

Installation and Operating Manual

LITHIUM STORAGE SYSTEM

TS 48 V



TESVOLT
THE ENERGY STORAGE EXPERTS

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1 IMPORTANT INFORMATION ABOUT THIS MANUAL

1.1 APPLICABILITY

This document applies to the modular battery storage system TESVOLT TS48V in conjunction with the Sunny Island battery inverter manufactured by SMA.

Read this manual thoroughly to ensure error-free installation, initial commissioning and maintenance of the TESVOLT TS48V. Installation, initial commissioning and maintenance must be carried out by a qualified, authorised specialist. The Installation and Operating Manual should be kept close to the unit and must be accessible to all individuals involved in installation or maintenance at all times.

All information on the battery inverter SMA Sunny Island contained in this manual is non-binding. TESVOLT assumes no responsibility for the accuracy and currency of this information. Ensure that you follow the relevant product documentation, such as installation or operating manuals from the manufacturers, for the battery inverter and other third-party products.

This Installation and Operating Manual applies to Germany only, without restriction. Ensure that you adhere to the applicable local legal regulations and standards. The standards and legal regulations in other countries may contradict the specifications in this manual. In this case, please contact service@tesvolt.com or the TESVOLT Service Line +49 (0) 3491 8797 - 200.

1.2 MEANING OF SYMBOLS

Symbols in the manual

This manual contains the following types of warnings and information:



DANGER!

This symbol indicates that electric shock may result if you fail to follow the instruction, even when the unit is disconnected from the utility grid, as a voltage-free state only occurs after a time delay.



DANGER!

This symbol indicates that death or serious injury may result if you fail to follow the instruction.



CAUTION!

This symbol indicates that injury may result if you fail to follow the instruction.



WARNING!

This symbol indicates that damage may result if you fail to follow the instruction.



NOTE:

This symbol indicates information relating to use of the device.

Symbols on the unit

The following types of warning, prohibition and mandatory symbols are also used on the unit:



CAUTION! RISK OF CHEMICAL BURNS

If the battery is damaged and a fault occurs, this may result in electrolyte escaping and the formation of hydrofluoric acid in small concentrations and quantities, among other effects. Contact with these liquids can cause chemical burns.

- Do not subject the battery modules to violent impact.
- Do not open, disassemble or mechanically alter the battery modules.
- If there is contact with the electrolyte, rinse the affected area immediately with water and promptly seek medical attention.

**CAUTION – RISK OF EXPLOSION!**

Improper handling or fire can cause lithium battery cells to ignite or explode and cause serious injuries.

- Do not install or operate the battery modules in potentially explosive areas or areas with high humidity.
- Store the battery modules in a dry place and within the temperature ranges specified in the data sheet.
- Do not open, drill through or drop the battery cells or modules.
- Do not expose the battery cells or modules to high temperatures.
- Do not throw the battery cells or modules into a fire.
- In case of fire, use CO₂ fire extinguishers if the fire comes from the battery. In case of fire in the vicinity of the battery, use an ABC fire extinguisher.
- Do not use defective or damaged battery modules.

**CAUTION! HOT SURFACE**

If there is a malfunction, components can become very hot and cause serious injury if touched.

- Switch the battery storage system off immediately if it is defective.
- Take particular care when handling the unit if malfunctions or defects become apparent.

**NO NAKED FLAMES!**

Handling naked flames and sources of ignition in the immediate vicinity of the storage system is prohibited.

**DO NOT INSERT ANY OBJECTS INTO THE STORAGE SYSTEM CASING'S OPENINGS!**

No objects, such as screwdrivers, may be inserted through openings in the casing of the storage system.

**WEAR SAFETY GOGGLES!**

Wear safety goggles when working on the unit.

**FOLLOW THE MANUAL!**

It is imperative that you follow the Installation and Operating Manual when working on and operating the unit.

1.3 GENERAL SAFETY INFORMATION

**Danger! Danger of death if the safety information is not followed!**

Improper use can lead to fatal injuries. Any person tasked with working on the system must have read and understood this manual, particularly section "2 Safety" on page 8 et seq. **All safety information must be followed without fail.**

Everyone who works on the TESVOLT TS48V must follow the specifications in this manual.

This manual cannot describe every conceivable situation, and for this reason the applicable standards and corresponding occupational health and safety regulations always take priority.

In addition, installation may also involve residual hazards under the following circumstances:

- Installation is not carried out properly.
- Installation is carried out by personnel who have not received the relevant training or instruction.
- The safety information in this manual is not followed.

1.4 LIMITATION OF LIABILITY

TESVOLT GmbH assumes no liability for personal injury, damage to property, damage to the product and follow-on damage attributable to the following causes:

- Non-compliance with this manual,
- Improper use of the product,
- Repairs, opening the battery cabinet and other actions performed on or with the product by unauthorised and/or unqualified personnel,
- Use of non-approved spare parts.

Unauthorised modifications or technical changes to the product are forbidden.

1.5 APPROPRIATE USE

TESVOLT TS48V is a modular battery storage system based on lithium-ion technology. The components were built in accordance with the current state of the art in technology and product-specific standards.

The TESVOLT TS48V is intended for use with the SMA Sunny Island battery inverter. Any other use must be agreed with the manufacturer and, if necessary, with the local energy supply company.

It may only be operated in closed rooms. The TESVOLT TS48V works in an ambient temperature range of -10°C to 50°C and at a maximum humidity of 85%. The battery cabinet may not be exposed to direct sunlight or placed directly beside sources of heat.

The battery cabinet may not be exposed to corrosive environments.

When installing the battery storage system, ensure that it is standing on a sufficiently dry, horizontal and flat surface with sufficient load-bearing capacity.

The altitude of the installation site may not be higher than 2,000 m above sea level without approval in writing from the manufacturer.

In regions subject to flooding, care must be taken to ensure that the battery cabinet is installed in a suitably elevated location and is protected against contact with water.

According to IEC 62619, the battery storage system must be installed in a fire-proofed room. This room must be free from fire loads and must be equipped with an independent fire alarm unit in accordance with the locally applicable regulations and standards. The room must be separated by class T60 fire doors. Comparable fire protection requirements also apply to other openings in the room (e.g. windows).

Adherence to the specifications in this manual also forms part of appropriate use.

The TESVOLT TS48V may not be used:

- for mobile use on land or in the air (it may only be used on water in agreement with, and with the written consent of, the manufacturer),
- for operating medical equipment,
- as a UPS system.

1.6 GUARANTEE

The current guarantee conditions can be downloaded from the internet by visiting www.tesvolt.com.

1.7 PREREQUISITES FOR INSTALLATION TECHNICIANS

The locally applicable regulations and standards are to be adhered to for all work.

The installation of the battery storage system may only be carried out by qualified electricians who have the following qualifications:

- Training in dealing with hazards and risks associated with installing and operating electrical equipment, systems and batteries,
- Training in installing and commissioning of electrical equipment,
- Knowledge of and adherence with the locally applicable technical connection requirements, standards, directives, regulations and laws,
- Knowledge of handling lithium-ion batteries (transport, storage, disposal, sources of danger),
- Knowledge of and compliance with this Installation and Operating Manual and other applicable documents,
- Successful participation in **TESVOLT TS 48 V certification training** (information about the training courses can be found at www.tesvolt.com. For further information, please send an email to academy@tesvolt.com).

2 SAFETY



DANGER! Life-threatening electric shock from damaged components or short circuit

Bridging the battery poles causes a short circuit that results in a flow of electrical current. A short circuit of this type should be avoided under all circumstances. For this reason, please follow these instructions:

- Use insulated tools and insulated gloves.
- Do not place any tools or metal components on the battery modules or the APU LV.
- Always remove watches, rings and other metal objects when working with the batteries.
- Do not install or operate the battery storage system in explosive areas or areas with high humidity.
- When working on the battery storage system, switch off all voltage supplies first to the charge controller, then to the battery, and ensure that they cannot be switched on again.



DANGER! Chemical burns and poisoning due to electrolyte or poisonous gases

During normal operation, no electrolyte can escape from the battery and no poisonous gases can form. Despite careful design, damage to the battery in the event of a fault can result in escaping electrolyte or small concentrations and quantities of toxic gases, organic solvent gases and hydrofluoric acid: For this reason, please follow these instructions:

- Do not subject the battery modules to violent impact.
- Do not open, disassemble or mechanically alter the battery modules.

In the event of contact with the electrolyte, rinse the affected area immediately with water and promptly seek medical advice.

**DANGER! Improper handling can result in life-threatening burns**

Lithium battery cells can ignite if handled improperly. For this reason, ensure that you adhere to the following instructions for handling lithium battery cells:

- Do not install or operate the battery modules in potentially explosive areas or areas with high humidity.
- Store the battery modules in a dry area and within the temperature ranges specified in the data sheet.
- Do not open, drill through or drop the battery cells or modules.
- Do not expose the battery cells or modules to high temperatures.
- Do not throw the battery cells or modules into a fire.
- In case of fire, use CO₂ fire extinguishers if the fire comes from the battery. In case of fire in the vicinity of the battery, use an ABC fire extinguisher.
- Do not use defective or damaged battery modules.

**DANGER! Danger of death due to misuse**

Any use that extends beyond or deviates from appropriate use of the battery storage system can lead to significant hazards.

DANGER! Danger of death due to unqualified operators

Incorrect handling of the battery storage system can result in significant hazards for the operator. For this reason, any action that requires the battery cabinet to be opened may only be carried out by qualified specialists in accordance with the instructions in section "1.7 Prerequisites for installation technicians" on page 8.

**WARNING! Improper use can cause damage to the battery cells**

- Do not expose battery cells or modules to rain and do not immerse them in liquids.
- Do not expose battery cells to corrosive environments (e.g. ammonia, salt).
- Only use inverters agreed with and approved by TESVOLT.
- Commission TS 48V storage systems within **six months** of delivery at the latest.

3 PREPARATION

3.1 TOOLS REQUIRED

TOOLS	USE
5–30 Nm torque wrench with 10 and 13 mm sockets and 6 mm hexagon socket	e.g. for tightening the grounding connections and the DC connections to the battery modules or the DC connecting cables on the SMA Sunny Island
5 mm hex key	tightening the fastening screws on the cover of the SMA Sunny Island
TX 25, TX 30 Torx screwdriver	e.g. for fastening baying connectors in double cabinets
PH 3 Phillips screwdriver	fastening the battery modules and APU LV in the battery cabinet
50 mm ² and 120 mm ² crimping tool	crimping the ring cable lug, for example for the DC connecting cable on the SMA Sunny Island or bat fuse
Voltmeter > 400 V _{AC} and > 150 V _{DC}	measuring the power supply and battery voltages and testing the battery modules' state of charge
19 mm spanner	optional: lifting the cabinet cover, fitting the spacers
Side cutters and combination pliers	working with the DC connection plastic cover plates on the battery modules

3.2 TRANSPORT TO THE END CUSTOMER

Transport regulations and safety information

All the requirements set out in the German Ordinance on the Transport of Dangerous Goods by Road, Rail and Inland Waterways (GGVSEB) and the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) must be adhered to.

- The TS 48V may only be transported by the manufacturer or by a forwarding agency engaged by the manufacturer. Should transport on public roads nevertheless be necessary, this may only be carried out by personnel who have received appropriate training and instruction. This instruction is to be documented and carried out periodically.
- Smoking is prohibited in the vehicle during the transport journey, and also in the immediate vicinity during loading and unloading.
- Two tested Class D metal fire extinguishers (minimum capacity: 2 kg) and equipment for dangerous goods in accordance with the ADR are to be carried in the vehicle.
- The freight carrier is prohibited from opening the outer packaging of the battery module.



DANGER! Risk of injury due to improper transport in a vehicle

Improper transport and/or inadequate transport locks can cause the load to slide or topple over, leading to injuries. Position the cabinet vertically and in such a way that it cannot slide around in the vehicle, and use securing straps to prevent it from toppling over and sliding.



CAUTION! Risk of injury due to the battery cabinet toppling over

The cabinet usually weighs over 100 kg and may topple over if tilted, causing injuries or material damage.



CAUTION! Risk of injury if safety shoes are not worn when the cabinet is being transported

If hazards occur, injuries such as crushing injuries can occur due to the heavy dead weight of components when the cabinet or battery modules is/are being transported. For this reason, all individuals involved must wear safety shoes with protective toe caps.

**CAUTION!**

Please also follow the safety information in section "3.3 Transport at the end customer's site" on page 11 below, especially when loading and unloading.

**WARNING! Risk of damage to the unit during transport with installed battery modules**

Transporting the cabinet with battery modules installed causes damage to the unit. The battery modules and cabinet must therefore always be transported separately from one another. Never move a cabinet once fitted with modules or, in particular, suspend it using a lifting device.

**WARNING! Risk of damage to the battery modules if transported incorrectly**

No more than five battery modules may be stacked on top of each other during transport, as they may incur damage due to their high dead weight.

3.3 TRANSPORT AT THE END CUSTOMER'S SITE

**CAUTION! Risk of injury due to improper transport of the battery modules**

Battery modules are heavy (36 kg) and can cause injuries if they topple over or slide around. Ensure that transport is carried out safely and that only suitable means of transport are used.

**CAUTION! Risk of injury due to the battery cabinet toppling over during transport**

The cabinet usually weighs over 100 kg and may topple over if tilted, causing injuries or material damage.

**CAUTION! Risk of injury if safety shoes are not worn when the cabinet is being transported**

If hazards occur, injuries such as crushing injuries can occur due to the heavy dead weight of components when the cabinet or battery modules are being transported. For this reason, all individuals involved must wear safety shoes with protective toe caps.

**CAUTION! Risk of injury from sharp edges and metal panels when transporting the cabinet**

When the unpacked cabinet is being transported or installed, there is an increased risk of injury, particularly due to sharp-edged metal panels. For this reason, all individuals involved must wear safety gloves.

**WARNING! Risk of damage to the unit during transport with installed battery modules**

Transporting the cabinet with battery modules installed causes damage to the unit. The battery modules and cabinet must therefore always be transported separately from one another. Never move a cabinet once it is fitted with modules or, in particular, suspend it using a lifting device.

**NOTE: Transport by at least two people**

We recommend using a hand truck. Caution: Do not damage the housing and mounting components!

The individual components of the TS 48V can weigh over 100 kg, which makes them unsuitable for transport by one person. We recommend at least two people install the system. A dolly or hand truck is helpful during the installation process. **No more than five battery modules may be stored or transported one on top of the other.**



Figure 3.1 Permissible and impermissible storage positions of a packaged battery module

INSTALLATION SITE

Necessary prerequisites

Section "1.5 Appropriate use" on page 7 lists all the necessary prerequisites and conditions for installing a TS 48V.

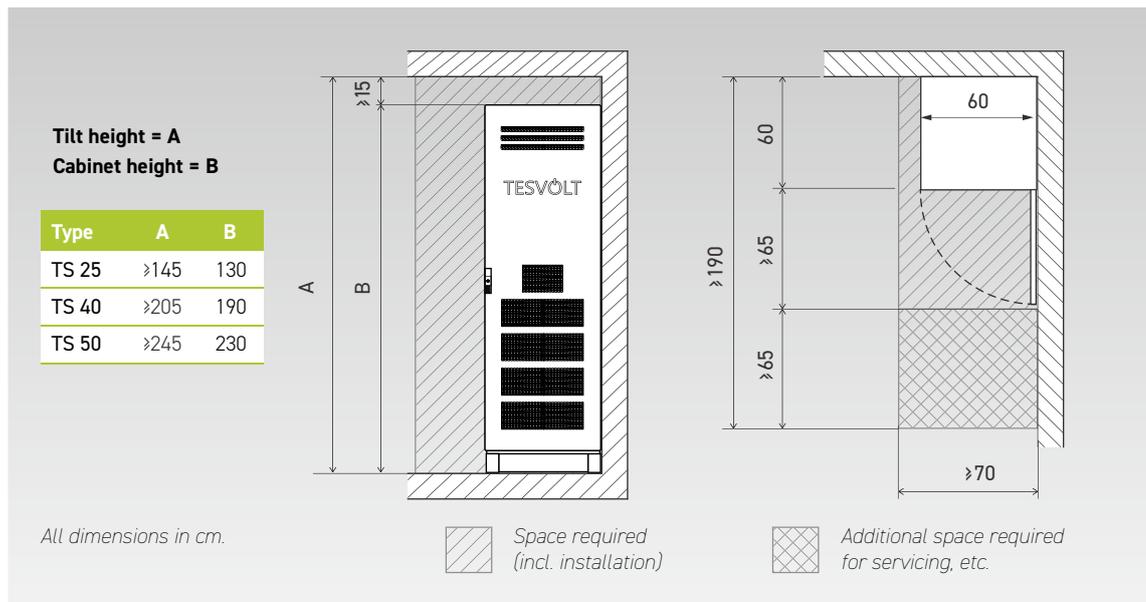
When selecting the installation site, bear in mind transport routes and the necessary site clearance.



WARNING! Possible damage to the building due to excessive static loads.

Once installed, the battery storage system usually weighs from several hundred kilograms to significantly more than 1,000 kilograms. Ensure that the installation site has sufficient load-bearing capacity. If in doubt, consult a structural engineer.

Dimensions



4 TECHNICAL DATA

4.1 TESVOLT TS48V

TESVOLT BATTERY MODULE		
Energy module	4.8 kWh	
C-rate	1C	
Cell	Lithium NMC prismatic (Samsung SDI)	
Max. charging/discharging current	94 A	
Cell balancing	Active Battery Optimizer	
Cycles expected at 100% DoD 70% EoL 23°C +/- 5°C 1C/1C	6,000	
Cycles expected at 100% DoD 70% EoL 23°C +/- 5°C 0.5C/0.5C	8,000	
Efficiency (battery)	up to 98 %	
Operating voltage	47.6 to 58.1 V _{DC}	
Operating temperature	-10 to 50°C	
Humidity	0 to 85 % (non-condensing)	
Altitude of installation site	< 2,000 m above sea level	
Weight	36 kg	
Dimensions (H x W x D)	163 x 490 x 480 mm	
Certificates/standards	Cell	IEC 62619, UL 1642, UN 38.3
	Product	CE, UN 38.3, IEC 6100061/2/3/4, BattG 2006/66/EC
Guarantee	10-year performance guarantee, 5-year system guarantee	
Recycling	TESVOLT provides a free battery collection scheme in Germany	
Battery specification as per DIN EN 62620:2015	IMP47/175/127/[14S]E/20+60/90	

COMPLETE SYSTEM										
Number of battery modules		2	3	4	5	6	7	8	9	10
TS 25 (2 – 5 modules)	1,300 x 600 x 600 mm (H x W x D)	•	•	•	•					
TS 40 (2 – 8 modules)	1,900 x 600 x 600 mm (H x W x D)	•	•	•	•	•	•	•		
TS 50 (2 – 10 modules)	2,300 x 600 x 600 mm (H x W x D)	•	•	•	•	•	•	•	•	•
TS Flex (energy as required)		Flexibly configure your system according to your requirements.								
Energy [kWh]		9.6	14.4	19.2	24.0	28.8	33.6	38.4	43.2	48.0
Capacity [Ah]		188	282	376	470	564	658	752	846	940
Maximum output power		1C								
Self-consumption (standby)		3 W (without battery inverter)								
Weight [kg]		192	228	264	300	386	422	458	514	550
System		single-phase, three-phase								
Protection class		IP 20 (indoor use)								

5 TS 48V BATTERY STORAGE SYSTEM

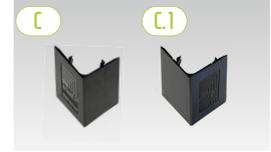
5.1 CABINET STRUCTURE AND COMPONENTS



Empty VX cabinet



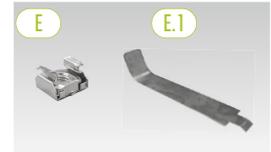
C-rail (TS)



Base corner cover plate



Pan head screw with washer



Cage nut (left) and auxiliary tool for fitting



Cable retention clip



Ring screw



Spacer with accessories for lifting the top of the cabinet



Grounding point with fitting accessories



Empty TS cabinet



Grounding strip (door) with accessories



TS cabinet extension set



VX cabinet extension set



TS/VX cabinet extension set



Grounding set for cabinet extension

5.2 CABINET SCOPE OF DELIVERY

ITEM	QUANTITY*			DESCRIPTION
	TS 25	TS 40	TS 50	
(A)	1	1	1	Cabinet
(B)	1	1	1	C-rail (VX cabinet – pre-installed)
(C)	2	2	2	Base corner cover plate (right)
(C.1)	2	2	2	↳ Base corner cover plate (left)
(D)	50	50	50	M6 x 16 pan head screw (Phillips)
(D.1)	50	50	50	Plastic washer
(E)	50	50	50	M6 cage nut
(E.1)	1	1	1	↳ Auxiliary tool for fitting the cage nuts
(F)	2	2	2	Cable retention clip for C-rail (strain relief)
(G)	4	4	4	Ring screw
(H)	4	4	4	20 mm spacer
(H.1)	4	4	4	↳ M6 x 16 countersunk screw (Torx TX 30)
(H.2)	4	4	4	↳ Cover cap
(H.3)	4	4	4	↳ Plastic washer
(I)	1	1	1	Grounding point (VX cabinet – two pre-installed grounding points)
(I.1)	2	2	2	↳ ST5 x 12 self-tapping screw (Torx TX 30)
(I.2)	1	1	1	↳ M8 nut
(I.3)	1	1	1	↳ Washer
(I.4)	1	1	1	↳ Contact washer
(J)	1	1	1	10 mm² grounding strip (M8 ring cable lugs on both ends, pre-installed on VX cabinet)
(J.1)	2	2	2	↳ M8 nut
(J.2)	2	2	2	↳ Washer
(J.3)	2	2	2	↳ Contact washer
(K)	1			TS cabinet extension set
(K.1)		6		↳ Baying connector
(K.2)		24		↳ ST5.5 x 13 mm pan head screw (Torx TX 30)
(L)		1		VX cabinet extension set
(L.1)		8		↳ Baying connector
(L.2)		24		↳ ST5.5 x 13 mm pan head screw (Torx TX 30)
(L.3)		12		↳ M6 x 35 setscrew
(M)		1		TS/VX cabinet extension set
(M.1)		8		↳ Baying connectors
(M.2)		32		↳ ST5.5 x 13 mm pan head screw (Torx TX 30)
(M.3)		20		↳ M8 x 16 mm screw
(M.4)		20		↳ M8 speed nut
(M.5)		1		↳ 6.00 m sealing strip (use is optional)
(N)		1		Cabinet extension grounding set
(N.1)		2		↳ M8 x 30 screw
(N.2)		2		↳ Spring washer
(N.3)		2		↳ Washer
(N.4)		2		↳ Contact washer
(N.5)		2		↳ M8 speed nut
(N.6)		1		↳ Grounding cable

*The quantities given are for the standard configurations of the storage unit models. The quantities provided here will vary accordingly in non-standard configurations.

5.3 CONSTRUCTION AND STORAGE SYSTEM COMPONENTS



APU LV



4.8-1C-LV48 battery module



APU LV connector kit



LV module connector kit



LV DC connecting cable set



Installed TS 48 V



Type plate TS 48 V



Installation manual



TESVOLT USB-Stick



Battery room sticker

5.4 SCOPE OF DELIVERY FOR STORAGE SYSTEM COMPONENTS

ITEM	QUANTITY*			DESCRIPTION
	TS 25	TS 40	TS 50	
1	1	1	1	APU LV
2	5	8	10	Battery Battery module 4.8-1C-LV48 incl. Active Battery Optimizer (ABO)
3	1	1	1	APU LV connector kit from the APU to the first battery module
3.1	1	1	1	└ LV S-shaped connector
3.2	1	1	1	└ Short LV I-shaped connector
3.3	1	1	1	└ Rack balancing bridge
3.4	1	1	1	└ CAT 6 patch cable – 0.27 m ribbon
3.5	4	4	4	└ DIN 6923 - M8 self-locking flanged nut
3.6	2	2	2	└ DIN 6921 - M8 x 16 hexagon flanged bolt
4	4	7	9	LV module connector kit
4.1	8	14	18	└ Long LV I-shaped connector
4.2	8	14	18	└ DIN 6921 - M8 x 20 hexagon flanged bolt
4.3	4	7	9	└ CAT 6 patch cable – 0.27 m ribbon
4.4	4	7	9	└ Rack balancing bridge
5	1	1	1	LV DC connecting cable set
5.1	1	1	1	└ DC connecting cable – 5.00 m 120 mm² (+, with red marking on one end, M8 ring cable lug)
5.2	1	1	1	└ DC connecting cable – 5.00 m 120 mm² (-, with blue marking on one end, M8 ring cable lug)
5.3	1	1	1	└ CAT 6 patch cable – 5.00 m
5.4	1	1	1	└ Grounding cable – 5.00 m 16 mm² (M8 ring cable lug on one end)
5.5	1	1	1	└ Red heat shrink tubing – 65 mm for 120 mm²
5.6	1	1	1	└ Blue heat shrink tubing – 65 mm for 120 mm²
5.7	2	2	2	└ M8 ring cable lug for 120 mm²
6	2	2	2	Type plate TS 48 V
7	1	1	1	TESVOLT TS48 V Installation and Operating Manual
8	1	1	1	TESVOLT USB-Stick
9	1	1	1	Battery room sticker

*The quantities given are for the standard configurations of the storage unit models. The quantities provided here will vary accordingly in non-standard configurations.

5.5 OTHER COMPONENTS



10 Switch



11 SMA Sunny Island



12 SMA Sunny Home Manager 2.0



13 SMA Data Manager M incl. external 24 V power supply



14 SMA Energy Meter 2.0



15 LV B01 2X bat fuse and NH1 250 A tag fuse



16 LV B03 4X bat fuse and NH1 250 A tag fuse



17 DC connector set bat fuse to Sunny Island (10 m)



18 Cabinet connector kit 1.20 m or 2.30 m



19 Emergency power distribution, single-phase

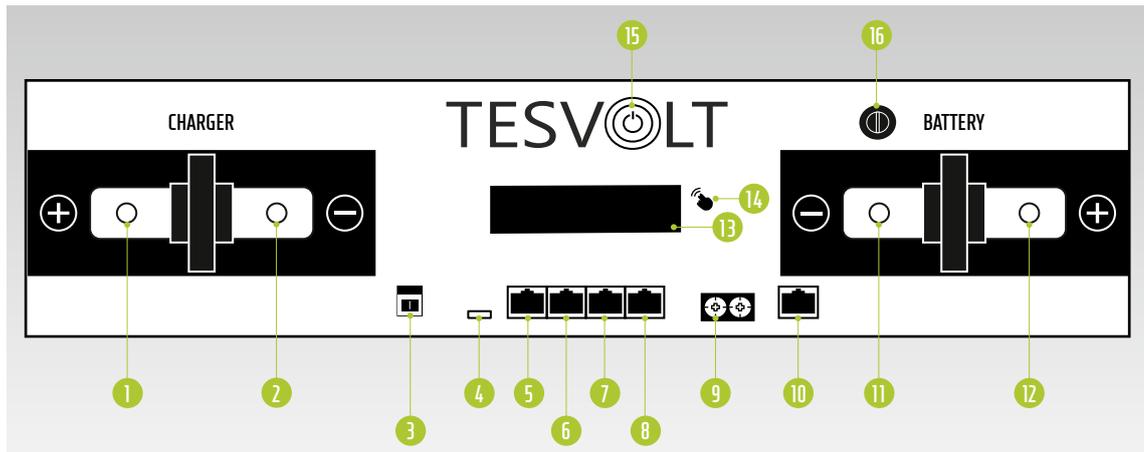


20 Emergency power distribution, three-phase

5.6 SCOPE OF DELIVERY FOR OTHER COMPONENTS

ITEM	QUANTITY	DESCRIPTION
10	1	Switch
11	1 or 3	SMA Sunny Island 4.4 M/6.0 H/8.0 H
12	1	SMA Sunny Home Manager 2.0
13	1	SMA Data Manager M alternative for item 12; incl. external 24 V power supply
14	1	SMA Energy Meter 2.0 alternative for item 12
15	Optional:	LV B01 2X bat fuse
15.1	3	└ NH1 250 A tag fuse
16	Optional:	LV B03 4X bat fuse
16.1	6	└ NH1 250 A tag fuse
17	Optional:	DC connector set bat fuse to Sunny Island (10 m)
17.1	1	└ DC connecting cable – 10.00 m 50 mm ²
17.2	6	└ 50 mm ² M8 ring cable lug
17.3	6	└ 50 mm ² M10 ring cable lug
17.4	6	└ Thin-wall heat shrink tubing, 40 mm, red
17.5	6	└ Thin-wall heat shrink tubing, 40 mm, blue
18	Optional:	Cabinet connector kit – 1.20 m or 2.30 m
18.1	1	└ DC connecting cable – 1.20 m or 2.30 m 120 mm ² (+, M8 ring cable lugs, with red marking on both ends)
18.2	1	└ DC connecting cable – 1.20 m or 2.30 m 120 mm ² (-, M8 ring cable lugs with blue marking on both ends)
18.3	1	└ CAT 6 patch cable - 2.00 m or 3.00 m)
18.4	2	└ DIN 6921 - M8 x 20 hexagon flanged bolt
19	Optional:	Emergency power distribution, single-phase
20	Optional:	Emergency power distribution, three-phase

5.7 CONNECTIONS AND STRUCTURE OF THE APU LV



NO.	DESIGNATION	DESCRIPTION
1	CHARGER +	DC connection on the SMA Sunny Island or bat fuse for the positive pole (red)
2	CHARGER -	DC connection on the SMA Sunny Island or bat fuse for the negative pole (blue)
3	E-STOP	Two-pin plug for optional connection of a floating emergency stop switch for quick shutdown (pre-installed with the bridge on delivery)
4	TERM	CAN bus termination TERM must be activated (ON) for the first and last CAN bus participant.
5	CAN IN	APU LV master-slave communication (input)
6	CAN OUT	APU LV master-slave communication (output)
7	CAN SMA	ComSync IN connection on the SMA Sunny Island
8	LAN	Ethernet interface for access to APU LV using BatMon (DHCP router required)
9	ADDRESS	Further information can be found in the section "Overview of all addressing options" on page 51.
10	BAT-COM	Communication port to the first battery module
11	BATTERY -	The battery's DC connection for the negative pole
12	BATTERY +	The battery's DC connection for the positive pole
13	DISPLAY	Display interface
14	MARKING	Marking for activating and changing the display by tapping
15	SWITCH	On/off switch for the battery
16	Fuse (F1)	Fuse to protect the APU LV (2A miniature fuse, 5 x 20 mm, time lag (T) according to DIN 41571-2, type: ESKA 521.020, 250 V _{AC}). Operation is not possible with a defective fuse.

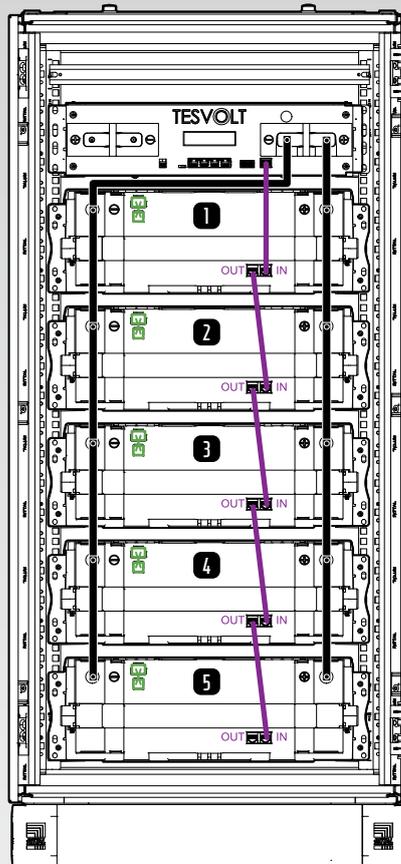
5.8 CONNECTIONS AND STRUCTURE OF THE BATTERY MODULE



NO.	DESIGNATION	DESCRIPTION
17	- POLE	Battery negative pole
18	+ POLE	Battery positive pole
19	RACK BALANCING IN	Rack balancing (input)
20	RACK BALANCING OUT	Rack balancing (output)
21	BAT-COM OUT	Battery module communication port (output)
22	BAT-COM IN	Battery module communication port (input)

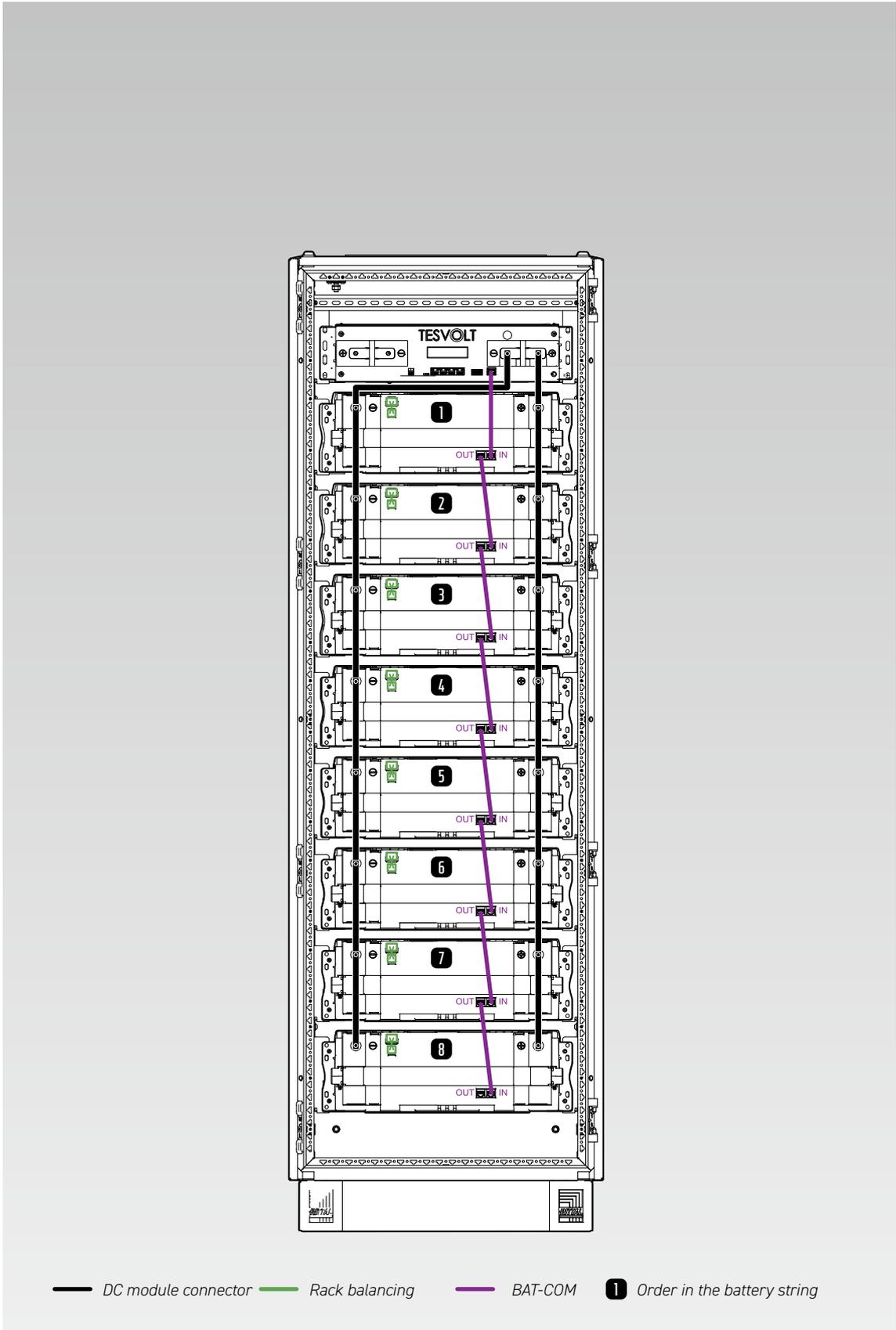
5.9 WIRING THE BATTERY MODULES

TS 25 wiring

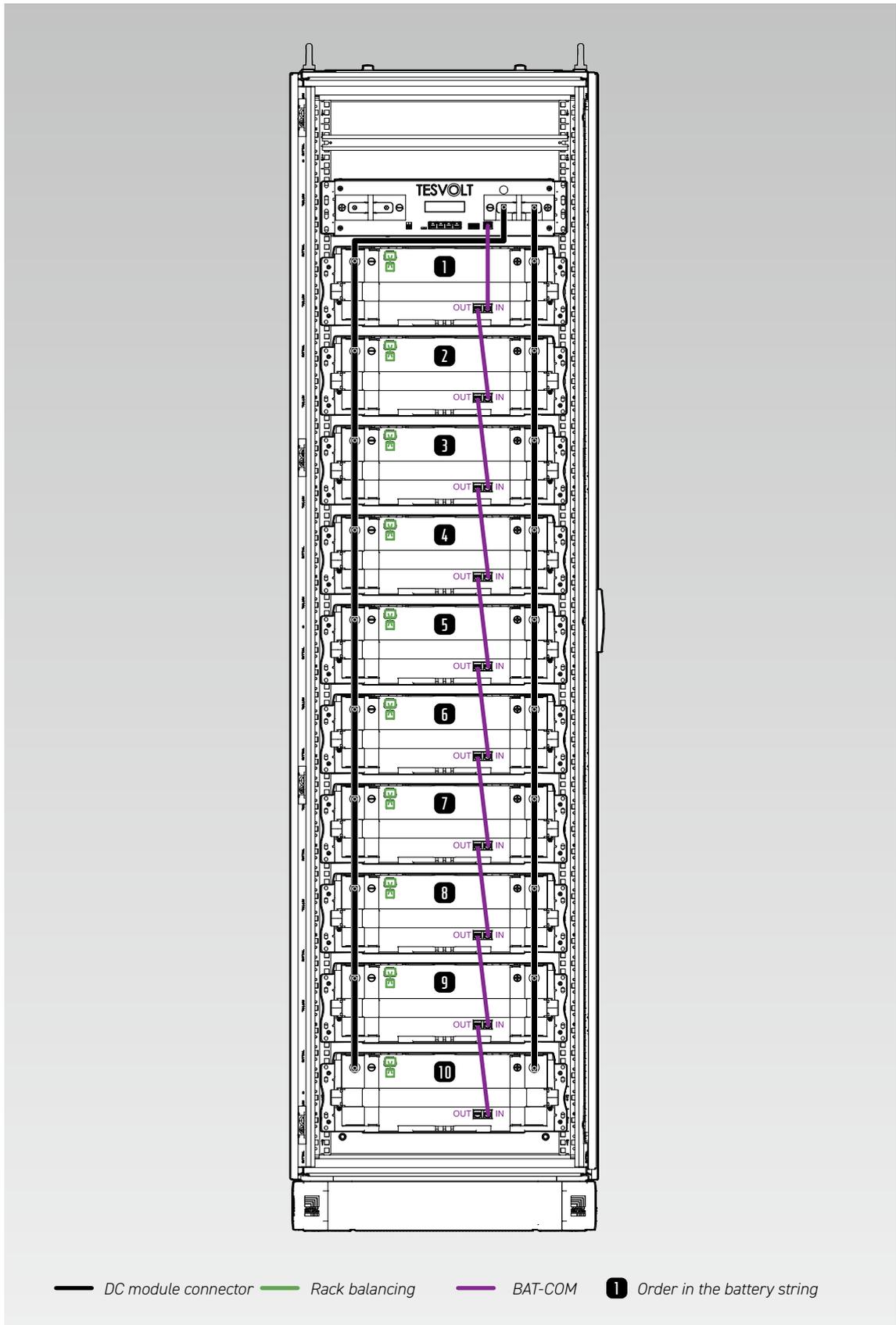


— DC module connector
 — Rack balancing
 — BAT-COM
 1 Order in the battery string

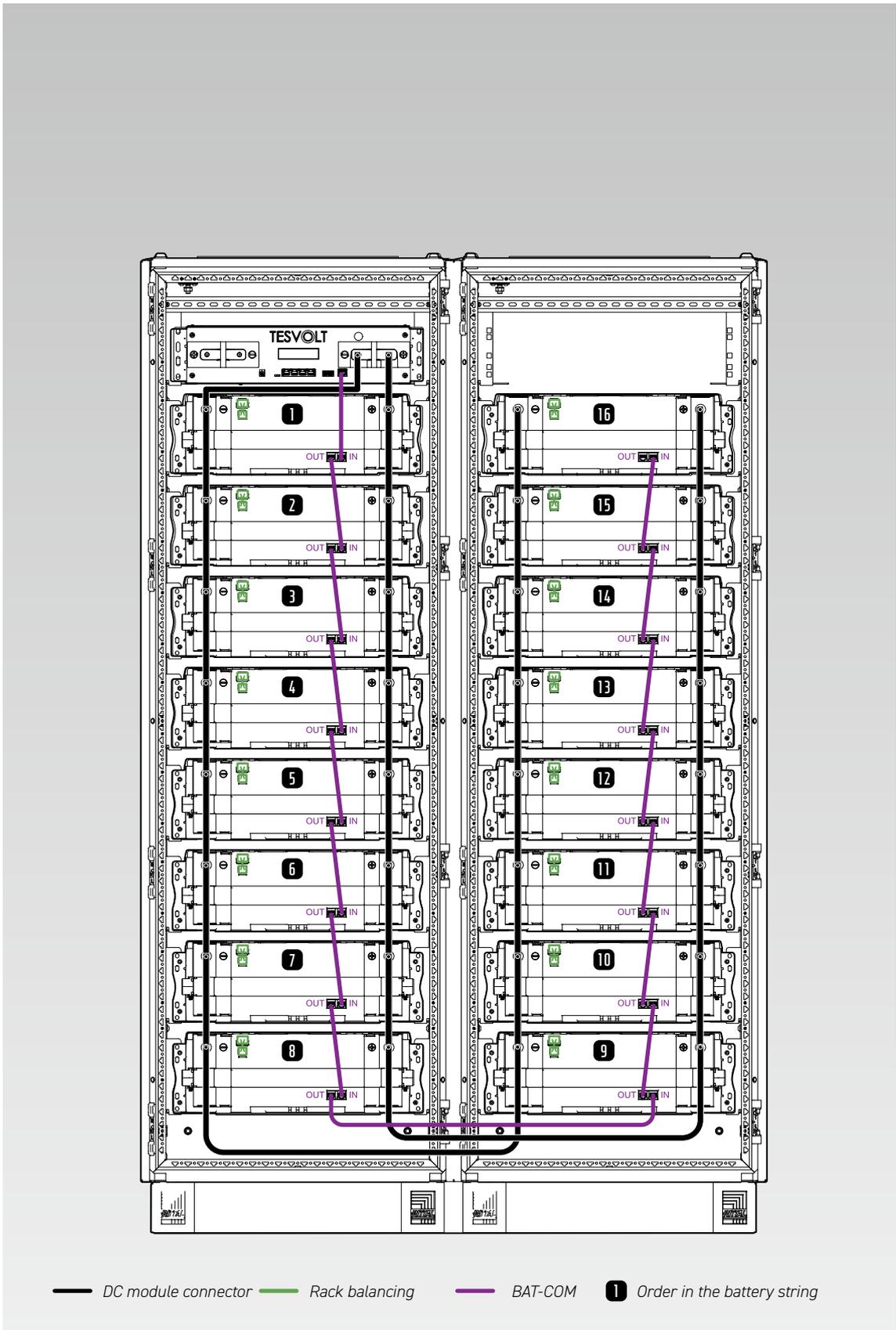
TS 40 wiring



TS 50 wiring



2 x TS 40 wiring



6 INSTALLATION

6.1 SETTING UP THE CABINET

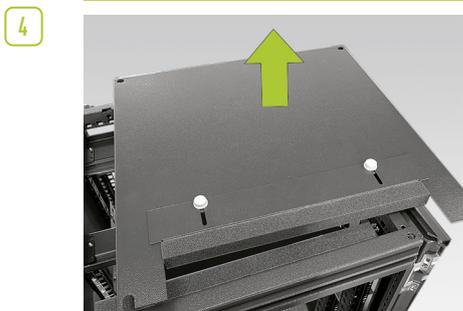
- 1 Remove the packaging and transport locks from the cabinet.



Optional: Install the ring screws:

When transporting the empty cabinet by crane, install four ring screws at the four corners of the cabinet. To do this, remove all the fastening screws from the cabinet cover and replace them with the ring screws **G**.

- 3 Transport the empty cabinet to its final installation site. While doing so, ensure that you follow the safety information in the section "3.3 Transport at the end customer's site" on page 11.



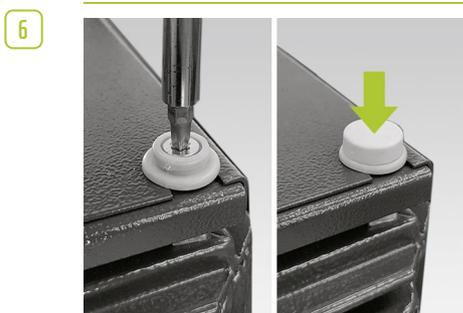
Optional: Lifting the cabinet covers for additional ventilation:

First of all, remove all ring screws or fastening screws and the upper cabinet cover (TS cabinet variant shown in picture as example).



Optional: Lifting the cabinet covers for additional ventilation:

Now screw the four spacers **H** into the threaded holes at each corner of the cabinet frame.



Optional: Lifting the cabinet covers for additional ventilation:

Then place the top cabinet cover on the spacers and fasten it with four M6 x 16 countersunk screws (TX 25) **H.1** including plastic washers **H.3**.

Next fasten the cover caps **H.2** to the plastic washers.

- 7 Now attach the type plates **G** to the cabinet in the following positions: 1 x on the inside of the door and 1 x visible on one external side wall.

8



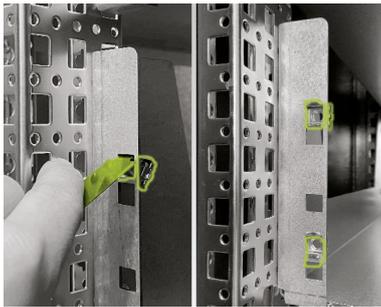
TS cabinet only: Now fit the cage nuts (E) for fastening the battery modules (2) using the auxiliary tool (E.1). Distribute the cage nuts from bottom to top. Start at the bottom edge of the slide rail for the relevant battery module. Fit the first two cage nuts in the opening directly above on both sides, leave the next seven openings empty and fit another pair of cage nuts in the next opening in both rack rails.

9



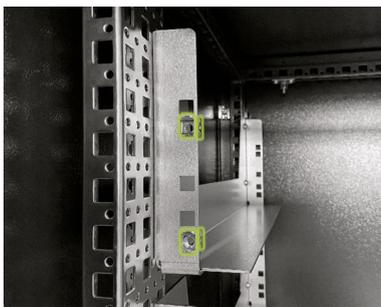
TS cabinet only: Fit the cage nuts (E) for fastening the APU LV (1) in the rack rails using the auxiliary tool (E.1). The APU LV occupies the topmost slide rail in the cabinet. Distribute the cage nuts from bottom to top. Start at the bottom edge of the slide rail. Leave the first opening empty, fit the first two cage nuts in the next opening on both sides, leave the next four openings empty and fit another pair of cage nuts in the next opening in both rack rails.

10



VX cabinet only: Now, fit the cage nuts (E) for fastening the battery modules (2) with the auxiliary tool (E.1) (see "5.9 Wiring the battery modules" on page 21 for the positions of the battery modules). Distribute the cage nuts from bottom to top. Start at the bottom edge of the slide rail for the relevant battery module. Fit the first two cage nuts in the second opening from the bottom on both sides, and fit the remaining two cage nuts in the top opening in the two slide rails.

11



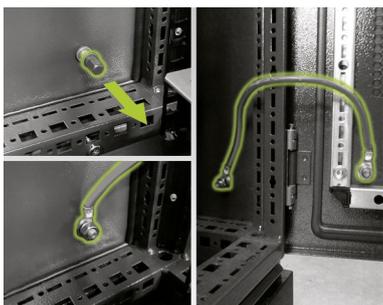
VX cabinet only: Fit the cage nuts (E) for fastening the APU LV (1) in the slide rails using the auxiliary tool (E.1). The APU LV uses the top slide rails in the left half of the cabinet. Distribute the cage nuts from bottom to top. Start at the bottom edge of the slide rails of the APU LV. Use the first opening and fit the first two cage nuts on both sides. Now, fit the remaining two cage nuts in the second opening in both slide rails from the top.

12



TS cabinet only: Fit the grounding point to an appropriate location on the cabinet's frame profile (e.g. at the front, on the lower left cabinet frame profile). The grounding point (I) is fastened with two ST5.5 x 12 (TX 30) self-tapping screws (LI).

13



TS cabinet only: Ground the cabinet door with the grounding strip (J). Use the grounding point on the side panel a few centimeters above the base, roughly at the same height as the lowest door hinge. First, remove the protective caps from the copper bolts on this grounding point and the cabinet door. Then connect the two grounding points using the grounding strip and the M8 nuts (J.1) with washer (J.2) and contact washer (J.3). The tightening torque is 10 Nm.

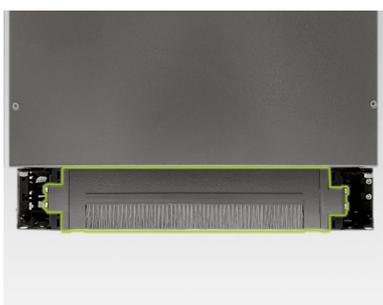
14



TS cabinet only: Install the C-rail (B) above the APU LV position. To do this, first, take the auxiliary tool (E) and install two cage nuts (E.1) in the two rack rails in the fourth hole from the top. Fasten the C-rail to these with two M6 x 16 pan head screws (D) (Phillips) and two plastic washers (D.1).

TS 25V only: The APU LV has to be installed first due to the TS 25 cabinet's small dimensions. The C-rail can then be fitted.

15



Prepare the base for fitting the storage system. A brush strip can be used in the base of the cabinet for easy cable routing. Simply install the brush strip on the required side of the base. To relocate the brush strip, two screws must be removed on the right and left sides of the brush strip. Then remove the base cover plate on the relevant side of the cabinet. Swap the brush strip and cover plate and then refit both.

16



Now you can install the base corner cover plates (C)/(C.1). The cover plates are snapped into place on each corner of the cabinet base. The logo on each base cover plate must face forwards on the front of the cabinet and to the rear on the back of the cabinet.

6.2 FITTING A CABINET EXTENSION

1



The first step is to remove the side panels on each cabinet where the cabinets are to be connected together.

2



Cabinet extension for TS cabinet only: Temporarily remove the rear panel from the right-hand cabinet. Now remove the brackets of the previously dismantled side panels on both halves of the cabinet. Then refit the rear panel of the right-hand cabinet.

Prepare the extension cabinet according to section “6.1 Setting up the cabinet” on page 25 et seq.

3



Cabinet extension for TS cabinet only: All six baying connectors (K.1) can now be fitted to connect the two halves of the cabinets. The baying connectors are located on the vertical cabinet frame profiles at the bottom, in the middle, and at the top. To do this, firstly place two ST5.5 x 13 pan head screws (K.2) in the diagonally converging extended holes with the bent end of the baying connector at the top. For now, tighten the screws hand-tight only.

4



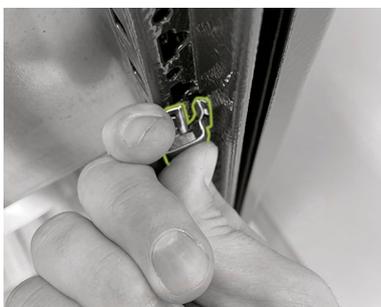
Cabinet extension for TS cabinet only: Once all the baying connectors have been pre-fitted, take a hammer and carefully tap down each baying connector in turn. This reduces the distance between the screws and pulls the two halves of the cabinet together. Stop when the two ST5.5 x 13 pan head screws (K.2) are at the upper end of the extended holes in the baying connector. Now fully tighten the two pan head screws.

5



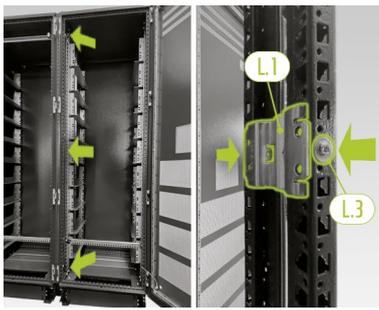
Cabinet extension for TS cabinet only: Fit two further ST5.5 x 13 pan head screws (K.2) in the small holes in the baying connector.

6



Cabinet extension for VX cabinet only: Once the side panel has been removed, take out the cage nuts that held it in place.

7



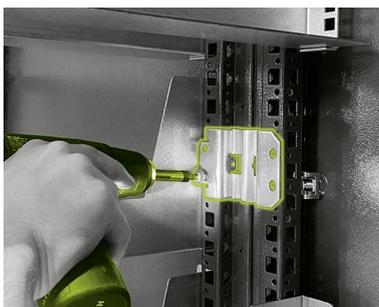
Cabinet extension for VX cabinet only: First of all, on the front of the cabinet, attach three baying connectors (L1) to the central, vertical cabinet profiles inside the cabinet at the top, middle and bottom. The baying connectors are fastened to the frame profiles with two M6 x 35 setscrews (L3) on each side from the right and left. For now, only tighten the screws loosely.

8



Cabinet extension for VX cabinet only: Now, fit the remaining three baying connectors (L1) to the vertical cabinet profiles at the rear of the cabinet at the same height as the front baying connectors already installed. When fitting the bottom baying connector, use the same process as for fitting on the front cabinet profiles. For the middle and top baying connectors, the slide rail must first be removed from one side of the fitting area.

9



Cabinet extension for VX cabinet only: Now fasten the middle and the top baying connectors using their four front holes using four ST5.5 x 13 pan head screws (L2). Then refit the relevant slide rail.

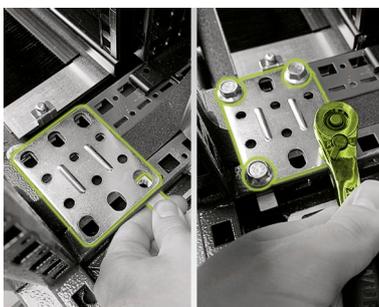
10



Cabinet extension for TS/VX cabinet only – optional:

The sealing strip (M.5) can be fitted between the cabinet frame abutting faces. The sealing strip has a self-adhesive side; use this to fasten it to one of the cabinets' abutting faces (frame profiles). The sealing strip is purely aesthetic and does not have a functional purpose.

11



Cabinet extension for TS/VX cabinet only: Now attach the lower baying connectors (M.1) in the cabinet. The lower baying connector is attached to the two abutting horizontal cabinet frame profiles on the two halves of the cabinet. To do this, place a speed nut (M.4) underneath each of the corner holes of the baying connector from the cabinet frame profile side. Use an M8 x 16 pan head screw (M.3) to fasten the connector.

12

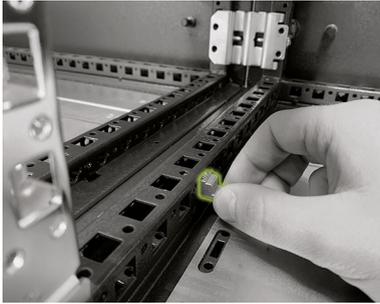
Fit the last upper baying connector (M.1) in the center of the cabinet where the abutting cabinet frame profiles of the two halves of the cabinet meet. Repeat the above step.

13



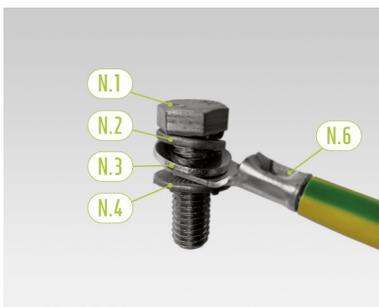
Cabinet extension for TS/VX cabinet only: Now fit the baying connectors (M.1) on the front and rear vertical cabinet frame profiles of both halves of the cabinet half-way up the cabinet. To do this, place an M8 speed nut (M.4) underneath each of the corner holes of the baying connector from the cabinet frame profile side. Fasten the connector to the VX cabinet side with two M8 x 16 screws (M.3) and two ST5.5 x 13 pan head screws on the TS cabinet side (M.2) using the small holes in the baying connector.

14



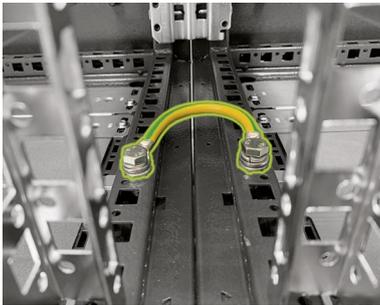
Fit the cabinet grounding connection set (N) to equalise the potential between the two halves of the cabinet. To do this, insert the M8 speed nuts (N.5) from the side into the two middle cabinet profiles at the cabinet base. You are free to choose the position, but both speed nuts must be directly opposite each other.

15



Now prepare the grounding cable (N.6) for installation. To do this, put a spring washer (N.2), a washer (N.3), the grounding cable's cable eyelet, (N.6) and, finally, the contact washer (N.4) onto the M8 x 30 screw (N.1). Ensure that the teeth of the contact washer (N.4) are pointing downwards, towards the end of the screw.

16



Fit the prepared grounding cable (N.6) using the M8 speed nuts (N.5) already installed in the central adjacent cabinet frame profiles at the cabinet base. Tighten both M8 pan head screws (N.1) with a torque of 12 Nm.

6.3 INSTALLING THE COMPONENTS



CAUTION! Electric shock if grounding is insufficient or absent!

If a fault occurs on the unit, insufficient or absent grounding can cause damage to the unit, and this brings with it the risk of injury from electric shock.

1

Ensure the battery cabinet is grounded. To do this, connect the grounding cable to the central grounding point (I.1). Use an M8 nut (I.2) for this and tighten to a torque of 8 Nm.



NOTE: Before installing the APU LV (1) note its serial number in the document "CS-S.FB.002.E.ENG_Commissioning_Protocol_TS48V", which can be found on the TESVOLT USB-Stick (8). The serial number can be found on a sticker on the underside of the APU LV. If you do not have a template, please contact service@tesvolt.com or the TESVOLT Service Line +49 (0)3491 8797-200.

2



Place the APU LV on the top slide rail. At the four fastening points, use the M6 x 16 pan head screws (D) (Phillips) and plastic washers (D.1) included in the pack to fasten to the pre-installed cage nuts.

3

TS 25 (TS cabinet) only: To relieve the strain, fit the C-rail (B) above the APU LV (I). Fasten the C-rail (B) to the pre-installed cage nuts (D.1) using two M6 x 16 pan head screws (D) (Phillips) and plastic washers.

4



The two-pin plug for the e-stop connection on the APU LV must be plugged in for operation. For further information about the e-stop, please refer to section "6.4 E-stop contact" on page 35 of this Installation and Operating Manual.

5

All battery modules (2) of a TS 48V battery storage system must have exactly the same state of charge. So be sure to check the voltage of the battery modules before fitting them. A battery module's correct voltage at installation must be 50.0 +/- 0.1 V. If you notice any deviations from this, please contact service@tesvolt.com or the TESVOLT Service Line +49 (0)3491 8797-200.

6

For systems with multiple APU LVs only: Divide the modules evenly between all the APU LVs in the system. All APU LVs must have the same number of connected battery modules.

7



Fit the first battery module below the APU LV in the slide rails. Fasten it to the pre-installed cage nuts using four M6 x 16 pan head screws (D) (Phillips) and plastic washers (D.1).

8



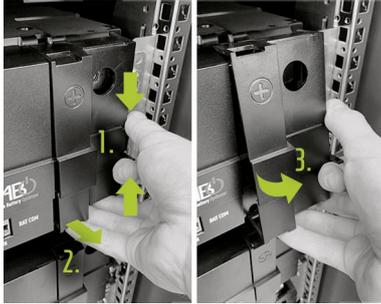
Now fit the remaining modules one after the other from the top to the bottom and fasten them in place as described above.



CAUTION! Risk of injury due to short circuit!

The battery modules and other components of the TS 48V are already live before commissioning. An inadvertent short circuit can lead to severe injuries. It is therefore essential that you avoid any action that may result in a short circuit, particularly when using uninsulated tools.

9

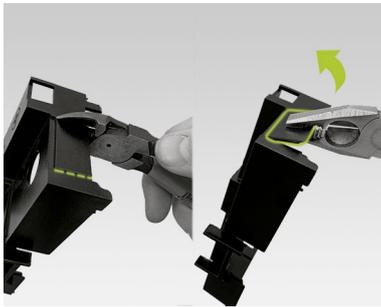


To fit the DC connectors, the side covers on the battery modules must be removed and prepared.

To remove the cover:

1. loosen the clasp,
2. gently pull the cover forwards from the bottom,
3. rotate the cover towards the side panel.

10

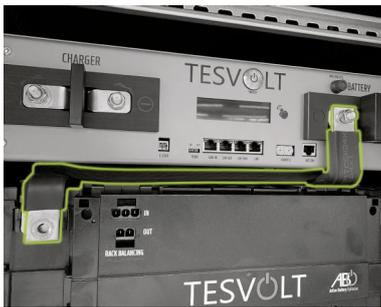


Now prepare the side covers on the battery modules for fitting the DC connectors:

1. Separate the predetermined breaking point using side cutters,
2. carefully break off the material to be removed using combination pliers.

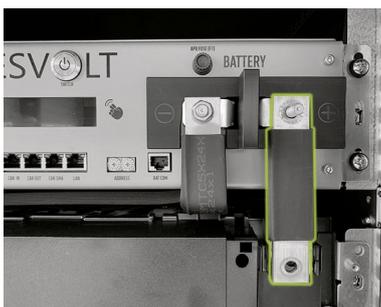
At the contact protection point on the last battery module, remove only the upper section for the module connector. The lower section remains closed to provide a touch guard.

11



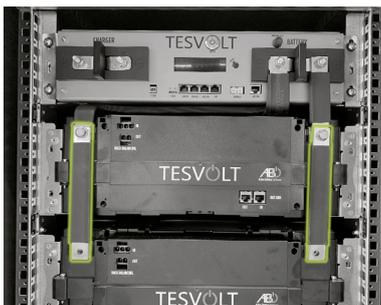
Now fit the DC connector from the APU LV (1) to the first battery module (2). Start with the S-connector (3.1) from the APU LV connector set (3). The S-connector connects the BATTERY connection (11) of the APU LV to the negative pole (17) of the first battery module. Use an M8 self-locking flanged nut (3.5) to fasten to the APU LV. Initially, tighten the connection so that it is hand-tight only. The DC connector (4.1) is only fastened to the battery module as part of the process of connecting to the following battery module.

12



Next, fit the short "I" connector (3.2) from the APU LV connector set (3). The connector forms a contact between the BATTERY "+" connection (12) of the APU LV and the positive pole (18) of the first battery module. Initially, tighten it to the APU LV so that it is hand-tight only using an M8 self-locking flanged nut (3.5). The DC connector (4.1) is only fastened to the battery module as part of the process of connecting to the following battery module.

13



You can now make the DC connections to the next battery module. To do this, use two long "I" connectors (4.1) from the LV module connector kit (4). Two M8 x 20 hexagon flanged bolts (4.2) are provided in each connector kit for fastening. The next DC connector (4.1) is only fastened to the next battery module as part of the process of connecting to the next battery module below. Initially, tighten the connections so that they are hand-tight only.

14



Continue using this procedure until you reach the last, lowest module. The long "I" connectors (4.1) are initially fastened to the last module so that they are hand-tight only using two M8 x 16 hexagon flanged bolts (3.6) (part of the APU connector kit).

Cabinet extension only: Two M8 x 20 hexagon flanged bolts (4.2) are also used to fasten the long "I" connectors (4.1) and the DC cabinet connecting cables (18.1)/18.2 on the bottom module. The procedure is described in the next step.



DANGER! Incorrect installation of the DC cabinet connecting cables when extending a cabinet can lead to a short circuit and life-threatening injuries

If the DC connecting cables (18.1)/18.2 are incorrectly installed, this may result in a short circuit. This may cause components to become extremely hot or produce an electric arc, which can lead to serious injuries. Pay careful attention to the following points to avoid a short circuit:

- Install the DC connecting cables (18.1)/18.2 one after the other and always fasten the first DC connecting cable to both battery modules first before proceeding to fit the second DC connecting cable.
- Ensure the DC connecting cables' contacts (18.1)/18.2 do not accidentally touch other components during the fitting procedure.
- Ensure that wiring is carried out properly in accordance with section "5.9 Wiring the battery modules" on page 21 et seq.

15



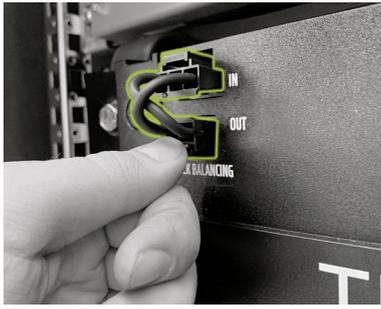
Cabinet extension only: Install all battery modules on the right side from the bottom upwards. Attach two long LV I-shaped connectors (4.1) between the modules using two M8 x 20 hexagon flanged bolts (4.2) or M8 x 16 (3.6) for the last module. Then install each of the DC connecting cables (18.1)/18.2 using two M8 x 20 hexagon flanged bolts (18.4). Connect the DC connecting cable with red marking (18.1) to the positive pole and the blue (18.2) to the negative pole on the lowest module in the left and right halves of the cabinet. Tighten all the connections so that they are hand-tight.

16



Cabinet extension only: Using the patch cable (18.3), connect the BAT-COM OUT connection on the lowest module on the left side to the BAT-COM IN connection on the lowest module on the right side. Connect the remaining BAT-COM connections on the rest of the battery modules. Note the BAT-COM cabling specifications on the left side of the cabinet in the subsequent installation steps.

17



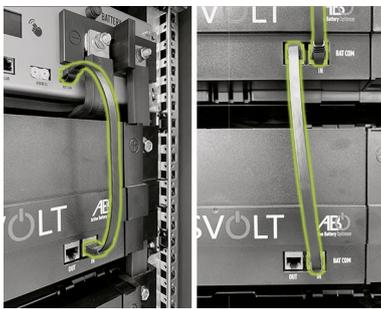
You may now fit the rack balancing bridges (3.3)/(4.4). Use the rack balancing bridge (3.3) from the APU connector kit on the first module below the APU LV. The remaining rack balancing bridges (4.4) can be found in the module connector kit.

STOP

WARNING! Possible damage to the unit due to incorrect BAT-COM wiring.

Incorrect connection of the BAT-COM communication cable leads to malfunctions in battery operation. Ensure that wiring is carried out properly in accordance with section "5.9 Wiring the battery modules", page 21 et seq.

18



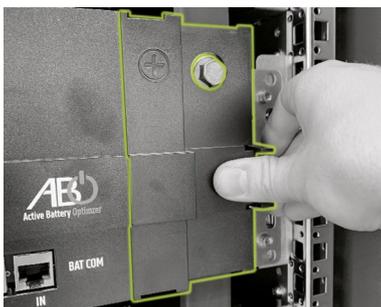
Wire the BAT-COM communication cable using the supplied patch cables (3.4) and (4.3). Using the patch cable (3.4), connect the BAT-COM connections (10) on the APU LV to the BAT-COM "IN" connection on the battery module located beneath the APU LV. You can then use a patch cable (4.3) to connect the same module's BAT-COM "OUT" connection to the next module's BAT-COM "IN" connection. Connect the remaining battery modules in the same way using the patch cables (4.3). The last battery module's BAT-COM "OUT" connection remains unused.

19



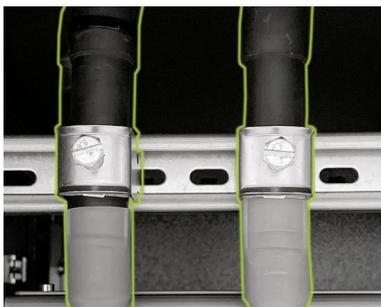
Now tighten the self-locking nuts (3.5) on the BATTERY connections on the APU LV (11)/(12) with a tightening torque of 12 Nm. The M8 x 20 (4.2) and M8 x 16 (3.6) hexagonal flanged screws on the DC connections on the battery modules (17)/(18) can now be tightened with a tightening torque of 12 Nm.

20



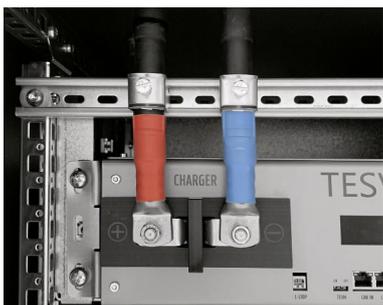
Finally, fit the side covers on the battery modules. Ensure the brackets snap into place correctly.

21



Now lay the DC cables (5.1)/(5.2) starting from the APU LV to the SMA Sunny Island or the bat fuse (15) or (16). Note that the cable can only be shortened on the SMA Sunny Island or bat fuse side. To relieve the strain on the DC cables, install the two cable retention clips (F) above the CHARGER connections of the APU LV (1) / (2) on the C-rail (B).

22



Only connect the DC cables (5.1) / (5.2) to the APU LV once the SMA Sunny Island is completely connected. Fasten the DC connecting cable with red marking (5.1) to the CHARGER "+" connection (1) and the DC connecting cable with blue marking (5.2) to the CHARGER "-" connection (2). Use two M8 self-locking nuts (3.5) to fasten, and tighten to a torque of 12 Nm. Finally, fix the DC cables in the cable retention clips (F).

23



Connect the CAN SMA connection (7) on the APU LV to the Com-Sync IN connection on the SMA Sunny Island using a patch cable (5.3).

24

Then connect the LAN connection (8) on the APU LV and the ComETH connection on the SMA Sunny Island using the switch.

25

Finally, fill out the commissioning protocol. You will find a template for this on the TESVOLT USB-Stick (8). Also note down the serial numbers of the battery inverter and peripheral devices such as the SMA Home Manager 2.0. Send the completed commissioning protocol to service@tesvolt.com.

6.4 E-STOP CONTACT

The TS 48V has a quick shutdown (e-stop) function. The unit has a Wago 734-162 two-pin plug that is accessible from the outside for this purpose. This electrical connection can be connected to an external control system using the matching Wago 734-102 jack. If necessary, the external control system can switch off the unit as quickly as possible using a separate (i.e. completely independent) switching path. The shutdown is much faster than the normal shutdown process. The wiring connection may only be implemented using a dry contact.



WARNING! Possible damage to the unit due to use of the e-stop

The e-stop contact is used to quickly shut down the system. As the battery storage system is not switched off properly when the e-stop is used, damage to the TS 48V can occur. For this reason, never use the e-stop to switch off the unit under normal circumstances.



WARNING! Possible damage to the APU LV or external components due to an unsuitable switching device

Connecting a wet switching device can result in damage to the APU LV and/or external components.

E-stop states

1. Contacts 1 and 2 of the Wago plug are connected, e.g. by an external relay; the e-stop is inactive and the APU LV is thus switched on.
2. Contacts 1 and 2 on the Wago plug are open, e.g. after activation of the external switch; the e-stop is active (this is shown on the APU LV display); the DC connection between the TS 48V and the SMA Sunny Island is interrupted.

Request to the external control system

Since the e-stop uses an internal voltage of 40 to 60 V_{DC} within the unit, external relay switching by means of a dry contact must be used for correct functioning. This switching can be adapted to match the requirements of the external control system. The possible circuit situations are shown in the figure below.

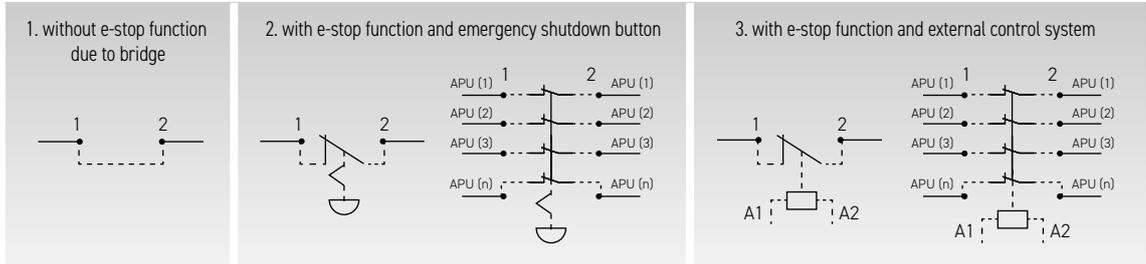


Figure 6.1 Various circuit situations for the e-stop



NOTE: If you are not using the e-stop function, the bridged plug must be fitted to the e-stop connection 3, as otherwise the storage system will remain inactive!



E-stop connection 3 on the APU LV with Wago plug with bridge between contacts 1 and 2.

7.2 NUMBER OF APU LV FOR VARIOUS APPLICATIONS

High short circuit currents in the SMA Sunny Island due to faulty consumer units can lead to overcurrent shutdown in the battery.

Procedure for number of APU LVs depending on the application

When designing the TESVOLT TS48V storage systems, we recommend following the procedure for the number of APU LVs given in the following table to ensure stable operation.

APPLICATIONS	PHASES	NUMBER OF APU LV
On-grid (no back-up power/no backup)	1	1 APU LV per SMA Sunny Island
	3	1 APU APU per cluster
On-grid with emergency power distribution (back-up power/backup)	1	1 APU LV per SMA Sunny Island
	3	1 APU APU per cluster*
Sunny Island system with multi-cluster box	3	2 APU LVs per cluster
Off-grid	1	1 APU LV per SMA Sunny Island
	3	2 APU LVs per cluster
Split-phase	2	1 APU LV per SMA Sunny Island

* Depending on the consumer units (e.g. old motors with high start-up currents), we would recommend two APU LVs per cluster.

7.3 CONNECTING SUNNY ISLAND TO BATTERY INVERTER



DANGER! Life-threatening electric shock or damage to the unit due to incorrect connection

The valid operating manual for the SMA Sunny Island provides authoritative information on correctly connecting the SMA Sunny Island. For this reason, the information provided in this manual is entirely non-binding.



WARNING! Possible damage to the TS 48V if the installation requirements are not met

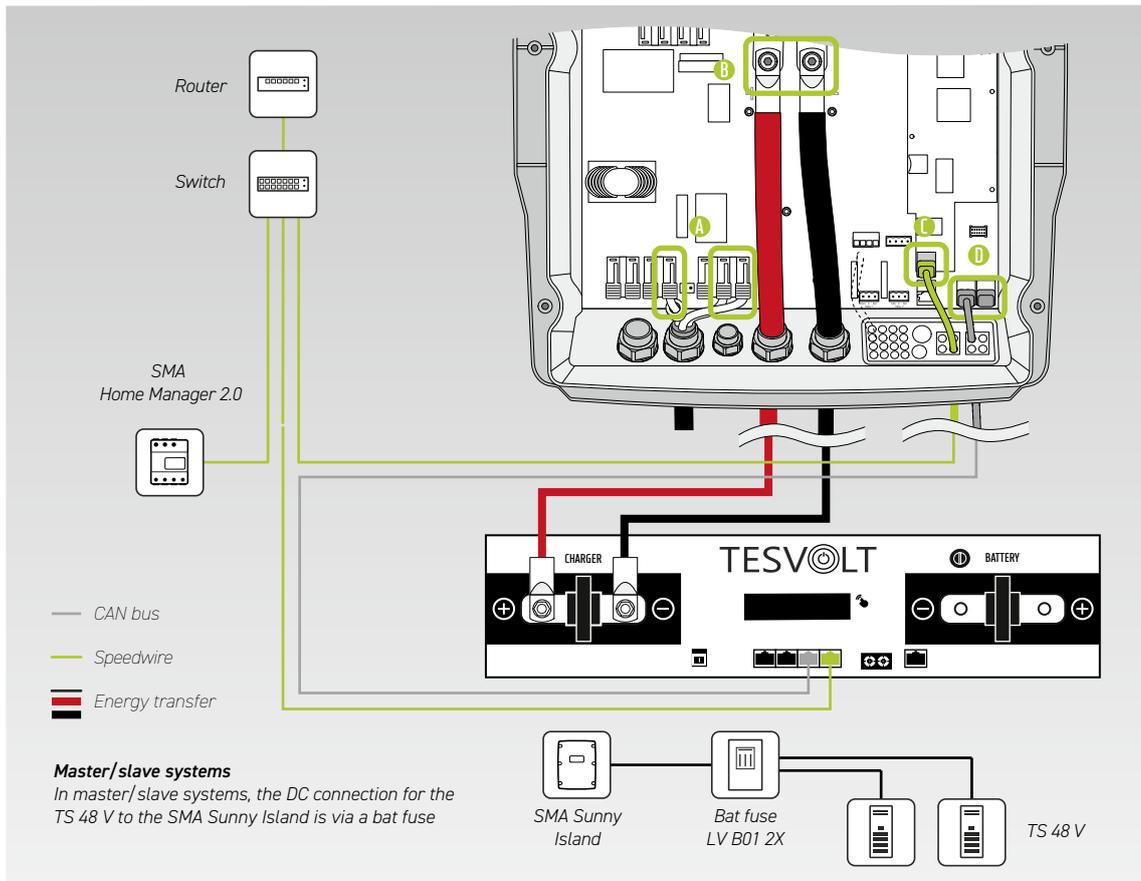
Installation of the TS 48V must be complete before the SMA Sunny Island is connected.



NOTE:

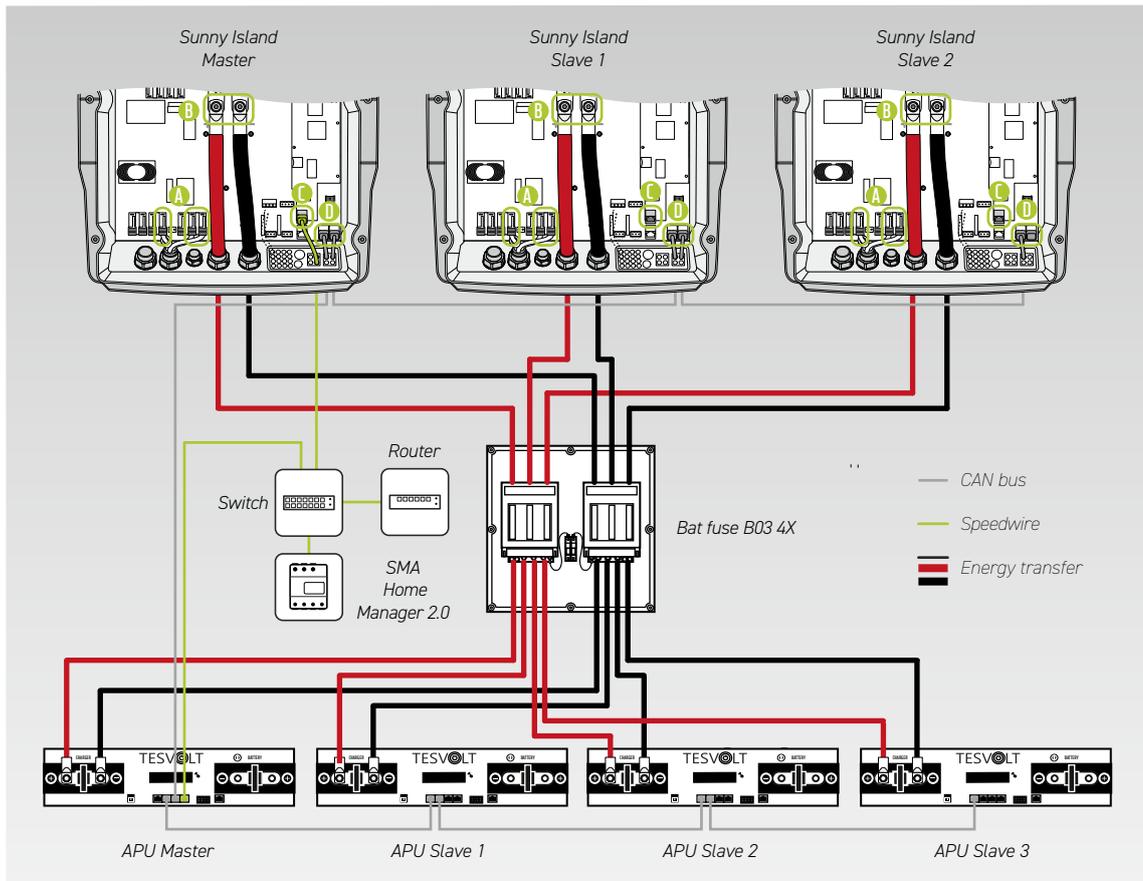
When using a bat fuse (15)/(16), use the LV DC connecting cable set (5) to connect the bat fuse to the SMA Sunny Island.

Single-phase SMA Sunny Island connection



ITEM	DESIGNATION	DESCRIPTION
A	AC connection terminals	AC 2 Gen/Grid terminals L, N _T and PE connection, connection to the public utility grid using triple-core cables, conductor cross-section 6 mm ² - 16 mm ²
B	DC connection terminals	Battery connection: Conductor cross-section: 50 - 120 mm ² /cable diameter: 14 - 25 mm Tightening torque 12 Nm
C	ComETH connection	Speedwire network cable, connection to switch The cable length between the two network participants must not exceed 50 m with patch cables or 100 m with laid cables.
D	ComSync IN/OUT connection	ComSync IN connection: CAN SMA connection 7 on the TS 48V APU LV (master) 1 ComSync OUT connection: terminating resistor must be plugged in. The overall length of the communication bus must not exceed 30 m.

Three-phase SMA Sunny Island connection



ITEM	DESIGNATION	DESCRIPTION
A	AC connection terminals	AC2 Gen/Grid terminals L, N _{TT} and PE connection, connection to the public utility grid using triple-core cables, conductor cross-section 6 mm ² - 16 mm ²
B	DC connection terminals	Battery connection: Conductor cross-section: 50 - 120 mm ² /cable diameter: 14 - 25 mm Tightening torque 12 Nm
C	ComETH connection	Speedwire network cable, connection to switch The cable length between the two network participants must not exceed 50 m with patch cables or 100 m with laid cables.
D	ComSync IN/OUT connection	ComSync IN connection: Master > SMA SMA CAN 7 on the TS 48 V APU (master) 1 Slave 1 > ComSync OUT Sunny Island master Slave 2 > ComSync OUT Sunny Island slave 1 ComSync OUT connection: Master > ComSync IN Sunny Island Slave 1 Slave 1 > ComSync IN Sunny Island Slave 2 Slave 2 > Terminating resistor must be plugged in. The overall length of the communication bus may not exceed 30 m.

Assembly distances for SMA Sunny Island units/bat fuse and connecting cable lengths

When using the bat fuse to Sunny Island (10 m) DC connector kit (17), the components must be arranged in a specific order as this is the only way to maintain the calculated lengths for the connecting cables.

Refer to the table below for the calculated lengths of the connecting cables. The assembly arrangement and the distances between the components are shown in the figure below.

LENGTH	- POLE	POINT OF CONNECTION 1	POINT OF CONNECTION 2
200 cm	Positive	Bat fuse	Master Sunny Island
200 cm	Negative	Bat fuse	Master Sunny Island
100 cm	Positive	Bat fuse	Slave 1 Sunny Island
100 cm	Negative	Bat fuse	Slave 1 Sunny Island
200 cm	Positive	Bat fuse	Slave 2 Sunny Island
200 cm	Negative	Bat fuse	Slave 2 Sunny Island

Table 7.1. Lengths of connecting cables when using the bat fuse to Sunny Island DC connector kit

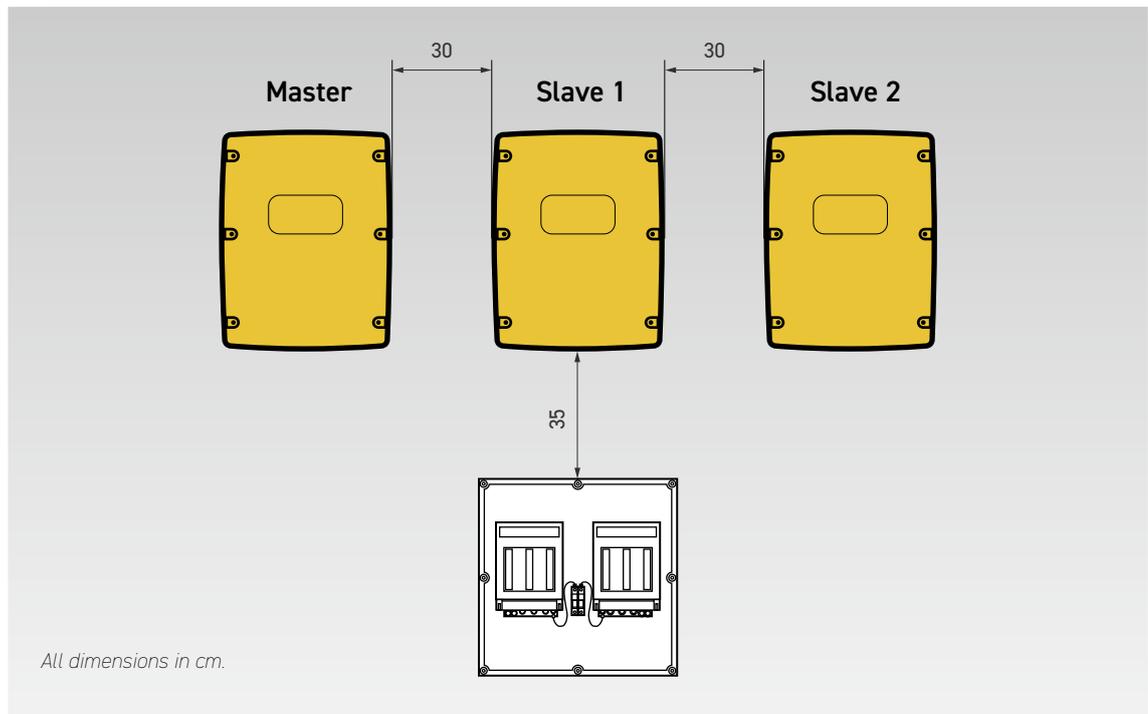


Figure 7.2 Correct distances between the components for fitting the bat fuse to the Sunny Island using the DC connector kit

8 COMMISSIONING

8.1 COMMISSIONING A SINGLE UNIT



WARNING! Possible damage to the battery due to incorrect configuration

Incorrect configuration can cause damage to the battery. The parameter settings influence the SMA Sunny Island's charging behavior. For this reason, it is important to make the correct settings during commissioning.

Prerequisites

The SMA Sunny Island has been installed in accordance with SMA's specifications (installation/connection).

Procedure

- 1 Check the wiring of the SMA Sunny Island and TS 48 V (see the SMA Sunny Island operating manual).
- 2 Check the wiring of the components in accordance with section "5.9 Wiring the battery modules" on page 21 et seq. If the wiring is correct, all live components will be protected against physical contact.
- 3 **Systems with bat fuse only:** Ensure the APU LV is switched off. Insert the tag fuses in the load-disconnecting switch on the bat fuse (15)/(16). Fasten the load-disconnecting switch to the bracket in the bat fuse and close the bracket. Then close the casing cover on the bat fuse.



WARNING! Possible damage to the APU LV due to undetected errors during installation

Carry out the check carefully in accordance with step 2, as damage to the APU LV can occur if there are deviations.

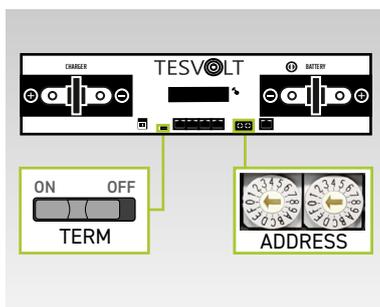


WARNING! Possible damage to the APU LV due to improper operation

If you tap on the APU LV to activate it or confirm an action, you must follow the instructions below to avoid damaging the APU LV:

1. Do not use objects to tap the unit under any circumstances.
2. Tap gently with your fingers on the marking 14 to the right of the display on the casing. **Never tap on the display.**

4



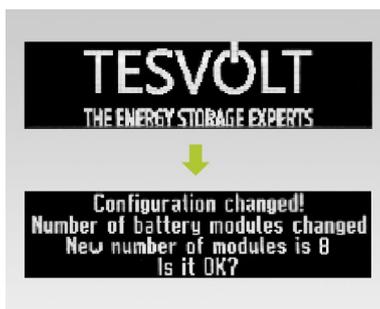
Check and, if necessary, correct the settings for the TS 48 V's termination and addressing ("TERM" 4 and "ADDRESS" 9) on the APU LV.

TERM is to be set to "ON" when operating a single TS 48 V, and ADDRESS is to be set to "0" and "0".

5

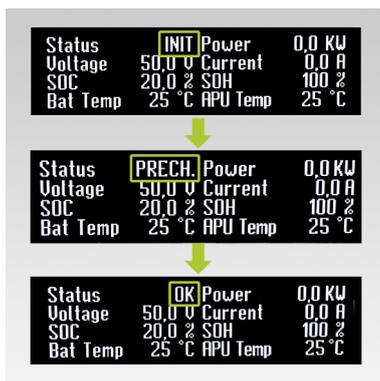
Press the On/Off switch ("SWITCH") 15 on the APU LV.

6



The number of battery modules detected is shown on the display. Confirm the number is correct by tapping twice on the marking 14 next to the display. If the displayed number of modules differs from the number actually present, switch off the APU LV and check the BAT-COM wiring. If the fault continues to occur regardless, please contact the TESVOLT Service Line +49 (0)3491 8797-200 or email service@tesvolt.com.

7



The TS 48V now switches to "INIT" mode and the switch starts to flash.

Once initialisation has been successfully completed and a fault-free status is achieved, the APU LV automatically begins the pre-charging process "PRECH".

After pre-charge mode, the switch lights up continuously. The status point on the battery display reads "OK". The TS 48V is now operational.

8



Tap beside the display again to access the next menu item. You will now be shown the assigned IP address, provided the LAN connection 8 is connected to the APU LV by a DHCP enabled router.

9

Next, commission the SMA Sunny Island system in accordance with the SMA specifications.



NOTE:

The APU LV display remains active for approximately two minutes and is then deactivated. It can be reactivated by tapping twice.

Depending on the number of modules installed, the storage capacity in ampere hours can be taken from the table and entered in the corresponding menu item when commissioning the Sunny Island(s).

STORAGE CAPACITY AS A FUNCTION OF THE NUMBER OF BATTERY MODULES																
Number of battery modules	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Capacity (Ah)	94	188	282	376	470	564	658	752	846	940	1,034	1,128	1,222	1,316	1,410	1,504

Table 8.1. Storage capacity as a function of the number of battery modules

8.2 COMMISSIONING TS 48V SYSTEMS USING THE MASTER/SLAVE PRINCIPLE



WARNING! Possible damage to the battery due to incorrect configuration

Incorrect configuration can cause damage to the battery. The parameter settings influence the SMA Sunny Island's charging behavior. For this reason, it is important to make the correct settings during commissioning.

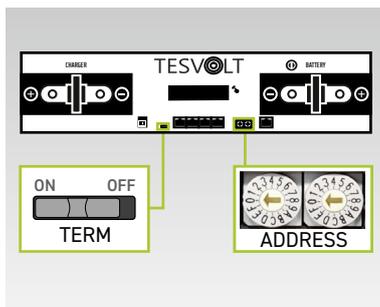
Prerequisites

The SMA Sunny Island has been installed in accordance with SMA's specifications (installation/connection).

Procedure

- 1 Check the wiring of the SMA Sunny Island and TS 48V (see the operating manual for the SMA Sunny Island).
- 2 Check the wiring of the components in accordance with section "5.9 Wiring the battery modules" on page 21 et seq. If the wiring is correct, all live components will be protected against physical contact.
- 3 Ensure the APU LV is switched off. Insert the tag fuses in the load-disconnecting switch on the bat fuse (15)/(16). Fasten the load-disconnecting switch to the bracket in the bat fuse and close the bracket. Then close the casing cover on the bat fuse.

4



Now enter the termination and addressing settings for TS 48V (TERM 4 and ADDRESS 9) in accordance with the section "Overview of all addressing options" on page 51 and the figures in section "10.2 Expanding capacity using additional TS 48V units" on page 48 et seq. In the case of master/slave systems, TERM 4 is to be set to "ON" for APU LVs of the master and the last storage system in the master/slave configuration. TERM 4 is to be set to "OFF" for all other slave APU in the arrangement.



WARNING! Possible damage to the APU LV due to improper operation

If you tap on the APU LV to activate it or confirm an action, you must follow the instructions below to avoid damaging the APU LV:

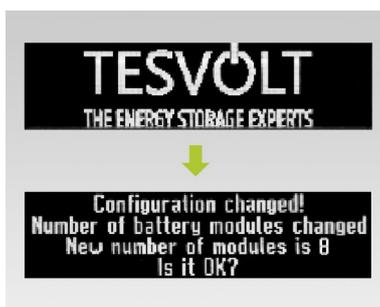
1. Do not use objects to tap the unit under any circumstances.
2. Tap gently with your fingers on the marking to the right of the display on the casing. **Never tap on the display.**



NOTE:

The APU LV display remains active for approximately two minutes and is then deactivated. It can be reactivated by tapping twice.

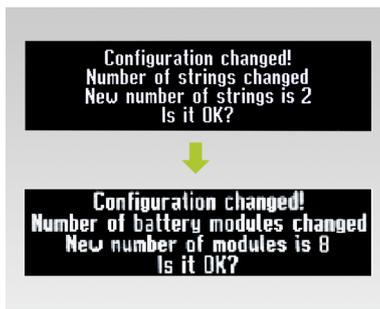
5



Switch on the TS 48V units in the reverse order to their position in the string (slave 3 > slave 2 > slave 1). To do this, first press the ON/OFF switch SWITCH 15 on the APU LV of the last slave TS 48V. The number of battery modules detected is shown on the display. Tap twice next to the display to confirm the number is correct. Otherwise, check the BAT-COM wiring.

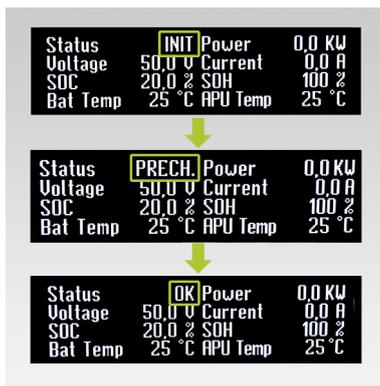
If present, next switch on the APU LV on slave 2 and then slave 1.

6



Switch on the master APU. If there is more than one APU LV in the cluster, an additional query appears in the master APU LV display. Tap twice next to the display to confirm the number is correct.

7



The TS 48V units now switch to INIT mode and the switches start to flash.

Once initialisation has been successfully completed and a fault-free status is achieved, the APU LVs automatically begin the pre-charging process "PRECH".

After pre-charge mode, the switches on all the APU LVs light up continuously. The status point on the battery display reads "OK". All TS 48V units in the master/slave arrangement are now operational.

8



On the master APU, tap beside the display again to access the next menu item. You will now be shown the assigned IP address, provided the LAN connection on the APU LV 8 is connected by a DHCP enabled router.

9

Next, commission the SMA Sunny Island System in accordance with the SMA specifications.

Depending on the number of modules installed, the storage capacity in ampere hours can be taken from the table and entered in the corresponding menu item when commissioning the Sunny Island(s).

If you are using more than 16 battery modules in your system, you can calculate the storage capacity yourself by multiplying the number of modules by 94 Ah.

STORAGE CAPACITY AS A FUNCTION OF THE NUMBER OF BATTERY MODULES																
Number of battery modules	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Capacity (Ah)	94	188	282	376	470	564	658	752	846	940	1,034	1,128	1,222	1,316	1,410	1,504

Table 8.2. Storage capacity as a function of the number of battery modules

9 DECOMMISSIONING



DANGER! Risk of injury due to electric shock after decommissioning

Large parts of the battery system are still under full voltage even after decommissioning, meaning there is a risk of an electric shock if operators touch live parts of the storage system.



DANGER! Risk of injury due to electric shock after decommissioning

- Discharging the capacitors in the battery inverter can take several minutes after switching off. For this reason, please wait 15 minutes until the system has largely discharged.
- The DC auxiliary circuit is not completely voltage-free after decommissioning; the voltage is merely low ($U_{DC} \leq 60 V_{DC}$), meaning a fatal electric shock can no longer occur if operators touch live parts of the DC auxiliary circuit.



WARNING! Possible damage to the unit due to incorrect decommissioning

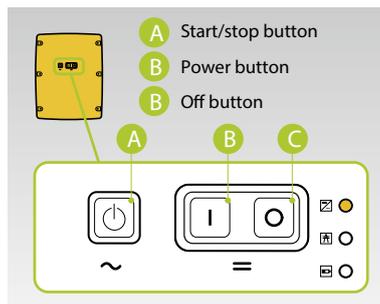
For standard decommissioning, the output must be 0 kW before the APU LV is decommissioned using the On/Off switch as this may otherwise damage the APU LV.



NOTE:

The SMA Sunny Island is an SMA product. For this reason, TESVOLT cannot guarantee the accuracy of information provided about this and other products belonging to SMA. Binding information can only be found in SMA's valid product documentation for the product.

1



First, stop the SMA Sunny Island. To do this, press the start/stop button (A) on the SMA Sunny Island and hold it down until the control LED on the SMA Sunny Island lights up orange.

2

Next, press the OFF button (C) on the SMA Sunny Island and hold it down until an audible signal is heard.

3



Switch off the battery (press the green-lit On/Off switch on the APU LV; the green LED must go out).

For systems with multiple TS 48V units, each APU LV must be switched off.

4

On the APU LV, disconnect the DC connecting cables (5.1) and (5.2) from the unit at the CHARGER connection (1/2).

5

Wait 15 minutes until the system is largely voltage-free, as the capacitors in the battery inverter take several minutes to discharge.

10 EXPANDING THE STORAGE SYSTEM

The capacity and the charging/discharging power of TESVOLT battery systems can be expanded.

10.1 EXPANDING THE CAPACITY USING THE TESVOLT EXPANSION MODULE

Installing expansion modules



DANGER! Risk of injury from high compensating currents if the expansion and original battery modules have different states of charge

If a battery module is installed in a TS 48V battery storage system and this module's state of charge differs from that of the battery modules already present, high compensating currents flow in the event of contact with existing battery modules and this can result in an electric arc or components becoming very hot and, consequently, to serious injuries.



WARNING! Possible damage to the unit and/or battery inverter if the expansion and original battery modules have different states of charge

If a battery module is installed in a TS 48V battery storage system and this module's state of charge differs from that of the battery modules already present, this can cause damage to the battery modules or to the APU LV.



NOTE:

Up to 16 battery modules can be connected to one APU LV. If more battery modules are to be operated in a system, (at least) one extra APU LV is required. Please note that each APU LV must have the same number of battery modules.

- 1 The new battery modules are supplied with a state of charge (SoC) of approx. 20%. Before you integrate a new battery module into an existing battery system, the existing system must be brought to the same voltage level. First check the new battery modules' state of charge by carrying out a voltage measurement; this must be exactly $50.0 \pm 0.1 V_{DC}$. If there are deviations, please contact the TESVOLT Service Line +49 (0) 3491 8797-200 or send an email to service@tesvolt.com.
- 2 Adjust the voltage of the original battery modules of the TS 48V so that it precisely matches the voltage of the new battery modules.
- 3 If necessary, install a cabinet extension in accordance with section "6.2 Fitting a cabinet extension", page 27.
- 4 Now prepare the extended cabinet for the electrical components to be fitted in accordance with section "6.1 Setting up the cabinet", page 25.
- 5 Complete the installation of the electrical components in accordance with section "6.3 Installing the components", page 30.
- 6 In the event of a restart, the APU LV queries the number of modules detected via the display. If the number is correct, confirm this by tapping twice on the marking to the right of the display. For more information, see section "8 Commissioning", page 42 et seq.
- 7 Next, commission the SMA Sunny Island system in accordance with SMA specifications. Call up the web interface on the master Sunny Island. The data for the battery capacity in Ah must be adjusted under Unit parameters → "Edit parameters" → "Battery" → "Nominal capacity". The data for the battery capacity of your TESVOLT TS 48V system can be found in "Table 8.1 Storage capacity as a function of the number of battery modules", page 43.

10.2 EXPANDING CAPACITY USING ADDITIONAL TS 48 V UNITS



WARNING! Possible damage to the unit and/or battery inverter if the unit is extended by different capacities

If you would like to use multiple TS 48V battery storage systems on one SMA Sunny Island, it is essential that they all have the same capacity.



WARNING! Possible damage to the unit and/or battery inverter if battery storage systems are connected in parallel without master/slave operation

When battery systems are connected in parallel, the APU LVs may not be operated as independent masters, but must always be configured and operated in in master/slave systems.



NOTE:

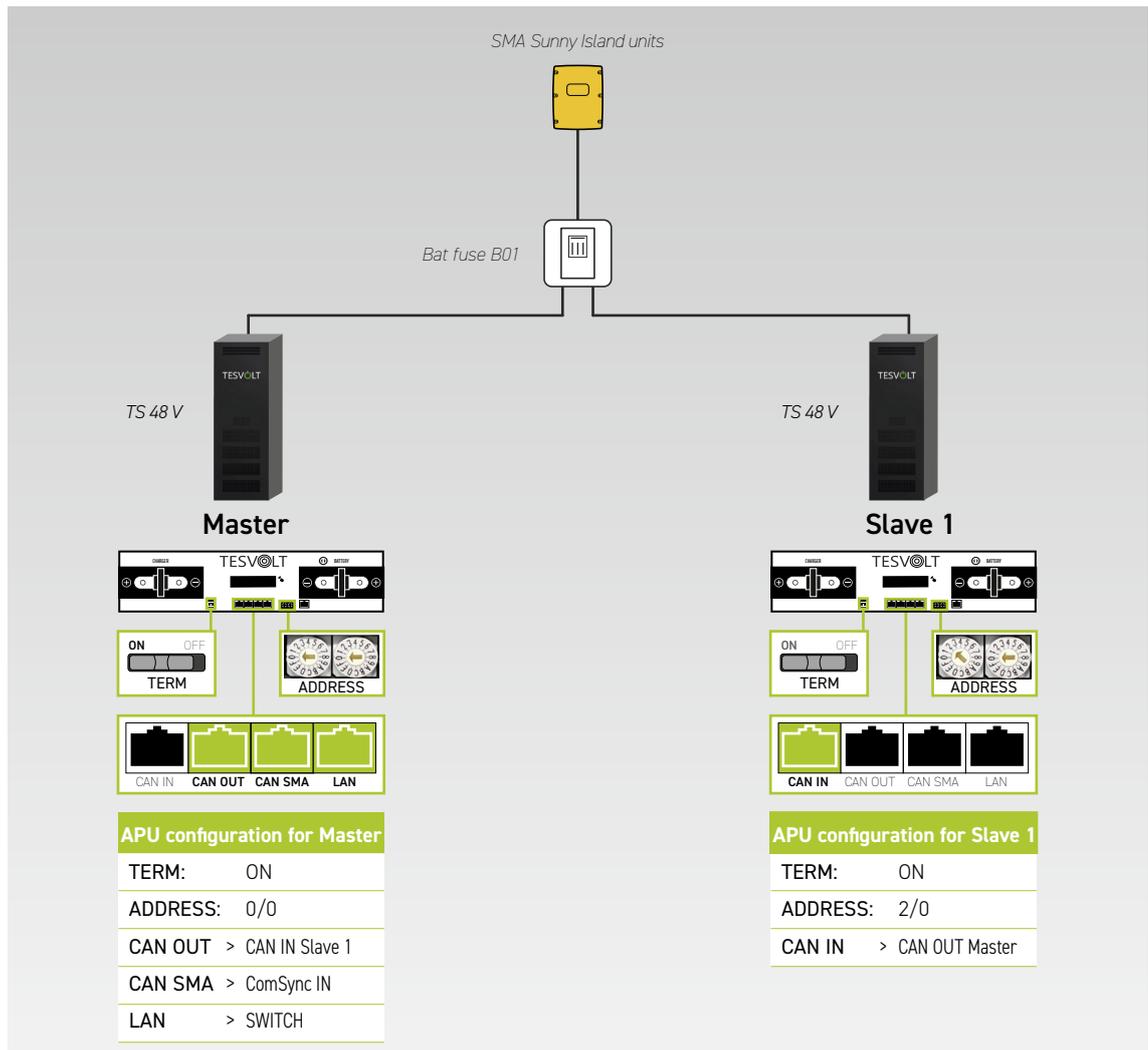
Up to four TS 48V units can be connected in parallel per SMA Sunny Island using the master/slave principle.



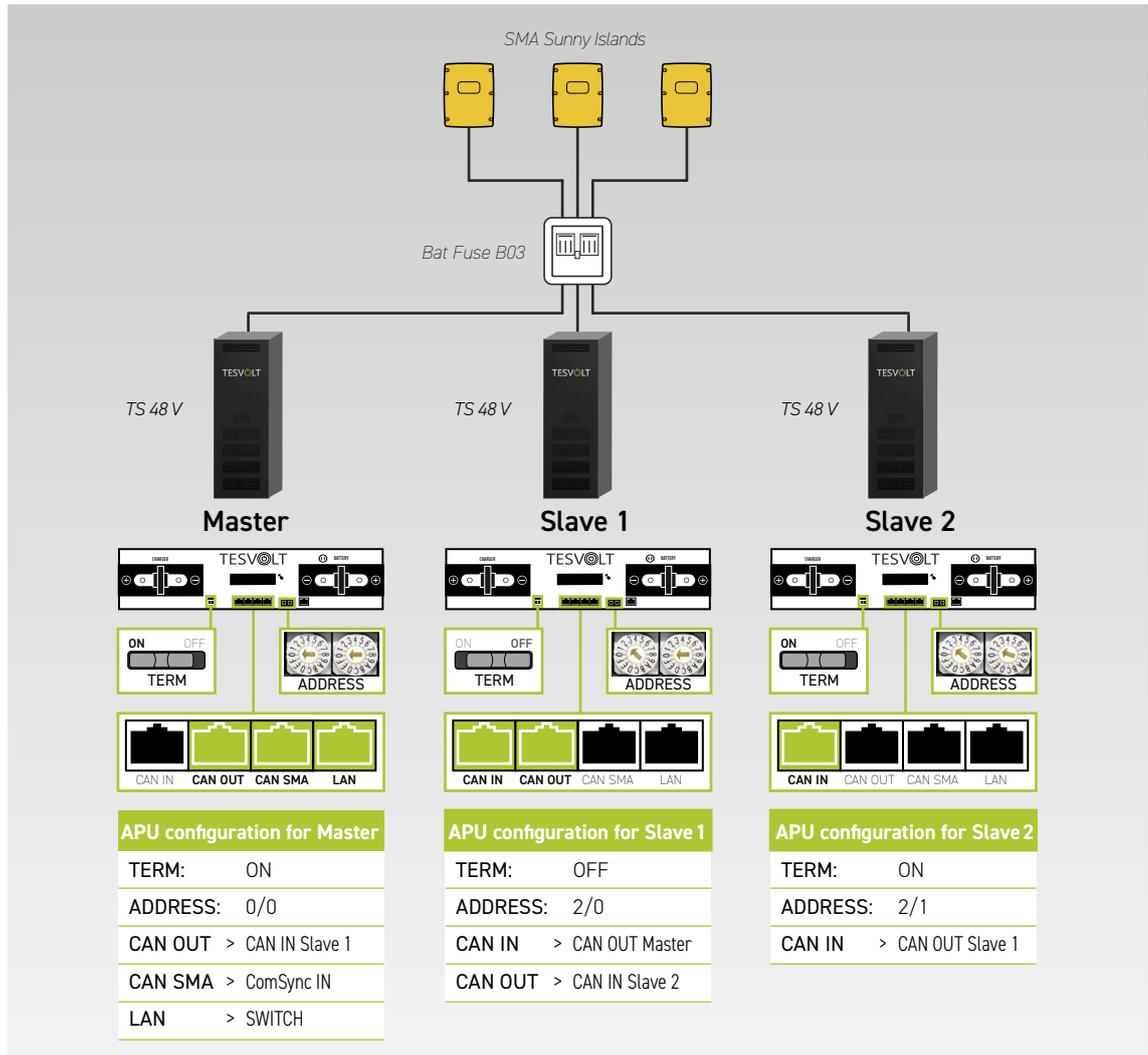
NOTE:

When expanding a single-phase storage system to include one or more slave storage systems, a bat fuse (15) (single-phase) or a (16) (three-phase) must be ordered and installed at the same time. If the system already has a three-phase bat fuse (16), up to four APU LVs can be connected to it, each with a maximum of 16 battery modules.

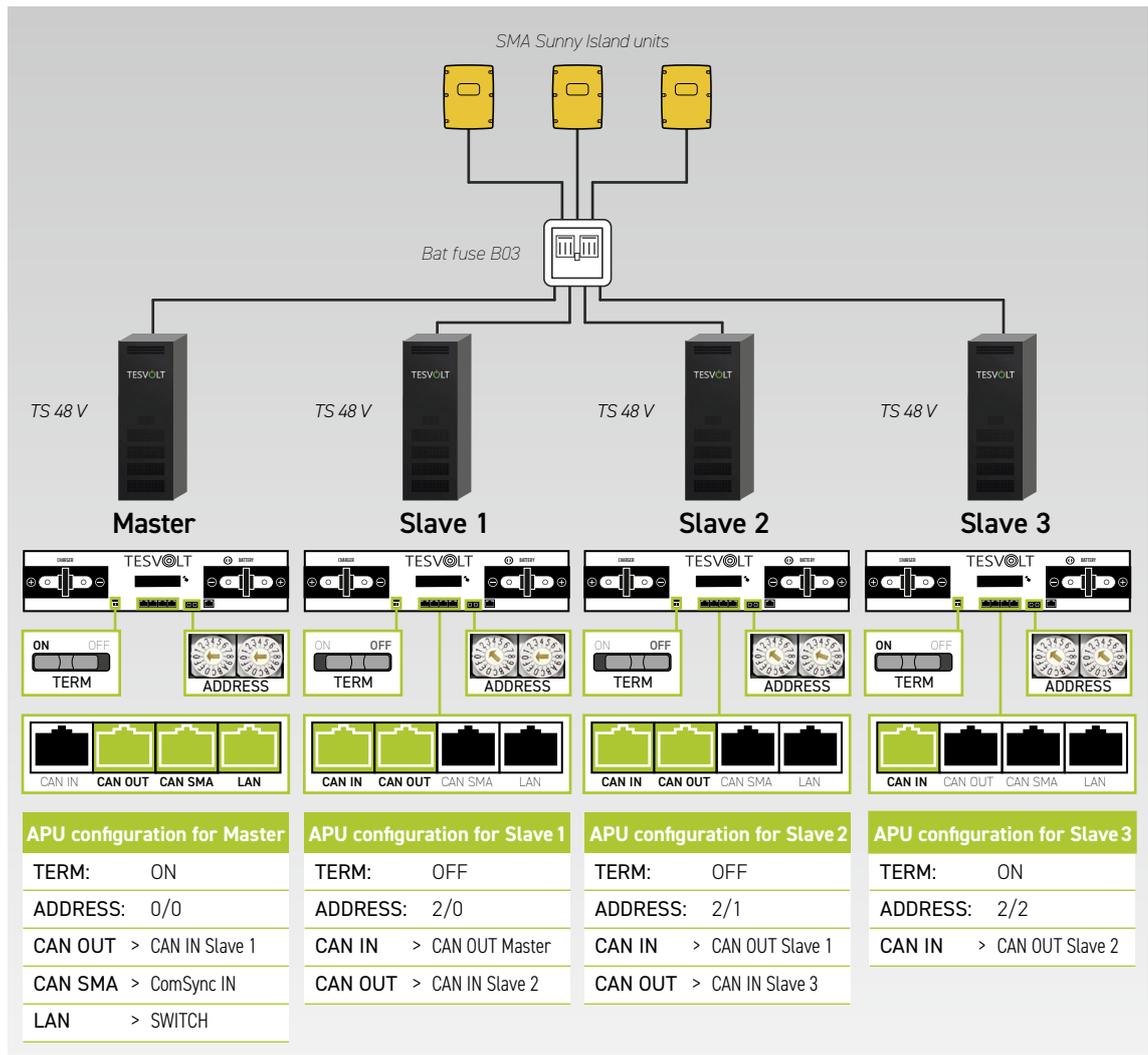
System with one master and one slave



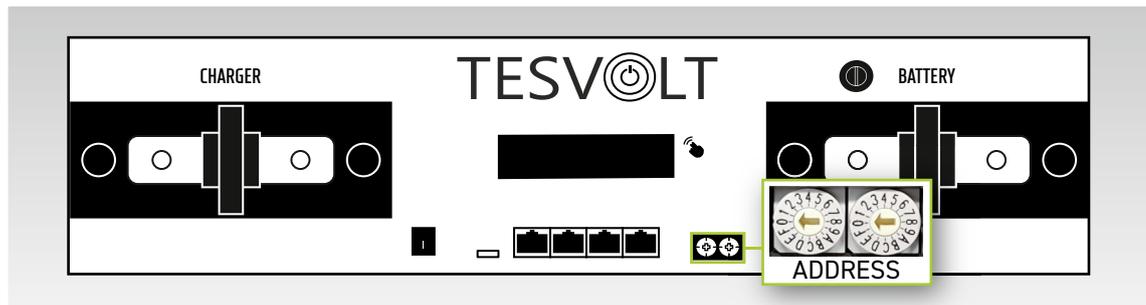
System with one master and two slaves



System with one master and three slaves



Overview of all addressing options



Set the address selector on the APU LV to match the configuration and data in the table below.

LEFT SELECTOR	RIGHT SELECTOR	DESIGNATION
0	0	Master 1
2	0	Slave 1 (of master 1)
2	1	Slave 2 (of master 1)
2	2	Slave 3 (of master 1)
0	0	Master 2
2	0	Slave 1 (of master 2)
2	1	Slave 2 (of master 2)
2	2	Slave 3 (of master 2)
0	0	Master 3
2	0	Slave 1 (of master 3)
2	1	Slave 2 (of master 3)
2	2	Slave 3 (of master 3)
0	0	Master 4
2	0	Slave 1 (of master 4)
2	1	Slave 2 (of master 4)
2	2	Slave 3 (of master 4)

10.3 CAPACITY UPGRADE WITH SMA SUNNY ISLAND

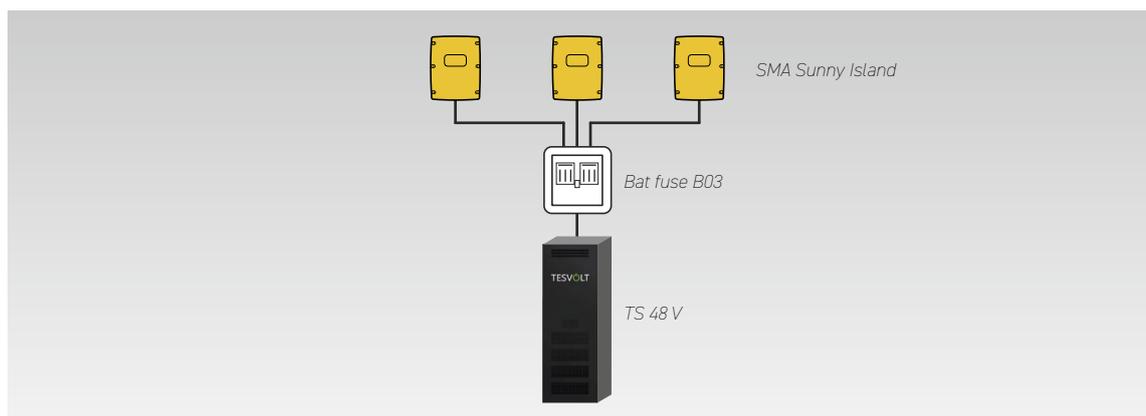


Figure 10.1 Three-phase system with three SMA Sunny Island units

By connecting a total of three SMA Sunny Island units, it is possible to increase the capacity of the system and/or carry out a three-phase connection of the TESVOLT TS 48V. If more than one SMA Sunny Island is connected to the TS 48V, a bat fuse to the Sunny Island (17) DC connector kit is required in addition to an (extra) LV B03 4X bat fuse (16) to distribute the current across the fuse elements. In a cluster of three SMA Sunny Island units, one inverter functions as the master unit and the other two as slave 1 and slave 2.

11 TESVOLT BATTERY MONITORING SOFTWARE – BATMON

11.1 VIEWS AND FUNCTIONS

TESVOLT BatMon is a piece of software that can be used to analyse and visualise batteries right down to the cell level.



NOTE:

The software can be found on the supplied TESVOLT USB-Stick  and must be installed in a writable directory on the "C:" drive, for start-up. The installation path suggested by the installation program must not be changed.

To obtain an overview of the battery using the BatMon software, the service laptop's LAN connection must be connected to the switch (see also "7.1 System structure", page 37). In addition to this, the switch must be connected to a DHCP enabled router.

After installation, launch the file "BatMon.exe". Tick all the boxes in the firewall query about full access to the network. The "System" menu item at the bottom of the BatMon interface includes a "Communication Port" button. Here, the APU LV serial number (see note or sticker on the underside of the APU LV's casing) and the IP address of the master (see display) must be selected under "Select APU".

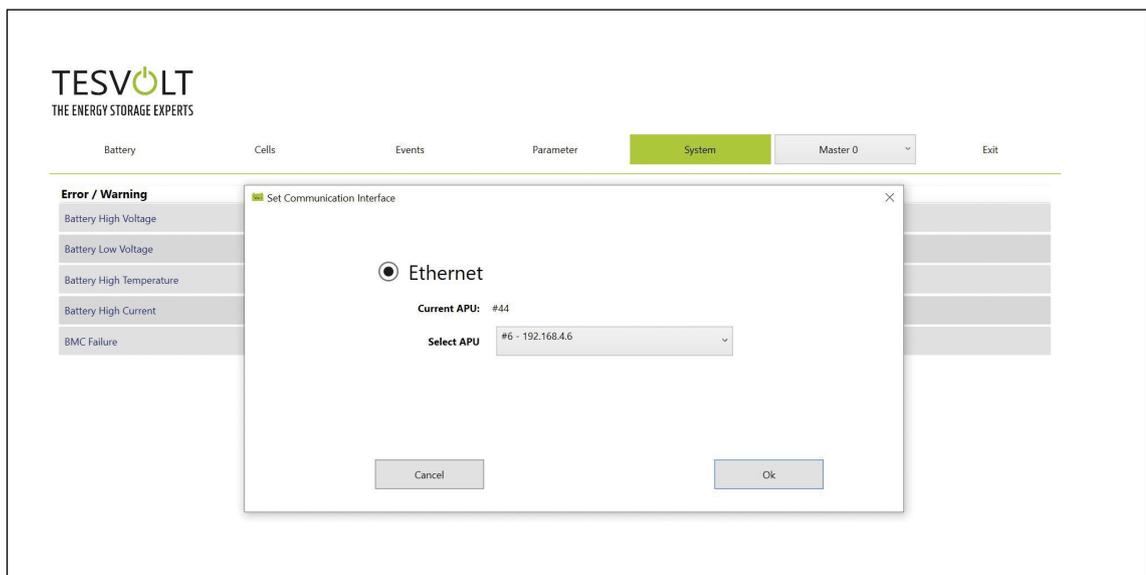


Figure 11.1 Screen for setting the network configuration



NOTE:

If the configuration is correct and the battery is successfully connected, a continuous green circle and the "online" icon will appear in the bottom right-hand corner of the BatMon interface.

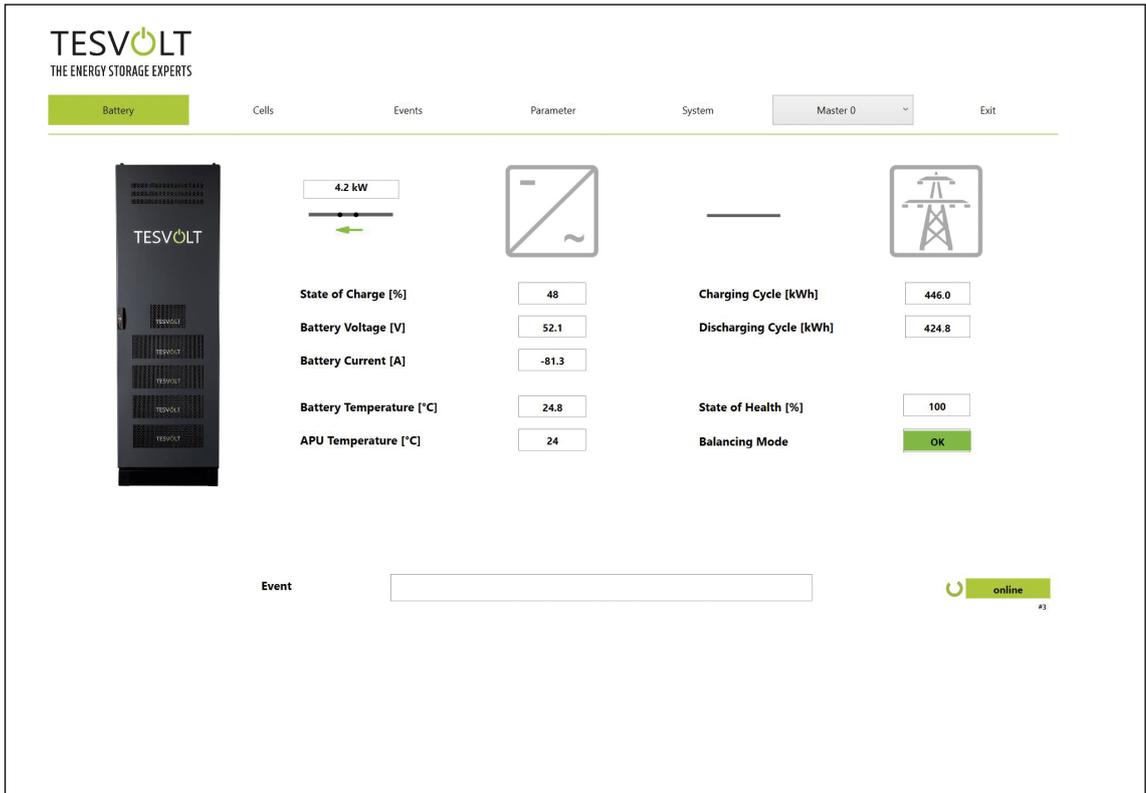


Figure 11.2 "Battery" screen

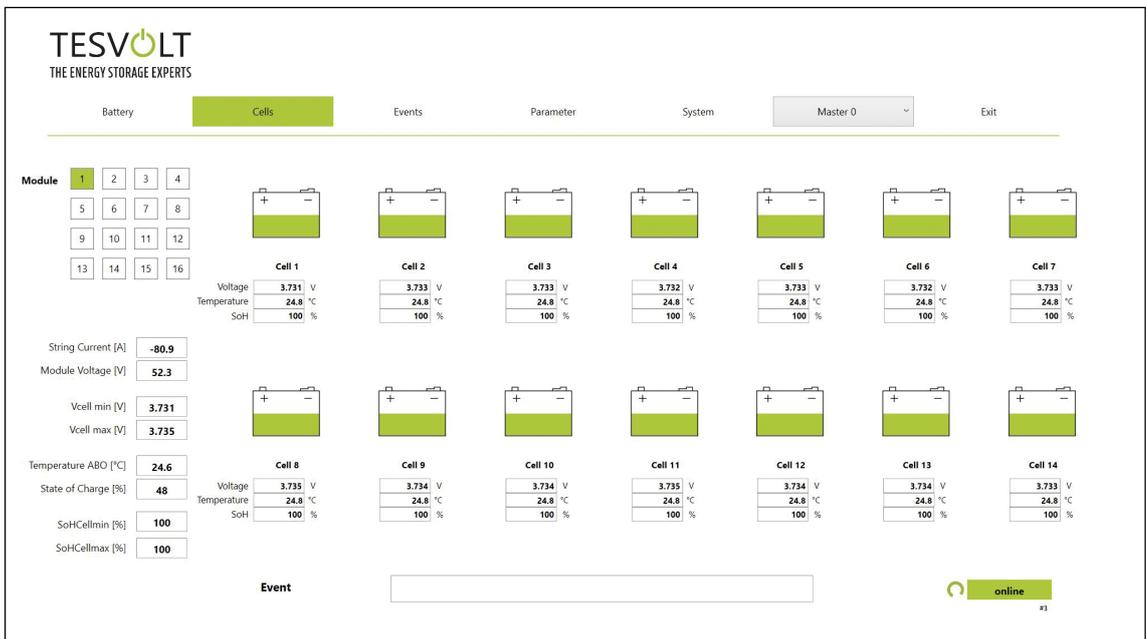


Figure 11.3 "Cells" screen

11.2 MENU STRUCTURE

The battery parameters highlighted in green in the table are password protected. Since these parameters directly affect the battery, they may only be configured by certified qualified specialists. You can obtain the password by directly requesting it from Service staff at TESVOLT GmbH.

BATTERY	CELLS	EVENTS	PARAMETER	SYSTEM	SELECTION
Charging/discharging power	Cell voltage	Event logbook	Battery parameters	Current errors	Master
Battery voltage	Cell temperature	Clear events	Load default	BatMon version	SLAVE
Charging/discharging current	SoC (cell)	Save events (as PDF)	Save default	Expert level	
Battery temperature	SoH (cell)		Reset APU	Start logging	
Balancing mode	Module voltage			Firmware download	
Charging cycle (kWh)	Charging/discharging power			Communication port	
Discharging cycle (kWh)	ABO temperature				
SoC (state of charge)					
SoH (state of health)					
Warning - time					
APU temperature					

Displayed data	Expert settings	Functions
	Only with password	

11.3 THE MOST IMPORTANT CELL PARAMETERS

SoC – state of charge

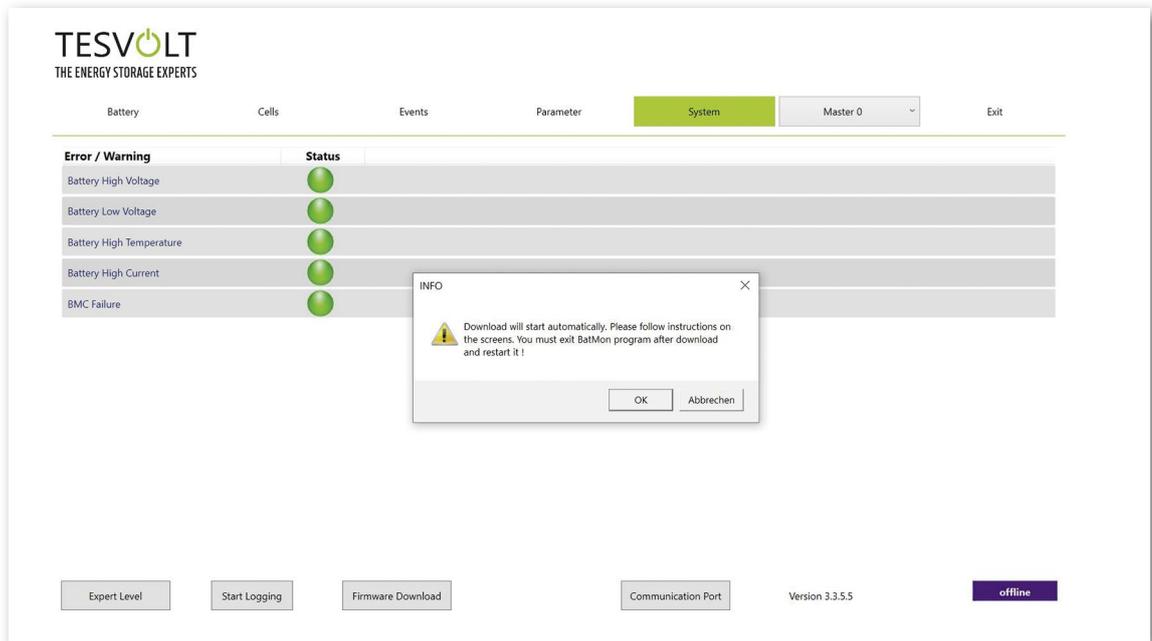
This value indicates the percentage that the battery has been charged to. 100% refers to a fully charged battery. The APU LV can use the parameters to determine the state of charge of a single cell or battery module, and to stop the charging process if necessary. This prevents overcharging. The software also has the same function for monitoring the discharge process to prevent unnecessary cell charging. Battery limit states define the points at which the system stops charging and discharging.

SoH – state of health

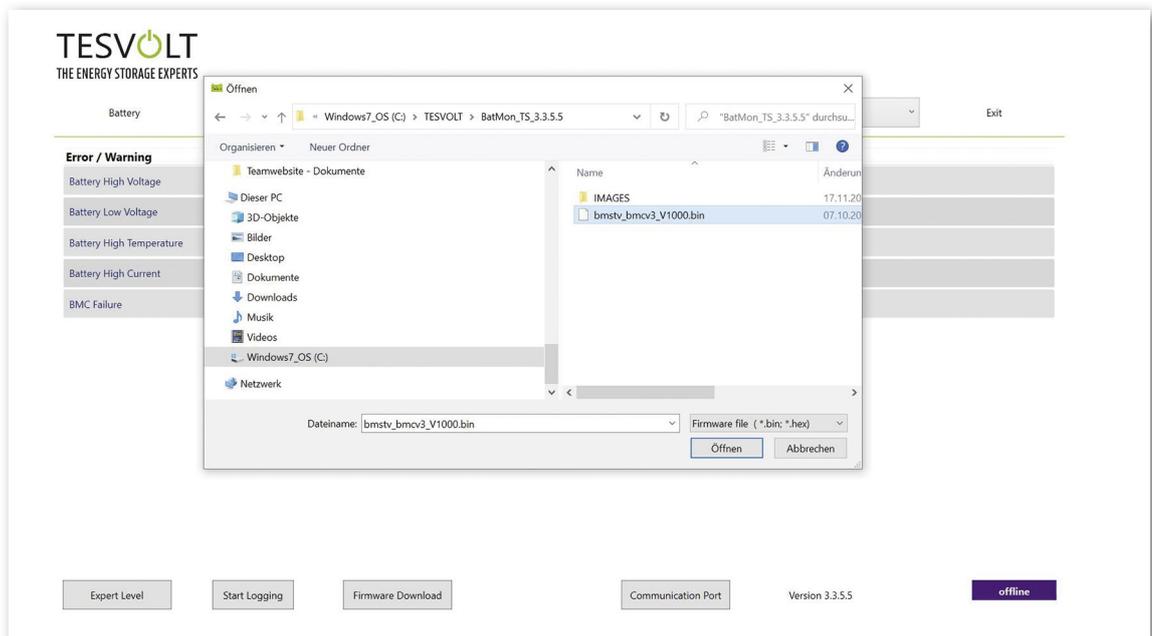
This value indicates a cell's health. Precise monitoring allows the system to detect performance differences between individual cells and thus detect damaged/defective cells.

12 FIRMWARE UPDATE

If required, the firmware update is installed via BatMon in coordination with TESVOLT Service. To do this, you have to enter the password in the Expert Level on the “System” page in BatMon. This can only be done in coordination with TESVOLT Service.



The latest firmware can then be downloaded with the “Firmware download” button on the “System” tab.



In the window that opens, select the firmware file (.bin) and confirm the selection by clicking on “Open”.

A screenshot of a Windows command prompt window. The title bar reads "C:\WINDOWS\system32\cmd.exe". The command prompt shows the following text:

```
C:\TESVOLT\BatMon_TS_3.3.5.5>echo off  
COM-Port: 0xFF  
IP-Addr: 192.168.50.161  
File-Name: ""  
running ETH update
```

Next, the update window opens. The update may take up to one minute. Afterwards, BatMon must be restarted.

13 FAULT AND WARNING MESSAGES ON THE TESVOLT TS 48 V

EVENT	DESCRIPTION	ACTION
-	Storage system does not start	Check the battery wiring (incorrect polarity or plugs do not contact correctly). Check that the 2 A APU Fuse microfuse (F1), which is located on the front right of the APU LV, is working; replace if necessary. Contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.
W920/W936 General	General battery fault	Restart the APU LV by pressing the On/Off switch. Check the parameter settings on the SMA Sunny Island.
F921/W937 - Battery high voltage	Overvoltage in one cell in the battery module	The active battery management system equalises the cell voltages. Battery overvoltage or undervoltage can indicate a faulty cell. If a limit voltage (undervoltage/overvoltage) occurs, the battery actively disconnects in a two-pole manner from the SMA Sunny Island by means of a DC relay. Contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.
F922/W938 Battery low voltage	Undervoltage in one cell in the battery module	
F923/W939 Battery high temperature	Upper temperature limit of a cell has been reached	Decommission the unit and let it cool down to at least 25°C. Check the wiring of the battery modules and the ventilation of the TS 48 V.
F924/W940 Battery low temperature	Lower temperature limit of a cell has not been met	Switch off the battery and increase the ambient temperature to at least 5°C.
F925/W941 Battery high temperature charge	Upper temperature limit has been reached when charging the battery	Switch off the battery and let it cool down to at least 25°C. Check the wiring of the battery modules.
F926/W942 Battery low temperature charge	Lower temperature limit has been reached when charging the battery	Switch off the battery and increase the ambient temperature to at least 5°C.
F927/W943 - Battery high current	Excessive current	Switch off the battery and check the battery parameters and the SMA Sunny Island parameters. Restart the battery.
F928/W944 Battery high current charge	Charging current too high when charging the battery	Switch off the battery and check the battery parameters and the SMA Sunny Island parameters. Restart the battery.
F929/W945 Switch contactor	Switch has reported a fault	Restart the battery.
F930 Short circuit	Peak current is too high	Decommission the TS 48 V and contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.
F932/W948 Cell imbalance	Cell voltages deviate too strongly from one another	Restart the battery. If the fault continues, check the cell voltages using the BatMon software and contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.
F972 Isolation fault	DC currents in the +/- cables differ	Check the grounding of the cabinet and the wiring. Also check the BAT-COM wiring and the CAN bus cables.
F973 Isolation test fault	The current sensor has a fault	Decommission the TS 48 V and contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.
E 201 IsoSPI connection time-out	ABO communication is faulty	Check the BAT-COM wiring.
E202 Master/slave communication fault	Communication between the APU LVs in the configuration is faulty	Check the CAN bus cables.
E203 BMC master/slave error	At least one APU LV has a fault	Check the addressing settings, the termination and the CAN bus cable. Also check the states of all APU LVs in the configuration. Restart the battery.
E205 Module mismatch	Master/slave configuration shows a different number of modules	Check the BAT-COM wiring. After this, start the systems individually and check the displayed number of modules in each case.
W301/F302 Board high/max. temp	Temperature exceeded on the BMC board	Switch off the APU LV and allow it to cool down.
W947 BMC internal	Internal fault in the controller	Restart the battery.



NOTE: For further assistance or in the event of persistent faults, please email service@tesvolt.com or contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.

14 MAINTENANCE



WARNING! Possible damage to the unit and/or battery inverter if it is not decommissioned properly

Before maintenance work is carried out, the TS 48V must be decommissioned in accordance with the procedures in section "9 Decommissioning", page 46.



NOTE:

When cleaning and maintaining the SMA Sunny Island, always follow the specifications and instructions in the technical documentation for the SMA Sunny Island.



NOTE:

The locally applicable regulations and standards must be followed for all maintenance work.

The TESVOLT USB-Stick contains the template of a maintenance log that you can use as an aid.

The lithium cells used by TESVOLT are low-maintenance. However, to ensure safe operation, all plug/screw connections on the electrical components should be inspected and, if necessary, returned to an operational condition by qualified specialists at least once a year.

The following checks or maintenance work must be carried out once a year:

- General visual inspection
- Check all screwed electrical connections; check the tightening torque with the values specified in the following table. Loose connections must be retightened to the specified torque.

CONNECTION	TIGHTENING TORQUE
APU LV connections / and /	12 Nm
Battery connections /	12 Nm
APU LV grounding	6 Nm
Central grounding point	8 Nm

- Check the SoC, SoH, cell voltages and temperatures of the battery modules for irregularities using the BatMon software.
- Switch the TS 48V off and on again once a year.



NOTE:

Take a screenshot of the "Battery" and "Cell" page of each battery, and archive them together with all events as a PDF.

If you would like to clean the battery cabinet, please use a dry cleaning cloth. Ensure that no moisture comes into contact with the battery connections. Do not use solvents of any kind.

15 DISPOSAL

TESVOLT battery modules installed in Germany are integrated into the free GRS collection system. Please contact TESVOLT Service Line +49 (0) 3491 87 97-200 or email service@tesvolt.com for more details.

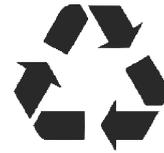
Please email service@tesvolt.com or contact the TESVOLT Service Line +49 (0) 3491 87 97-200. Further information can be found at <http://www.en.grs-batterien.de/index/>.

The batteries may only be disposed of in accordance with the disposal regulations for used batteries applicable at the time of disposal. Immediately decommission any damaged batteries and please contact your installer or sales partner first before disposal. Ensure that the battery is not subjected to moisture or direct sunlight. Ensure quick removal by your installer or TESVOLT.

1. Batteries, including rechargeable batteries, may not be disposed of in household waste. You are legally obligated to return used batteries.
2. Used batteries may contain pollutants that can damage the environment or harm your health if they are not stored or disposed of properly.
3. Batteries also contain important raw materials such as iron, zinc, manganese, copper, cobalt or nickel and can be recycled.

Further information can be found at <https://www.tesvolt.com/en/products/recycling.html>

Do not dispose of batteries in household waste!



16 LEGAL NOTICE

TESVOLT TS 48V Installation and Operating Manual

Last revised: 01/2021

We reserve the right to make technical changes.

TESVOLT GmbH

Am Heideberg 31

06886 Lutherstadt Wittenberg

Germany

TESVOLT Service Line +49 (0) 3491 8797-200

service@tesvolt.com

www.tesvolt.com

Legal note on the use of the contents

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