are not sealed, apply foam to the affected area.

5.2 Checking LV/HRC Fuses for Discolouration

1. **⚠ DANGER**

   High voltages are present in the Transformer Compact Station. Failure to adhere to the safety messages will lead to death or serious injuries as a result of electric shock.

   - Disconnect the low voltage (see Section 4.2).
   - Disconnect the medium voltage (see Section 4.3).
   - Disconnect the control voltage (see Section 4.4).

2. Check the LV/HRC fuses and tension springs for discolouration or changes to their appearance.

   If the LV/HRC fuses or tension springs are discoloured or if there are changes to their appearance, replace them.

3. Check insulation and terminals for discolouration and changes to their appearance.

   If the insulation or terminals are discoloured or if there are changes to their appearance, contact the SMA Service Line.

5.3 Checking the AC Circuit Breaker for Functionality

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

☐ A testing device approved by the manufacturer of the AC circuit breaker (e.g. TT1 from ABB).

Procedure:

- Use the testing device to check whether the AC circuit breaker is ready for operation (instructions are included in the testing device documentation).

  If the AC circuit breaker is not ready for operation, contact the SMA Service Line.

5.4 Torques

5.4.1 Torque List

NOTICE

Damage to screw connections from over-tightening

- Only apply the prescribed torque to tighten loose screw connections. Contact the SMA Service Line if specifications are missing.

Diameter	Torque
M4	3 Nm
M5	6 Nm
M6	10 Nm
M8	16 Nm
M10	30 Nm
M12	60 Nm
M16	120 Nm

5.4.2 Checking Torque of Screw Connections

1. **⚠ DANGER**

   High voltages are present in the Transformer Compact Station. Failure to adhere to the safety messages will lead to death or serious injuries as a result of electric shock.

   - Disconnect the low voltage (see Section 4.2).
   - Disconnect the medium voltage (see Section 4.3).
   - Disconnect the control voltage (see Section 4.4).

2. Check whether screw connections are tight.

   If screw connections are loose, tighten them using a torque wrench.

5.5 Checking That Interlocking Works

Interlocking

The low-voltage protection is carried out with a locking system. As soon as the AC circuit breaker is opened and locked, a key is released. You can use this key to prevent the medium-voltage control panel switching to earth. The key is blocked and cannot be removed.

There is a second lock on the medium-voltage control panel which releases another key. This key opens the scissors system of the MV transformer on the upper voltage side and enables access to the medium-voltage terminations.

1. Release the key in the key box for the medium-voltage side:
   - If there is one AC circuit-breaker present, open the AC circuit breaker and lock it. When doing this, take the key from one AC circuit breaker and stick it in the key box.
   - If there are two AC circuit-breakers present, open both of them and lock them. When doing this, take the keys from two AC circuit breakers and stick them in the key box.
   - Take the key for the medium-voltage control panel from the key box
2. Release the key for the medium-voltage terminations:
   - Unlock the medium-voltage control panel with the key from the key box for the medium-voltage side.
   - Disconnect the medium-voltage control panel for the medium-voltage side.
   - Earth the medium-voltage control panel for the medium-voltage side.
   - Take the key for the medium-voltage terminations from the medium-voltage control panel.
3. Use the key for the medium-voltage terminations to open the medium-voltage termination connection area.
4. Lock the connection area of the medium-voltage terminations using the key for the medium-voltage terminations.
5. Stick the key for the medium-voltage terminations into the medium-voltage control panel.
6. Unlock the medium-voltage control panel for the medium-voltage side and reconnect the medium voltage.
7. Replace the key for the medium-voltage side in the key box.
8. Take the key of the circuit breaker out of the key box and stick it into the circuit breaker.
9. Unlock the AC circuit breaker and close it.

6 Maintenance when Medium Voltage, Low Voltage and Control Voltage Is Present

6.1 Checking that Transformer Fan Works

⚠ DANGER

High voltages are present in the Transformer Compact Station. Failure to adhere to the safety messages will lead to death or serious injuries as a result of electric shock.

- Wear personal protective equipment.
- Do not touch any live components of the Transformer Compact Station or the medium-voltage grid.
- Comply with all applicable safety regulations for handling medium-voltage grids.

1. Set thermostat to the minimum value.
2. Check whether the transformer fan starts.

   If the transformer fan does not start, contact the SMA Service Line.
3. Reset the thermostat to the initial value. The initial value is included in the circuit diagram.

6.2 Checking Exterior of Steel Station for Damage

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

☐ Touch-up sticks, brushes or cans of spray paint or, alternatively, 2K-PUR acrylic paint in the appropriate RAL colour can be used to repair minor surface damage such as corrosion. Observe the relevant instructions of the paint manufacturer.

☐ Touch-up paint or 2K-PUR acrylic paint in the appropriate RAL colour can be used to repair large-area surface damage such as corrosion. Observe the relevant instructions of the paint manufacturer.

Position	RAL colour	Colour scheme
Roof	RAL 7004	Signal grey
Base	RAL 7005	Mouse grey
Enclosure	RAL 9016	Traffic white

☐ Abrasive cloth

☐ Degreaser

☐ Wire brushes

☐ Brush attachments for drill and angle grinder

☐ Orbital sander

Procedure:

1. Remove dirt.
2. To remove small-area surface damage:
   - Sand the surface.
   - Clean the surface using degreaser.
   - Paint the surface.
3. To remove large-area surface damage:
   - Sand the surface with orbital sander.
   - Clean the surface using degreaser.
   - Paint the entire surface.

7 Contact

If you have technical problems concerning our products, contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Device type
- Serial number
- Fabrication version if available
- Installation address with GPS coordinates
- Plant name
- Pictures of the faulty components
- Type and number of connected PV modules

Australia	SMA Australia Pty Ltd. Sydney	Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200
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