



SEW
EURODRIVE

Operating instructions



Power and Energy Solutions
Energy storage systems



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1 General information

1.1 Structure of the safety notes

1.1.1 Meaning of signal words

The following table shows the graduation and meaning of the signal words in the safety notes.

Signal word	Meaning	Consequences if not observed
⚠ DANGER	Imminent danger	Death or severe injuries
⚠ WARNING	Possibly dangerous situation	Death or severe injuries
⚠ CAUTION	Possibly dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the product or its environment

1.1.2 Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard
	Warning of dangerous electrical voltage
	Warning of electric arc

2 Safety notes

2.1 Target group

Specialist for mechanical work	Any mechanical work may be performed only by adequately qualified specialists. Specialists in the context of this documentation are persons who are familiar with the design, mechanical installation, troubleshooting, and maintenance of the product, and who possess the following qualifications: • Qualifications in the field of mechanics in accordance with the national regulations • Familiarity with this documentation
Specialist for electrotechnical work	Any electrotechnical work may be performed only by electrically skilled persons with a suitable education. Electrically skilled persons in the context of this documentation are persons who are familiar with electrical installation, startup, troubleshooting, and maintenance of the product, and who possess the following qualifications: • Qualifications in the field of electrical engineering in accordance with the national regulations • Familiarity with this documentation
Additional qualifications	In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation. The persons must have the express authorization of the company to operate, program, parameterize, label, and ground devices, systems, and circuits in accordance with the standards of safety technology.
Instructed persons	All work in the areas of transport, storage, installation, operation and waste disposal may only be carried out by persons who are trained and instructed appropriately. These instructions must enable the persons to carry out the required activities and work steps safely and in accordance with regulations.

2.2 Designated use

The energy storage system stores energy and provides it to the connected drive DC link. The energy storage system is designed for installation in electrical systems or machines. The systems are intended for mobile or stationary use. The energy storage system is only intended for operation with the devices of the MOVIDRIVE® modular inverter series in combination with an MDP92A or an MDE90A.

If the product is installed in electrical systems or machinery, startup is prohibited until it has been verified that the machine complies with local laws and regulations. For Europe, the Machinery Directive 2006/42/EU and the EMC Directive 2014/30/EU apply, for example. Observe EN 60204-1 (Safety of machinery – Electrical equipment of machines). The product meets the requirements stipulated in the Low Voltage Directive 2014/35/EU. The UL 508A standard is applied for the UL version.

The standards specified in the declaration of conformity apply to the product.

For the technical data and the specifications for the connection conditions, refer to the nameplate and the chapter "Technical data" in this documentation. Make sure to strictly follow the data and conditions.

Non-designated or improper use of the product may result in severe injury to persons and damage to property. The UL 508A standard is applied for the UL version.

2.3 Transport

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If the product is damaged, it must not be assembled, installed or started up.

Observe the following notes when transporting the device:

- Ensure that the product is not subject to mechanical impact.

If necessary, use suitable, sufficiently dimensioned handling equipment.

Observe the information on climatic conditions in chapter "Technical data" of the documentation.

Make sure that the energy storage units are discharged before transportation.

Make sure that the energy storage units are short-circuited during transportation.

2.4 Creating a safe working environment

2.4.1 Performing electrical work safely

Observe the following information to perform electrical work safely:

Electrical work may only be performed by an electrically skilled person or an electronically instructed person under the supervision of an electrically skilled person.

The fact that the operation or display elements are no longer illuminated does not indicate that the product has been disconnected from the supply system and no longer carries any voltage.

Dangerous voltage

When the system is switched on, dangerous voltages are present at all power connections as well as any cables and terminals that are connected. This even applies when the product is inhibited and the motor is in an idle state. Observe the following information to avoid the danger of electric shock:

- Do not touch any exposed live parts (e.g. male contacts, connectors, terminals).
- Ensure that the connection boxes are closed and screwed down before applying the supply voltage.
- Before applying the supply voltage, make sure that all of the required covers are mounted.
- Secure the output shaft against rotation when working without touch guard.

Danger due to electric arc

An electric arc may occur when plug-in connections are disconnected or connected while voltage is applied (e.g. connection between drive and control). In order to avoid damaging electrical components, observe the following information:

- Do not disconnect power connections during operation.
- Do not connect power connections during operation.
- Ensure that the product is de-energized before disconnecting and connecting the plug-in connections.

2.5 Installation/assembly

Ensure that the product is installed and cooled in accordance with the regulations in the documentation.

Protect the product from excessive mechanical strain. The product and its mounted components must not protrude into the path of persons or vehicles. Ensure that no components are deformed or no insulation spaces are modified, particularly during transportation. Electrical components must not be mechanically damaged or destroyed.

Observe the notes in chapter "Mechanical installation" (→  13) in the documentation.

2.6 Electrical installation

Ensure that all of the required covers are correctly attached after the electrical installation.

Make sure that preventive measures and protection devices comply with the applicable regulations (e.g. EN 60204-1 or EN 61800-5-1).

2.6.1 Required protective measures

Make sure that the product is properly connected to the ground connection and equip the system with equipotential bonding.

2.7 Protective separation

The product meets all requirements for protective separation of power and electronics connections in accordance with IEC 61800-5-1. The connected signal circuits must meet requirements according to SELV (**S**afety **E**xtra **L**ow **V**oltage) or PELV (**P**rotective **E**xtra **L**ow **V**oltage) to ensure protective separation. The installation must meet the requirements for protective separation.

In order to avoid exceeding the permitted contact voltages in SELV or PELV power circuits in the event of an error, continuous equipotential bonding is required in the vicinity of these power circuits. If this is not possible, other protective measures must be taken. These protective measures are described in IEC 61800-5-1.

2.8 Startup/operation

Do not deactivate monitoring and protection devices even for a test run.

When in doubt, switch off the device whenever changes occur in relation to normal operation (e.g. increased temperatures, noise, oscillation). Determine the cause of the fault and consult SEW-EURODRIVE, if necessary.

Where required, systems in which such devices are installed must be equipped with additional monitoring and protection devices in accordance with the respective applicable safety regulations, e.g. the law governing technical work equipment, accident prevention regulations, etc.

Additional protective measures may be required for applications with increased hazard potential. Be sure to check the effectiveness of the protection devices after every modification.

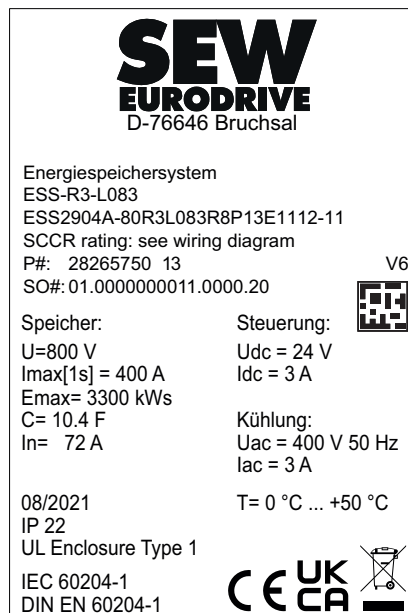
Observe the safety notes in chapters "Startup" (→  35) and "Operation" (→  36) in this documentation.

Never plug or unplug connectors while they are energized.

3 Device structure

3.1 Nameplate

The following image shows an example of a nameplate.



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3.2 Type designation

Example: ESS2904A-80R3L083R8P13E1311-11		
Product name	ESS....	ESS = energy storage system
Energy	2904	2904 = 2904 kW
Build status	A	A = Standard
Nominal voltage	80	80 = 800 V
Cabinet system	R	R = Rittal
Cabinet size (without base)	3	2 = 800 mm × 1600 mm × 570 mm 3 = 800 mm × 1800 mm × 570 mm 4 = 1600 mm × 800 mm × 765 mm 5 = 1800 mm × 800 mm × 765 mm 9 = Special
Module type	=	L = LS Materials
Module capacitance	083	041 = 41 F 083 = 83 F
Number of modules in series	R8	R8 = 8 modules (in series)
Number of modules in parallel	P1	P1 = 1 module (parallel)

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Example: ESS2904A-80R3L083R8P13E1311-11		
Language	3	1 = DE 2 = EN 3 = FR 4 = EN/FR (UL)
Communication	E	E = EtherCAT®
Temperature range	1	1 = Standard: 0 to +40 °C 2 = Broad temperature: -25 to +40 °C 3 = High temperature: 0 to +50 °C 4 = Low temperature: -30 to +10 °C
Color	3	3 = Gray, without logo 4 = Gray with SEW logo 5 = Orange, without logo 6 = Orange, with SEW logo
Connection configuration	11	0x = Without DC disconnecter 1x = With DC disconnecter x1 = Basic cabinet type x2 = Cabinet type extension
Version	11	1x = With base (100 mm) 2x = Without base 3x = With base – special 4x = With base – UL version x1 = Right-side door hinge x2 = Left-side door hinge

3.3 Markings

Mark	Definition
	The CE mark indicates compliance with the following European directives: • Low Voltage Directive 2014/35/EU • EMC Directive 2014/30/EU • Machinery Directive 2006/42/EC • Directive 2011/65/EU for limiting the use of certain hazardous substances in electrical and electronic equipment
	The UKCA mark states compliance with the following British guidelines: • Low Voltage Directive S. I. 2016/1101 • EMC S. I. 2016/1091 • Directive S. I. 2012/3032 for limiting the use of certain hazardous substances in electric and electronic equipment
	The waste disposal of this product is performed in compliance with the WEEE Directive 2012/19/EU.

4 Mechanical installation

4.1 Installation notes



⚠ WARNING

The energy storage units are still charged after the device has been switched off.

Severe or fatal injuries due to electric shock.

- ✓ The energy storage units must be discharged before you perform any work on the device.
- Only electrically skilled persons are permitted to discharge the energy storage unit and install the short circuit connector.



INFORMATION

Changes to the energy storage system are permissible only after asking and receiving written approval from SEW-EURODRIVE.

Violations will result in the invalidation of claims for liability for defects, warranty and guarantee claims.

4.2 Choosing the installation altitude

The energy storage system is connected to either an MDP92A power supply module or a MDE90A DC/DC-converter module. The distance between the energy storage system and the MDP92A/MDE90A must not exceed 30 m. This is based on the assumption that the connection cable between the energy storage system and MDP92A/MDE90A is a copper cable with a cross section of 35 mm². If it is not possible to meet this specification, please consult SEW-EURODRIVE.

4.3 Safe, clearance-free, and vibration-free fastening to the ground

Vertical installation

In order for the ESS system to be able to maintain its performance data as well as the IP degree of protection, vertical installation of the cabinet is required.

Accessibility

The front door of the ESS must be able to be opened completely for service work. A clearance of > 800 mm must therefore be provided in front of the energy storage cabinet.

Ventilation and venting

The air grilles in the device door must not be blocked. There must be nothing located within a radius of 30 cm in front of the grilles that hinders free airflow.

Operation at a high geographical altitude

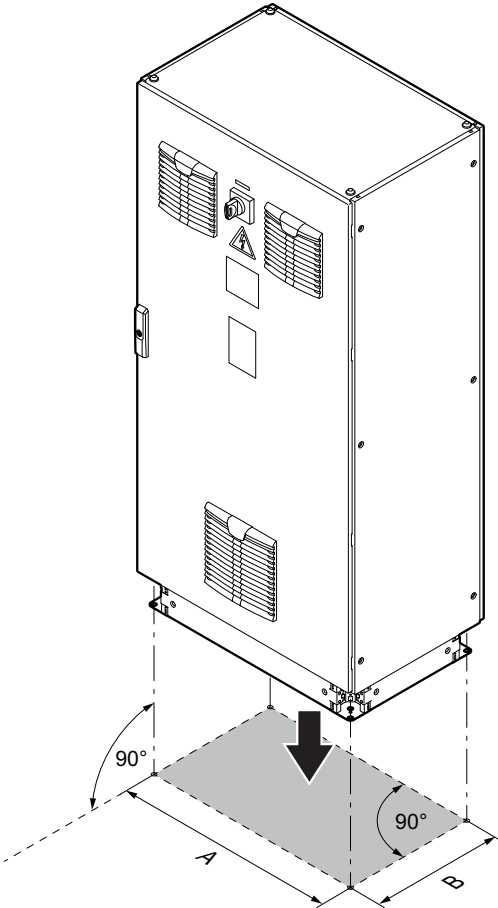
Installation of the cabinet at a geographical altitude of more than 2000 m above sea level can lead to decreased performance capability. Contact SEW-EURODRIVE Service.

Strain-relieved cables

All incoming and outgoing cables must be strain-relieved and laid without mechanical stress.

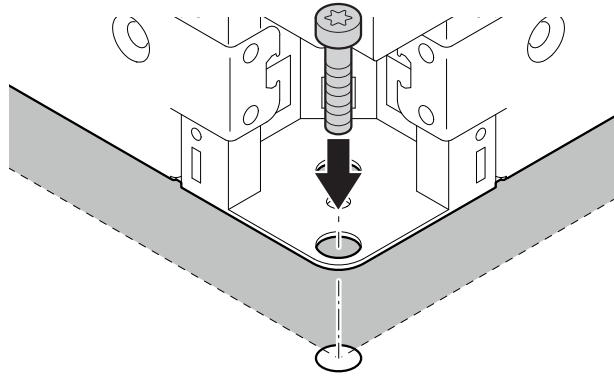
Base

The cabinet is supplied with a base that brings advantages for the running of cables depending on the application. Screw the base into the ground or fasten the cabinet securely to the wall. You can feed cables into the ESS-R2 and ESS-R3 storage systems in the base area from all four horizontal directions and directly from below. To do this, remove the corresponding sheet metal in the base or cut out the sheet metal.

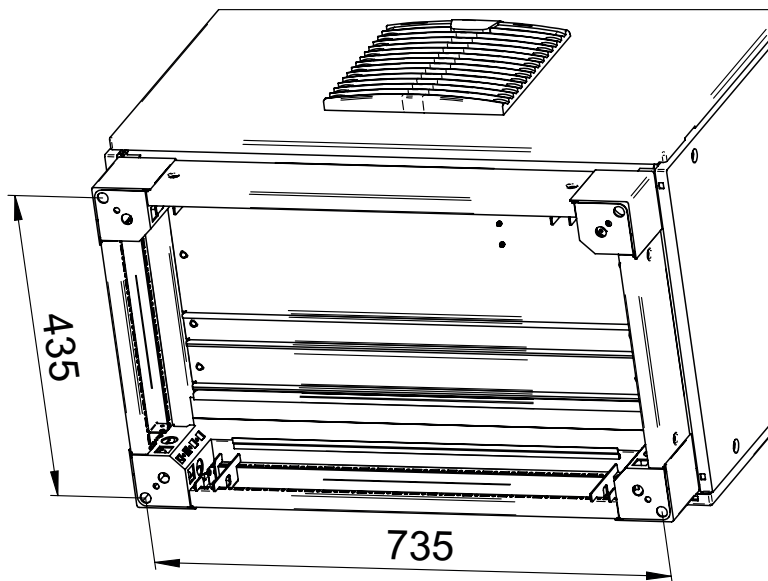


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Nominal size	A/B in mm
500	435
800	735



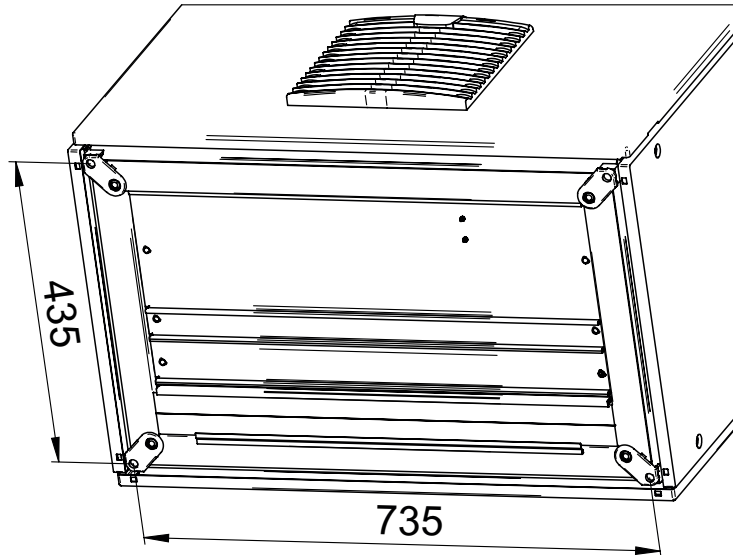
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Installation without base

The energy storage system can also be installed and operated without a base. It requires that all cables exit downwards unobstructed and using four M12 screws to fasten the energy storage system to the substructure with no vibration. The appropriate threads are on the bottom of the energy storage system. See next figure:

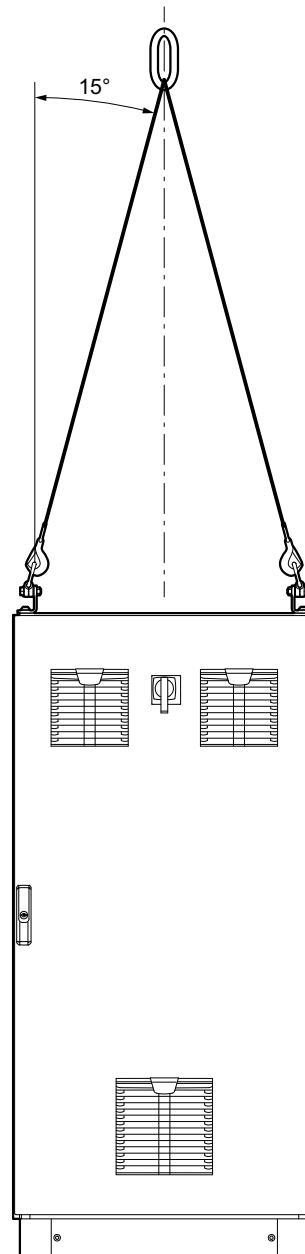


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Pierce through the spacer rings from the inside and screw the cabinet to the ground using four appropriate screws.

4.4 Double cabinet variant

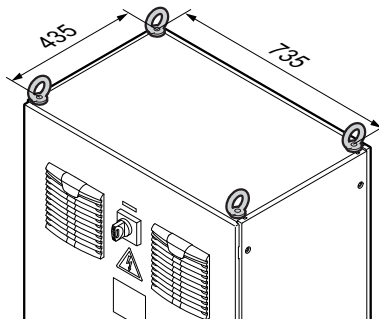
In addition to the points in chapter "7.2.1 Preventive measures against electrical hazards" (→ 19), the following is to be noted as well for the installation of the double cabinet. The double cabinet is equipped with two tabs on the top side that can make installation and transport easier. To do this, either a lifting beam and/or a rope or a chain with sufficient load bearing capacity is to be used. If a lifting beam is not used, both lines of the sling must be at least 3 m long so that an angle of inclination of approx. 15° results for both lines.



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4.5 Lifting eyes

The standard roof fastening screw can easily be replaced with a lifting eye for crane transport. Automatic equipotential bonding is preserved.



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Material	VE	Purchase order number
Galvanized steel C 15E	4 pcs.	4568.000
Stainless steel 1.4301 (AISI 304)	4 pcs.	4568.500

4.6 Permitted tightening torques

Screw connection		Tightening torques in Nm
Choke	L1	3.5 – 6
PE connection	PE	8

NOTICE

Failure to adhere to prescribed tightening torques.

Damage to the device.

- Always adhere to the stipulated tightening torques.

5 Electrical installation

5.1 Installation instructions



⚠ WARNING

The energy storage units are still charged after the device has been switched off.

Severe or fatal injuries due to electric shock.

- ✓ The energy storage units must be discharged before you perform any work on the device.
- Only electrically skilled persons are permitted to discharge the energy storage unit and install the short circuit connector.



INFORMATION

Changes to the energy storage system are permissible only after asking and receiving written approval from SEW-EURODRIVE.

Violations will result in the invalidation of claims for liability for defects, warranty and guarantee claims.

5.1.1 Preventive measures against electrical hazards



⚠ CAUTION

Risk of injury from arcing during a high-energy discharge (between two conductive metals).

Minor injuries.

- Make sure control cabinets are kept closed unless electrical components are de-energized.
- Disconnect any energy storage units such as accumulators from the electronics. Observe the measures for shutdown of the products used.
- Switch off other voltage sources.
- Before switching on the product, make sure that the protective cover is in place over the connections.
- Ensure that the product is insulated as far as possible and that no conductive foreign bodies can penetrate.



⚠ WARNING

Electric shock when connecting or disconnecting energized power connections.

Severe or fatal injuries.

- Switch off all supply voltages.
- Make sure that the devices of the system are de-energized.
- Never connect or disconnect the power connections while they are energized.
- Never disconnect the power connections if you do not know the actual state of charge of the energy storage unit.
- Discharge the energy storage units to less than 2 V before disconnecting them from the DC link.

5.1.2 Notes on PE connection

**▲ WARNING**

Electric shock due to high leakage current. A leakage current of $> 3.5 \text{ mA}$ may be generated in the energy storage system during operation.

Severe or fatal injuries.

- ✓ To avoid dangerous currents, observe the following information pursuant to standard EN 61800-5-1:
 - Supply system cable $< 10 \text{ mm}^2$:
 - Route a second PE conductor with the cable cross section of the supply system cable in parallel to the protective earth via separate terminals or use a copper PE conductor with a cable cross section of 10 mm^2 .
 - Supply system cable 10 mm^2 to 16 mm^2 :
 - Route a copper PE conductor with the cable cross section of the supply system cable.
 - Supply system cable 16 mm^2 to 35 mm^2 :
 - Route a copper PE conductor with a cable cross section of 16 mm^2 .
 - Supply system cable $> 35 \text{ mm}^2$:
 - Route a copper PE conductor with half the cross section of the supply system cable.

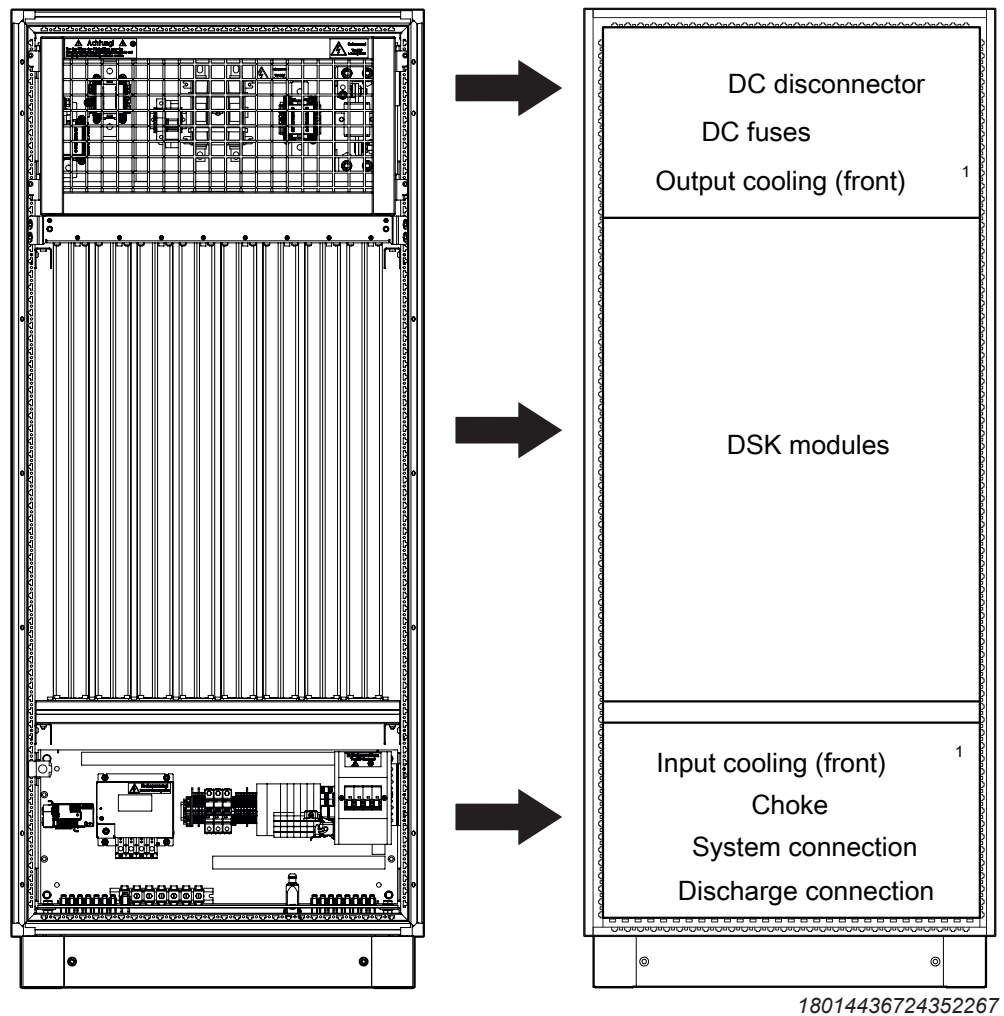
**INFORMATION**

The energy storage system is equipped with a short circuit connector in its delivery state. This prevents the charging of energy modules. Maintain this short circuit during the electrical installation in order to ensure safe working conditions. With the double cabinet variant, the expansion cabinet is also short-circuited via the short circuit connector contained in the basic cabinet. After completing the installation, the short circuit connector must be removed before startup.

The installation location must be selected in such a way that the shortest possible electrical connection between the MDP92A or MDE90A devices and the energy storage unit can be realized.

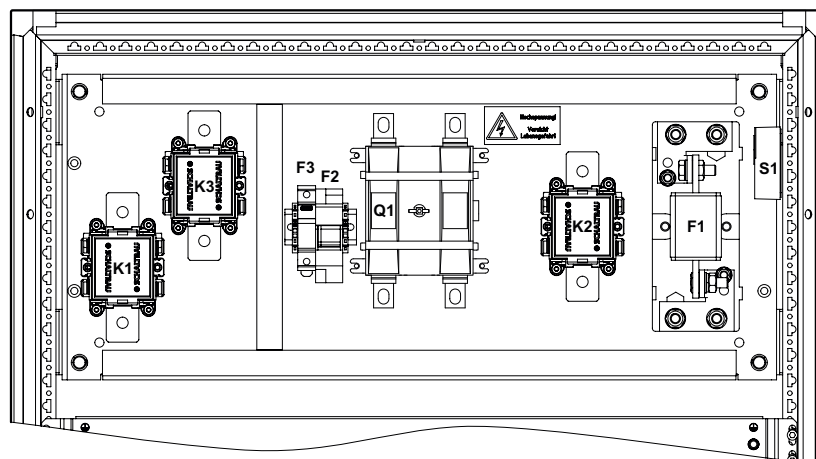
5.2 An overview of the energy storage system

An energy storage system and its breakdown are shown below.



¹ Does not apply to the low-temperature variant.

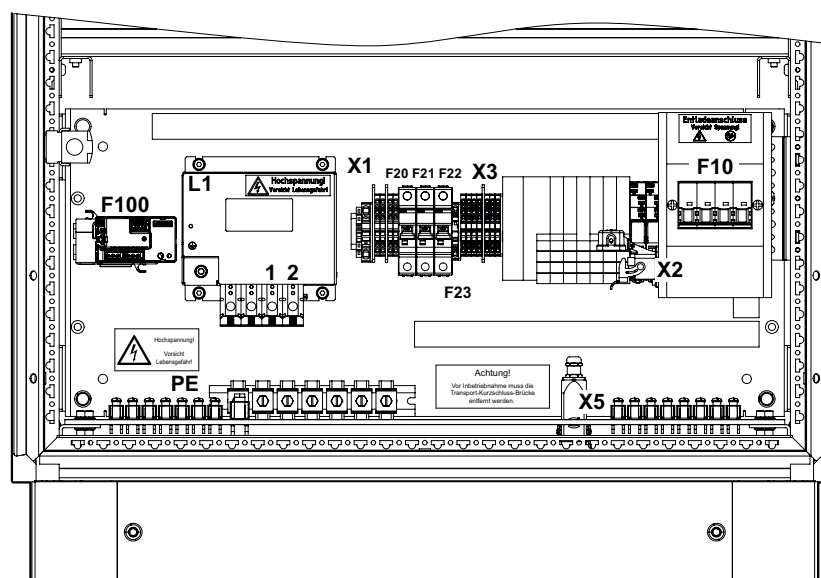
5.2.1 Top mounting area



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- [K1] Synchronization contactor negative path
- [K3] Synchronization contactor positive path
- [F2] Subfuse
- [F3] Measuring channel fuse
- [Q1] Disconnecter
- [K2] Bypass contactor
- [F1] Main fuse
- [S1] Thermostat

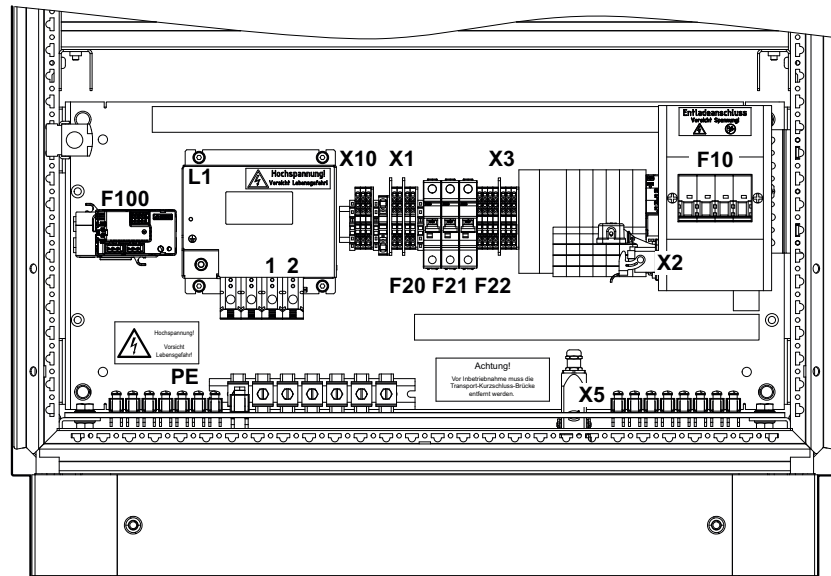
5.2.2 Bottom mounting area, standard variant



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- | | | | |
|--------|--------------------------|-------|---------------------------|
| [F100] | MRCD | [F22] | 24 V fuse |
| [L1] | DC link choke | [F23] | Fan fuse |
| [L1:1] | +UZ | [X3] | Internal 24 V distributor |
| [L1:2] | -UZ | [F10] | Discharge fuse |
| [X1] | Connection block control | [X2] | Discharge connection |
| [F20] | 24 V fuse | [X5] | Short-circuit connector |
| [F21] | 24 V fuse | [PE] | PE connection |

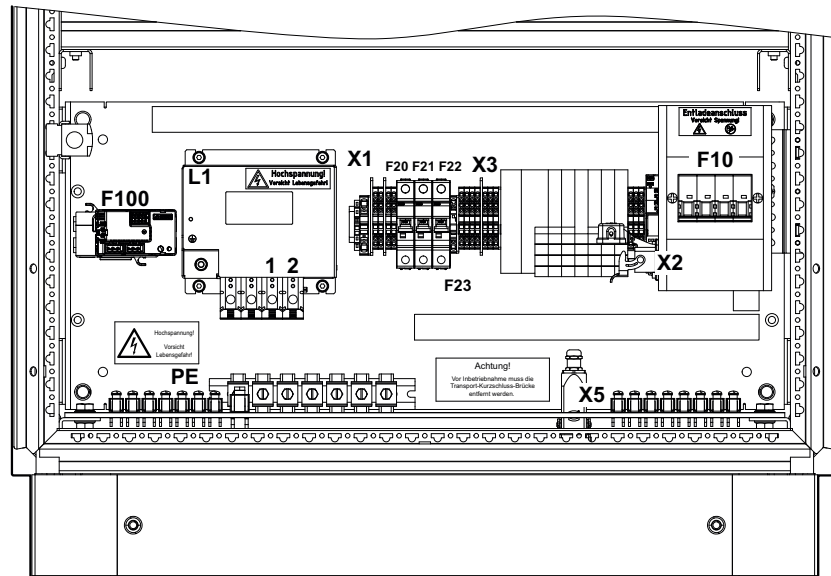
5.2.3 Bottom mounting area, high temperature variant



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[F100]	MRCD	[F21]	Fuse 24 V
[L1]	DC link choke	[F22]	Fuse 24 V
[L1:1]	+UZ	[X3]	Internal 24 V distributor
[L1:2]	-UZ	[F10]	Discharge fuse
[X10]	AC power supply for cooling unit	[X2]	Discharge connection
[X1]	Connection block control	[X5]	Short-circuit connector
[F20]	Fuse 24 V	[PE]	PE connection

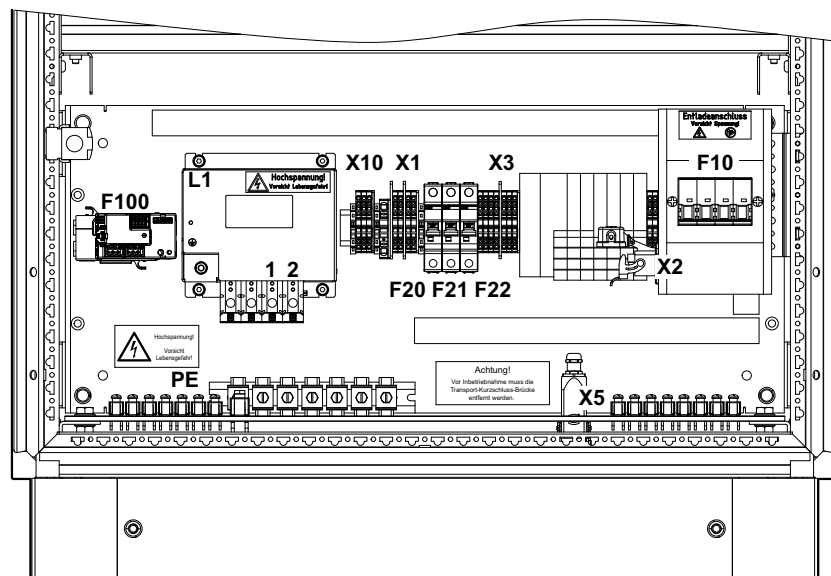
5.2.4 Bottom mounting area, broad temperature variant



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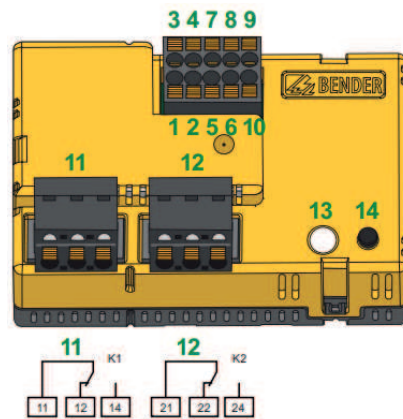
[F100]	MRCD	[F22]	24 V fuse
[L1]	DC link choke	[F23]	Fan fuse
[L1:1]	+U _z	[X3]	Internal 24 V distributor
[L1:2]	-U _z	[F10]	Discharge fuse
[X1]	Connection block control	[X2]	Discharge connection
[F20]	24 V fuse	[X5]	Short-circuit connector
[F21]	24 V fuse	[PE]	PE connection

5.2.5 Bottom mounting area, low temperature variant



[F100]	MRCD	[F21]	Fuse 24 V
[L1]	DC link choke	[F22]	Fuse 24 V
[L1:1]	+U _z	[X3]	Internal 24 V distributor
[L1:2]	-U _z	[F10]	Discharge fuse
[X10]	AC power supply for heater	[X2]	Discharge connection
[X1]	Connection block control	[X5]	Short-circuit connector
[F20]	Fuse 24 V	[PE]	PE connection

5.2.6 Detailed view of modular residual current device (MRCD)



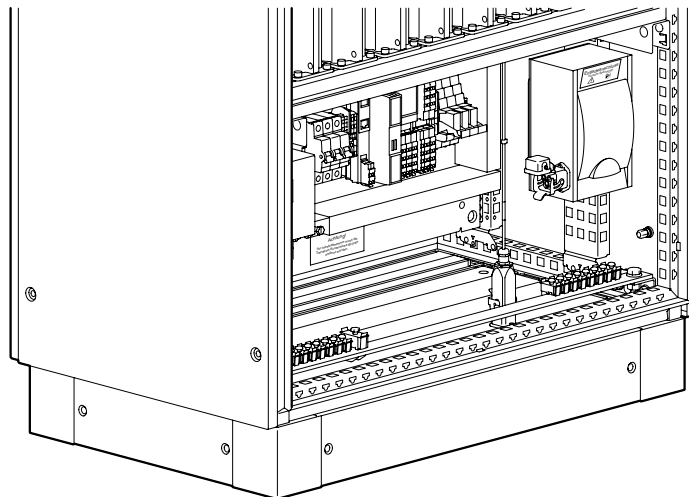
No.	Terminal	Meaning
1	24 V	Supply voltage U_s
2	GND	
3	D1	Contact feedback
4	DG	
5	T/R	Connection external test/reset
6	GND	
7	A	RS-485 interface
8	B	
9	X1	Terminals for cable bridge for connection of the integrated terminating resistor of the RS-485 interface
10	X2	
11	11, 12, 14	Relay K1 (prewarning)
12	21, 22, 24	Relay K2 (alarm)
13	–	LED: operation "ON" and "Alarm"
14	–	Test and reset button "T"

Source: Operating instructions for the MRCDB300 series, Bender, Version 08/2021, Page 19

5.2.7 Discharge connection

For the safe discharging of the energy storage units, the ESS energy storage systems have a discharge connection in the lower right area of the control cabinet. The connection is prepared for the safe connecting of the EKD discharge unit (SEW-EURODRIVE part number 28265610).

After you have discharged the energy storage unit, remove the discharge unit. Replace it with the short circuit connector instead. This will prevent the reaccumulation of storage voltage and will enable safe working conditions for the system.



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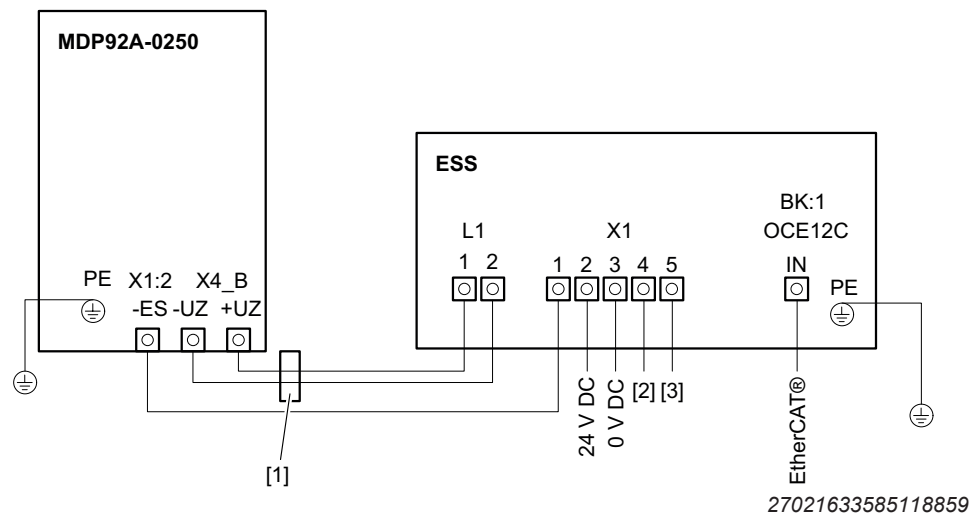
5.2.8 Door position switch

The energy storage system is equipped with a door position switch that can be evaluated via terminals X1:4 and X1:5. If necessary, apply 24 V voltage to these terminals.

The signal of the door position switch can optionally be used to perform a customer-specific evaluation to determine whether the door of the energy storage system is open or closed. In the standard case, the signal is not evaluated.

5.3 Connecting the MDP92A-0250 power supply module to the energy storage system

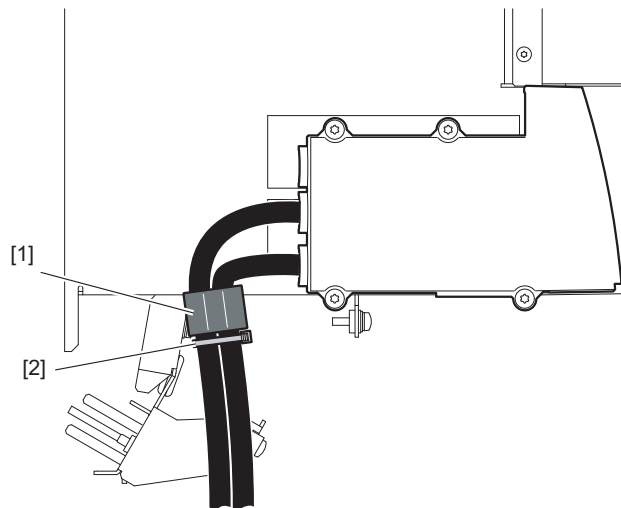
- ✓ Make sure that the requirements from chapter "Discharging energy storage units before service work" are implemented.
- 1. Make the PE connection with a cable cross section of at least 16 mm² directly at the PE ground busbar.
- 2. Connect the terminal X4_B: +U_Z of the MDP92A-0250 device to an appropriate single-core cable with double insulation, e.g. single 600-O VDE V₀/V 600/1000 V with a cable cross section of 35 mm² with the DC choke L1 terminal 1. Observe the regulations for using a ferrite sleeve in the MOVIDRIVE® modular operating instructions.
- 3. Connect the terminal X4_B: -U_Z of the MDP92A-0250 device to an appropriate single-core cable with double insulation, e.g. single 600-O VDE V₀/V 600/1000 V with a cable cross section of 35 mm² with the DC choke L1 terminal 2. Observe the regulations for using a ferrite sleeve in the MOVIDRIVE® modular operating instructions.
- 4. Lay an appropriate single-core cable with double insulation with a cross section of 1.5 mm² to 6.0 mm² between the X1:2 (-ES) connection on the MDP92A-0250 and terminal X1:1 (ES-) of the energy storage system.
- 5. Lay a control cable for DC 24 V supply to connection X1:2 (DC 24 V) and X1:3 (DC 0 V). Match the cross section of this cable to the fusing.
- 6. Connect the last existing station to the "IN" input of the BK1 bus coupler. Use the 5-meter cable with the part number 18179983, or alternatively the 10-meter cable with the part number 18179991.



- [1] Ferrite sleeve
 [2] Door position switch X1:4
 [3] Door position switch X1:5

5.4 Connecting the MDP92A-0100 power supply module to the energy storage system

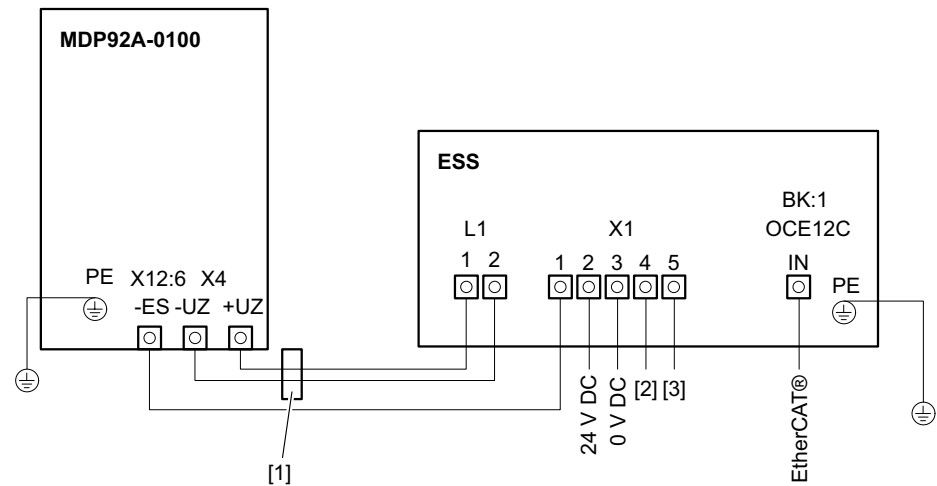
- ✓ Make sure that the requirements from chapter "Discharging energy storage units before service work" are implemented.
- 1. Make the PE connection with a cable cross section of at least 16 mm² directly at the PE ground busbar.
- 2. Connect terminal X4: +U_Z of the MDP92A-0100 device to an appropriate single-core cable with double insulation, e.g. single 600-O VDE V0/V 600/1000 V with a cable cross section of 35 mm² with the DC choke L1 terminal 1. To do so, use the connection set with part number 28261666, which is used for two-row setup. Attach a ferrite sleeve. The ferrite sleeve must be ordered separately (part number 25665308). The ferrite sleeve enclosed to the devices is not suitable for this purpose. In the same way, connect terminal X4: -U_Z of the MDP92A-0100 device to an appropriate single-core cable with double insulation, e.g. single 600-O VDE V0/V 600/1000 V with a cable cross section of 35 mm² with the DC choke L1 terminal 2.



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- [1] Ferrite sleeve
- [2] Cable tie for securing the ferrite sleeve to the sheet metal

- 3. Lay an appropriate single-core cable with double insulation with a cross section of 1.5 mm² to 6.0 mm² between the X12:6 (-ES) connection on the MDP92A-0100 and terminal X1:1 (ES-) of the energy storage system.
- 4. Lay a control cable for DC 24 V supply to connection X1:2 (DC 24 V) and X1:3 (DC 0 V). Match the cross section of this cable to the fusing.
- 5. Connect the last existing station to the "IN" input of the BK1 bus coupler. Use the 5-meter cable with the part number 18179983, or alternatively the 10-meter cable with the part number 18179991.



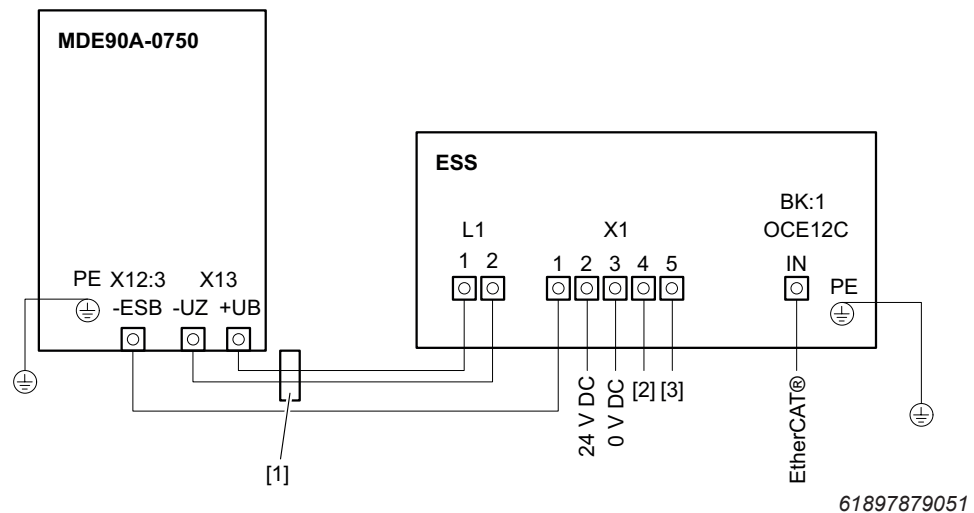
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- [1] Ferrite sleeve
- [2] Door position switch X1:4
- [3] Door position switch X1:5

5.5 Connecting the MDE90A-0750 DC/DC converter module to the energy storage system

- ✓ Make sure that the requirements from chapter "Discharging energy storage units before service work" are implemented.
- 1. Make the PE connection with a cable cross section of at least 16 mm² directly at the PE ground busbar.
- 2. Connect terminal X13: +U_B of the MDE90A-0750 device to an appropriate single-core cable with double insulation, e.g. single 600-O VDE V0/V 600/1000 V with a cable cross section of 35 mm² with the DC choke L1 terminal 1. Observe the regulations for using a ferrite sleeve in the MOVIDRIVE® modular operating instructions.
- 3. Connect the terminal X13: -UZ of the MDE90A-0750 device to an appropriate single-core cable with double insulation. E.g. single 600-O VDE V0/V 600/1000 V with a cable cross section of 35 mm² with the DC choke L1 terminal 2. Observe the regulations for using a ferrite sleeve in the MOVIDRIVE® modular operating instructions.
- 4. Lay an appropriate single-core cable with double insulation with a cross section of 1.5 mm² to 6.0 mm² between the X12:3 (-ESB) connection on the MDE90A-0750 and terminal X1:1 (ES-) of the energy storage system.
- 5. Connect a control cable for DC 24 V supply to connection X1:2 (DC 24 V) and X1:3 (DC 0 V). Match the cross section of this cable to the fusing.
- 6. Connect the last existing station to the "IN" input of the BK1 bus coupler. Use the 5-meter cable with the part number 18179983, or alternatively the 10-meter cable with the part number 18179991.

For the double cabinet variant, perform all of the connections to the basic cabinet specified above. You do not need any connections to the expansion cabinet.



- [1] Ferrite sleeve
- [2] Door position switch X1:4
- [3] Door position switch X1:5

5.6 Connecting the MDE90A-0200 DC/DC converter module to the energy storage system

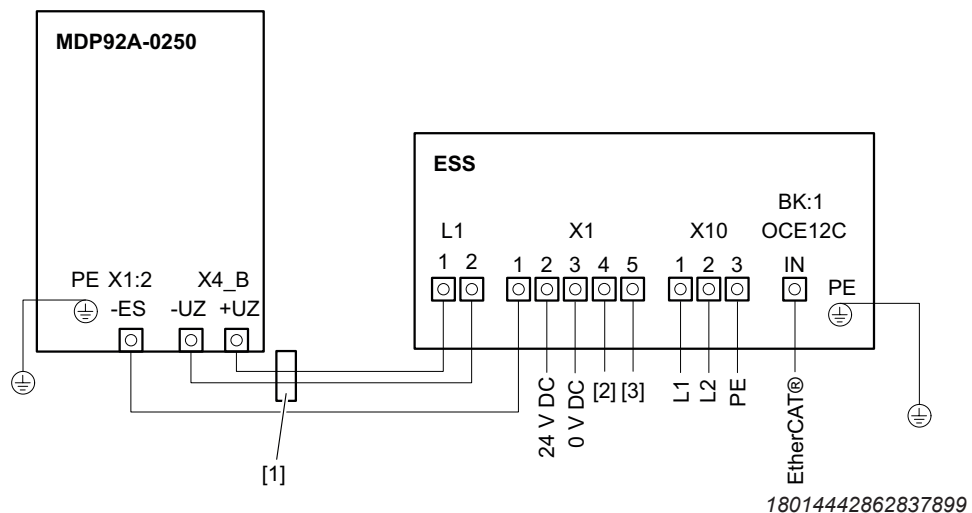
If you have any questions, contact the SEW-EURODRIVE. Service.

5.7 Terminal assignment

Terminal	Connection	Brief description
L1:1	+U _z	DC link connection
L1:2	-U _z	
X1:1	-ES	Measurement connection negative pole balancing
X1:2	24V _{in}	24 V supply
X1:3	0V _{in}	
X1:4	Normally open	Door position switch (NO contact)
X1:5		
BK:1 IN	EtherCAT®	System bus
PE	PE	PE connection

5.8 Connecting the ESS high temperature variant

- ✓ For the high temperature variant, you need to additionally connect a power supply for the cooling unit.
- 1. Install a miniature circuit breaker in accordance with the cooling unit manufacturer's specifications.
- 2. Install a cable for connecting the cooling unit. Match the cross section of this cable to the miniature circuit breaker.



- [1] Ferrite sleeve
 [2] Door position switch X1:4
 [3] Door position switch X1:5

5.8.1 Terminal assignment for high temperature variant

⚠ WARNING



Electric shock due to a faulty or missing connection of the miniature circuit breaker for the cooling unit, see "Other applicable documentation".

Severe or fatal injuries.

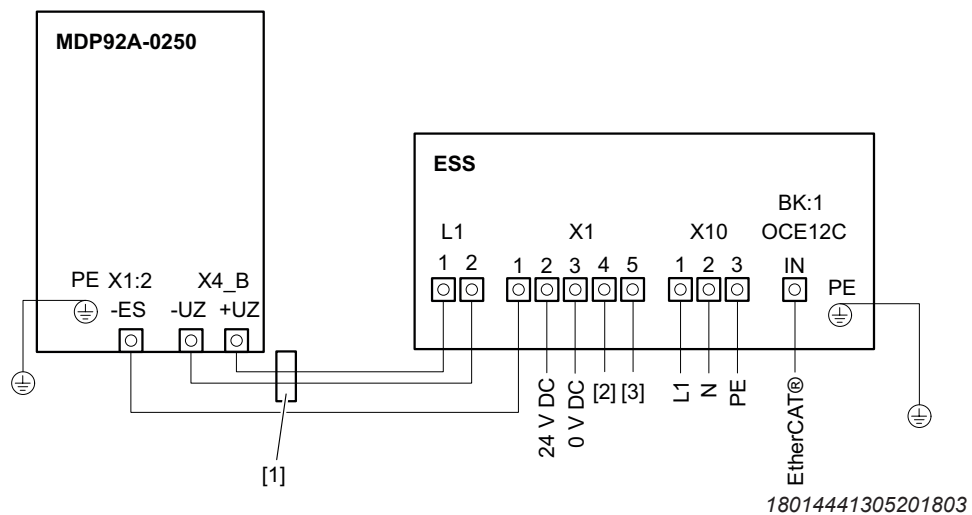
- Connect the energy storage system to a circuit breaker
- Check if the circuit breaker is properly installed.

Terminal	Connection	Brief description
L1:1	+U _z	DC link connection
L1:2	-U _z	
X1:1	-ES	Measurement connection negative pole balancing
X1:2	24V_in	24 V supply
X1:3	0V_in	
X1:4	Normally open	Door position switch (NO contact)
X1:5		

Terminal	Connection	Brief description
X10:1	L1	AC power supply for cooling unit External, AC 380 – 480 V 2ph
X10:2	L2	
X10:3	PE	
BK:1 IN	EtherCAT®	System bus
PE	PE	PE connection

5.9 Connecting the ESS low temperature variant

- ✓ For the low temperature variant, you need to additionally connect a power supply for the heater.
- 1. Install an external back-up fuse according to the heater manufacturer's specifications.
- 2. Install a cable for connecting the heater. Match the cross section of this cable to the back-up fuse.



- [1] Ferrite sleeve
[2] Door position switch X1:4
[3] Door position switch X1:5

5.9.1 Terminal assignment for low temperature variant

⚠ WARNING



Electric shock due to a faulty or missing connection of the miniature circuit breaker for the cooling unit, see "Other applicable documentation".

Severe or fatal injuries.

- Connect the energy storage system to a circuit breaker
- Check if the circuit breaker is properly installed.

Terminal	Connection	Brief description
L1:1	+U _z	DC link connection
L1:2	-U _z	
X1:1	-ES	Measurement connection negative pole balancing
X1:2	24V_in	24 V supply
X1:3	0V_in	
X1:4	Normally open	Door position switch (NO contact)
X1:5		
X10:1	L1	AC power supply for heater External, AC 230 V 1ph (CE)/AC 115 V 1ph (UL)
X10:2	N	
X10:3	PE	
BK:1 IN	EtherCAT®	System bus
PE	PE	PE connection

6 Startup

6.1 Startup of the MOVIKIT® modules



⚠ WARNING

Fire hazard due to failure to respond to a fault.

Severe or fatal injuries.

- Make sure that the diagnostic signals supplied by the energy storage system can be evaluated at all times. Use the "Storage unit monitoring" function of the MOVIKIT® software modules for this purpose. For further information, refer to the MOVIKIT® manuals.

During startup, settings must be adjusted in the PowerMode or EnergyMode software module. Adjust the following settings:

- Storage unit monitoring
- Storage unit synchronization/disconnection
- Control of the multi-fuse concept

In addition, optionally adjust settings if a discharge option via a braking resistor is provided.

For further information about programming, refer to the corresponding MOVIKIT® manual.

6.2 Startup of energy storage units

If energy storage units are used, SEW-EURODRIVE creates a list of parameters during project planning that must be set during startup. Use the import function in MOVISUITE® under the "Data exchange" menu item for this purpose.

7 Operation

7.1 Monitoring the energy storage systems



⚠ WARNING

Fire hazard due to failure to respond to a fault.

Severe or fatal injuries.

- Make sure that the diagnostic signals supplied by the energy storage system can be evaluated at all times. Use the "Storage unit monitoring" function of the MOVIKIT® software modules for this purpose. For further information, refer to the MOVIKIT® manuals.

The installed LS Materials energy storage units can be connected to the control system via a bus coupler from SEW-EURODRIVE. To do so, the bus coupler must be added manually in the IEC Editor and the corresponding terminals with their variables must be connected via the "Storage Monitoring" function in the MOVIKIT® Power and Energy Solutions module. For further information, refer to the MOVIKIT® manuals. The MOVIKIT® software module (PowerMode or EnergyMode) then takes over monitoring of the storage unit. If necessary, the MOVIKIT® software module automatically disconnects the energy storage unit from the DC link and issues a corresponding fault message.

7.2 Signal analysis

Each module of the energy storage unit provides the following signals that can be analyzed by the SEW-PLC:

- Module temperature
- Module overvoltage

The MOVIKIT® Power and Energy Solutions modules analyze these two measurements for each module and, also with the aid of the data sheet values, also additionally calculate the following values per module, which are then provided to the IEC programmer:

- Modular temperature fault ($T < -40\text{ °C}$)
- Modular temperature fault ($T > 65\text{ °C}$)
- Modular temperature warning ($T > 60\text{ °C}$)

In addition, a door position switch is available that can be evaluated via terminals X1:4 and X1:5. A 24 V voltage may be applied to these terminals.

The signal of the door position switch can optionally be used to perform a customer-specific evaluation of whether the door of the energy storage system is open or closed. In the standard case, the signal is not evaluated.

7.3 Disconnecting energy storage units



⚠ WARNING

Electric shock when connecting or disconnecting energized power connections.

Severe or fatal injuries.

- Switch off all supply voltages.
- Make sure that the devices of the system are de-energized.
- Never connect or disconnect the power connections while they are energized.
- Never disconnect the power connections if you do not know the actual state of charge of the energy storage unit.
- Discharge the energy storage units to less than 2 V before disconnecting them from the DC link.

The energy storage unit may only be disconnected after it has been discharged to less than 2 volts. Due to the physical properties of the storage cells used, the energy storage units can re-establish voltage after discharging. Therefore, short-circuit the discharged energy storage units. Observe the specifications in chapter "Discharging energy storage units before service work" for this purpose.

7.4 Disconnecting the system from the grid



⚠ WARNING

Ineffective disconnection from the grid due to charged storage units.

Severe or fatal injuries.

- Disconnect all supply voltages.
- Make sure that the devices of the system are de-energized.
- Discharge the energy storage units using a braking resistor or a discharge unit from SEW-EURODRIVE.
- Short-circuit the energy storage units after discharging.

Disconnecting the system from the grid does not necessarily lead to a safe state. The energy storage units must therefore be discharged and shorted before you perform any work on the system. Observe the specifications in chapter "Discharging energy storage units before service work" for this purpose.

7.5 Modular residual current device

The energy storage system is equipped with a modular residual current device (MRCD).

7.5.1 Functional test of the modular residual current device

Test the functionality of the modular residual current device on a regular basis. The required test intervals for compliance with the requirements of DGUV V3 are to be set individually depending on the respective hazard assessment.

The MOVIKIT® PowerMode and EnergyMode software modules automatically test the functionality every time the energy storage unit is synchronized and switched on. If the storage unit is not disconnected and switched on again for a predefined period of 1 to 365 days, the system issues a warning. In such a case, actively initiate the test by disconnecting the storage unit and switching it on again.

You can set the predefined period via the MOVIKIT® software module. The default setting is 180 days. Alternatively, you can also initiate the test manually on the MRCD. To do so, press the test button "T" for 5 to 10 seconds. Independently of the regular tests, also perform the test after maintenance and repair work has been carried out.

7.5.2 Required settings

The MOVIKIT® PowerMode or EnergyMode software module continuously processes the signals of the modular residual current device. A warning or an error is output depending on the strength of the fault current. An error will also trigger the disconnection of the energy storage unit. To ensure this monitoring function, adjust the corresponding settings in the MOVIKIT® software modules as well as in the higher-level controller.

7.5.3 Procedure in the event of a short circuit or ground fault

If a short circuit or ground fault occurs in the system, after discharging, short-circuit the energy storage unit according to the regulations in chapter "Discharging energy storage units before service work". Identify and then eliminate the cause of the fault.

Check all components for damage and wear before continuing operation. This also includes fuses and contactors.

7.5.4 System states of the modular residual current device

You can identify the current state of the modular residual current device via a combined red/green LED on the MRCD. The following table below shows the meaning of the states. Refer to the manufacturer's documentation for more information.

The LED indicates the system state by means of colours and lighting/flashing. The changeover contacts of the relay outputs K1 and K2 have defined switching positions for each system state.

System state	GREEN LED ON	RED LED Alarm	Notes	Relay K1	Relay K2
Device switched off	off	off	Device is de-energised, no monitoring, no monitoring function.	de-energised	de-energised
Normal operating state	lights	off	The device is supplied with the specified voltage and monitors the primary circuit. No residual current flows which would lead to tripping.	energised	energised
Prewarning	lights	flashes briefly	The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the prewarning.	de-energised	energised
Alarm state	off	lights	The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the alarm.	de-energised	de-energised
Device error	off	flashes slowly	The device is supplied with the specified voltage and monitors the primary circuit. An error is detected by the periodic self tests.	de-energised	de-energised

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Source: Operating instructions for the MRCDB300 series, Bender, Version 08/2021, Page 51

7.6 Setpoint temperature setting for high temperature variant

The optionally installed cooler is factory configured for a setpoint temperature of 35 °C. Do not adjust the setpoint temperature.

In case of an error, you will see the corresponding error code on the cooling unit's display. Please observe the information in the cooling unit's operating manual for how to proceed if there is an error.

INFORMATION



A cooling unit failure may result in a temperature warning or a temperature error by the DSK modules' temperature sensors.

7.7 Procedure in the event of a fuse tripping

If a fuse in the energy storage system has been tripped, do not replace the fuse while the storage unit is charged. Disconnect the system from the grid and discharge the energy storage unit. Only electrically skilled persons are permitted to discharge the energy storage unit and install the short circuit connector. For further information, see chapter "Safe state" (→ 42).

If the main fuse must be replaced after it has been tripped, also check the subfuse.

If a fuse has been tripped, check all current-carrying parts and replace these parts in the event of damage. If an overload occurs with other disconnecting components, e.g. contactor, thermal circuit breaker, etc., replace the entire component.

INFORMATION



Only use the fuses configured by SEW-EURODRIVE.

7.7.1 Indicator for UL variant

In the UL variant, the discharge connection fuse F10 is equipped with an indicator. This indicates via a red light that the fuse has tripped. However, the indicator can only indicate a tripped fuse if a voltage of > 350 V is present and if a load is connected on the output side.

7.8 Power-on for the low temperature variant

If the energy storage unit is at its minimum ambient temperature (-30 °C) for longer periods of time, then please allow for a 30-minute heat-up phase before power on. During this time, the internal temperature of the energy storage system will be pre-heated using the integrated heater. Do not place the energy storage system under load before the pre-heating phase is finished.

7.9 Useful life

The storage units are subject to aging due to environmental effects and operating conditions. This leads to a decrease in the useful capacitance and an increase in the equivalent series resistance of the storage units.

This means that the storage units have a limited useful life. The end of the useful life is defined as the point in time when one or both of the following cases occur:

- The capacitance of the energy modules is reduced by 20%.
- The equivalent series resistance of the energy modules has increased by 100%.

INFORMATION



During project planning, the energy storage units must be dimensioned in such a way that they meet the requirements even at the end of their useful life.

Therefore, have project planning carried out by SEW-EURODRIVE that is specific for the application. This also enables an estimation of the useful life.



⚠ WARNING

Fire hazard from absent fault response.

Severe or fatal injuries.

- After the useful life has been reached, the memory modules must be replaced. Otherwise, in the event of a fault, it can no longer be ensured under all conditions that the fuse will trip.

8 Service

8.1 Points to observe before service work



⚠ WARNING

Ineffective DC disconnection in the event of a storage unit fault.

Severe or fatal injuries.

- ✓ If there is a storage unit fault, the energy storage unit cannot be disconnected from the rest of the application in an electrically safe manner by opening the DC disconnect, as further connections to the application may still be present.
- Discharge and short-circuit the energy storage unit in accordance with regulations before performing any service work on the system.

The energy storage system contains a disconnecter that can be used to disconnect an intact energy storage unit from the rest of the application. If service work is not being performed on the energy storage system itself, it is sufficient if you disconnect the energy storage unit from the application via the DC disconnecter for the duration of the work. In such a case you do not have to discharge the energy storage unit.

If one of the errors shown in the following table occurs, the energy storage unit must be discharged and short-circuited even for service work outside the energy storage system. SEW-EURODRIVE recommends always discharging the energy storage unit if in doubt.

Error code	Error code hex	Error code dec
144.193	0x90c1	37057
144.194	0x90c2	37058
144.195	0x90C3	37059
144.197	0x90c5	37061
144.199	0x90c7	37063
144.201	0x90c9	37065
144.202	0x90ca	37066
144.203	0x90cb	37067
144.204	0x90cc	37068
144.205	0x90cd	37069
144.206	0x90ce	37070
144.207	0x90cf	37071
144.209	0x90D1	37073
144.210	0x90D2	37074
144.211	0x90D3	37075
144.212	0x90D4	37076
144.213	0x90D5	37077
144.214	0x90D6	37078
144.216	0x90D8	37080
145.32	0x9120	37152

Error code	Error code hex	Error code dec
145.33	0x9121	37153
145.37	0x9125	37157
145.64	0x9140	37184
145.65	0x9141	37185

Observe the instructions in chapter "Discharging energy storage units before service work" for this process.

For further information, refer to the documentation of the MOVIKIT® PowerMode/EnergyMode software modules.

8.2 SEW-EURODRIVE electronics service

If you cannot remedy a fault, contact SEW-EURODRIVE Service. You can find the addresses at www.sew-eurodrive.com.

Specify the following so that SEW-EURODRIVE Service can help you more effectively:

- Information regarding the device type on the nameplate (e.g. type designation, serial number, part number, product key, purchase order number)
- Brief description of the application
- Fault message on the status display
- Type of fault
- Accompanying circumstances
- Unusual events preceding the problems

8.3 Discharging energy storage units before service work

The safe state of the energy storage system must be ascertained in advance before service work. The inside of the door of the energy storage system contains an overview of the 4 steps that are required to create a safe state. These 4 steps are described in detail below.

8.3.1 Step 1

1. Disconnect the connection between MDP92A or MDE90A and the energy storage unit, e.g. via the DC contactors using the controller.
2. Disconnect the system from the AC grid. Make sure that you disconnect all relevant connections if there are several AC connections.
3. Make sure that all the connections that are now opened cannot be reconnected during service work.
4. Make sure that the supply unit is de-energized at all poles using a suitable measuring instrument. Perform the measurements at all locations shown in the overview on the inside of the door.
5. For the low-temperature variant and high-temperature variant, you also need to ensure that all poles are de-energized at terminal X10.

8.3.2 Step 2

1. Discharge the energy storage system at the X2 connection designated for this using an EKD discharge unit. Observe the operating instructions of the discharge unit for this. The particularities of the discharge of a double cabinet are described in the chapter "Discharge process for the double cabinet variant" (→ 44).
2. After successful discharge, check the discharge process according to the specifications in the operating instructions of the discharge unit.

8.3.3 Step 3

1. If the energy storage system is discharged to $< 2\text{ V}$, you can use the short circuit connector X5 on the socket contact X2 to prevent the energy storage system from recharging.
2. It is absolutely necessary to connect the short-circuit connector so that voltage cannot accumulate again on the double-layer capacitor. The F10 fuse must always be ON so that the short circuit is ensured.
3. For the UL variant, additionally check at the two measuring points on the front of the discharge connection unit that the energy storage unit is de-energized.

8.3.4 Step 4

1. You can now open the safety guard.
2. After the safety guard has been removed, the mechanical extension of the disconnection switch can be pulled out. This simplifies accessibility to the internal components and avoids injuries from the relatively long, pointed component. To ensure the correct installation depth when reinstalling the linkage, mark the linkage before removing it.
3. It must be ascertained again that there is a de-energized state between the first module on the positive pole and the last module on the negative pole. No voltage greater than 0 V is permitted to be present due to the connected short circuit connector.
4. The voltage between the last module on the negative pole and the PE must likewise be 0 V .
5. Measure the individual module voltages between the positive and the negative pole. They must not be higher than $\pm 2\text{ V}$.
6. Measure the voltage between the positive pole and the PE for each module. The voltage must be 0 V .
7. If a value outside of the specified measured values is measured in the voltage measurements, contact SEW-EURODRIVE Service.

8.3.5 Discharging using the braking resistor

As an alternative to the process using a discharge unit described here, you can also discharge the system using a braking resistor. To do so, perform the following steps:

1. Discharge the energy storage system to $< 2\text{ V}$ using the braking resistor. Observe the "MOVIDRIVE® modular" product manual.
2. Switch off the voltage supply of all devices in the system.
3. Make sure that the device is de-energized at all poles.
4. Check the voltage on the DC link. The voltage must be $< 2\text{ V}$.

5. Make sure that the energy storage unit is de-energized at all poles at discharge connection socket X2.
 - ⇒ Discharge fuse F10 must be set to ON.
6. Perform steps 3 and 4 from the chapters "Step 3" (→ 43) and "Step 4" (→ 43).

8.3.6 Discharge process for the double cabinet variant

The double cabinet consists of a basic cabinet and an expansion cabinet, each with 6 to 8 DSK modules that are internally connected to each other. There is a connection for a discharge unit in each of the two cabinets. It does not matter which of the two cabinets is connected to a discharge unit. All DSK modules are always discharged at the same time through the existing connection. It is not possible to only discharge the energy storage unit in one cabinet. The discharge process can be accelerated greatly by connecting one discharge unit each to both of the existing connections. For correct discharging, observe the regulations in the documentation of the discharge units of SEW-EURODRIVE. Despite the interconnection, for safety reasons you must check that both cabinets are de-energized after the discharge process. After the discharge, connect the short circuit connector to the X2 socket in the basic cabinet.

8.4 Activation after service work

After service work is completed, a visual inspection as well as a safety check in accordance with EN 60204-1 must be carried out and recorded accordingly before restarting.

- ✓ You have finished the service work.
1. Visual inspection and safety inspection
 2. Switch the F10 fuse on the discharge socket to OFF.
 3. Remove the short-circuit connector.
 4. Connect the AC connectors and the controller.
 5. Restart the system in accordance with the MOVIKIT® Power and Energy Solutions PowerMode/EnergyMode manual.

8.5 Shutdown

The procedure for temporary shutdown of the energy storage system can be found in chapters "Discharging energy storage units before service work" and "Switching on after service work" (→ 44).

For permanent shutdown for the purpose of disassembly, proceed as follows:

- ✓ You have fully implemented the specifications of the chapter "Discharging energy storage units before service work".
1. Short-circuit each energy module individually using an insulated wire with a minimum cross-section of 1.5 mm².
 - ⇒ Disassembly of the energy modules is now possible.
 2. Continuously maintain the short circuit.

8.6 Extended storage

Observe the following points when shutting down or storing the storage cabinets:

- Make sure that the energy storage system is short-circuited during storage. For information about installing the short circuit connector, refer to chapter "Discharging energy storage units before service work" (→ 42).
- Note that the useful life of the energy storage system is affected during storage. For further information, refer to chapter "Useful life" (→ 40).
- During storage, make sure that the permitted storage temperature for the energy storage system is observed. The permitted storage temperature can be found in chapter "General technical data".

8.6.1 Storage period of DSK modules

SEW-EURODRIVE uses "LSUM" type DSK modules in the ESS energy storage system. The manufacturer of the "LSUM" DSK modules guarantees compliance with all technical data in the data sheet for storage of up to 4 years at 25 °C. If the specified storage conditions are complied with, the DSK modules can be stored for up to 10 years without significant wear.

SEW-EURODRIVE recommends storing "LSUM" DSK modules for no longer than 10 years. This recommendation is not binding. This recommendation does not affect the statutory warranty liability of SEW-EURODRIVE.

8.7 Waste disposal

Dispose of the product and all parts separately in accordance with their material structure and the national regulations. Put the product through a recycling process or contact a specialist waste disposal company. If possible, divide the product into the following categories:

- Iron, steel or cast iron
- Stainless steel
- Magnets
- Aluminum
- Copper
- Electronic parts
- Plastics

The following materials are hazardous to health and the environment. These materials must be collected and disposed of separately:

- Oil and grease

Collect used oil and grease separately according to type. Ensure that the used oil is not mixed with solvent. Dispose of used oil and grease correctly.

- Screens
- Capacitors

**Waste disposal according to WEEE Directive 2012/19/EU**

This product and its accessories may fall within the scope of the country-specific application of the WEEE Directive. Dispose of the product and its accessories according to the national regulations of your country.

For further information, contact the responsible SEW-EURODRIVE branch or an authorized partner of SEW-EURODRIVE.

9 Inspection, maintenance, and repair

9.1 Spare parts overview

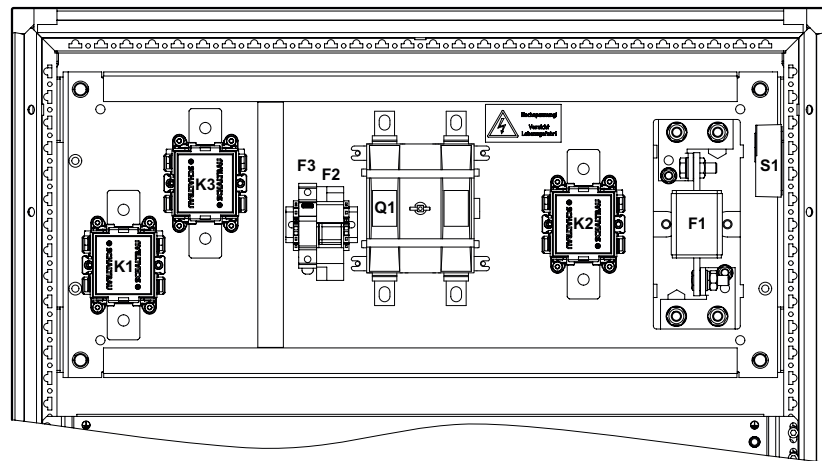
A spare parts package is available for the energy storage cabinet. The available spare parts are shown in the following subchapters.

INFORMATION



Only use original spare parts. If third-party components are used – even if these components are technically equivalent – SEW-EURODRIVE will not accept any liability and cannot guarantee compliance with device properties or that the device will function correctly.

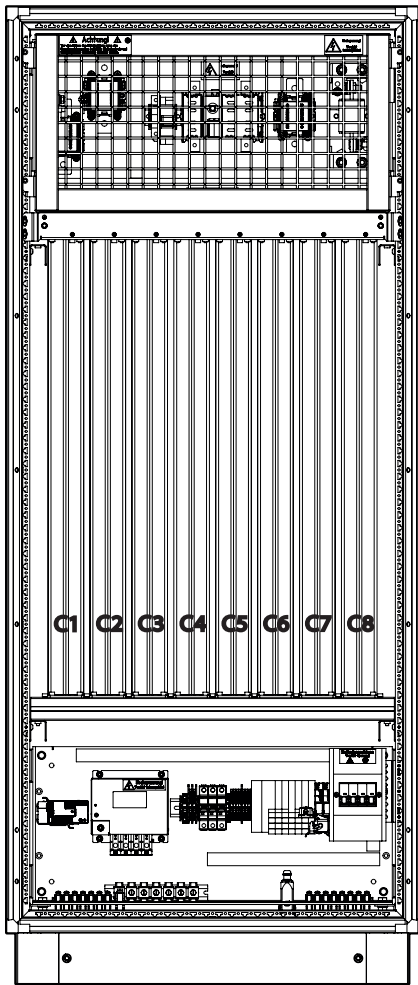
9.1.1 Upper mounting plate



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BMK	Designation	Part number	Comment
K1 – K3	Contactor C310A7300 24I-V	25691953	
F3	Measuring cable fuse 4 A	08003491	
F3	Fuse holder	13292196	
F2	Subfuse 32 A	25783130	
F2	Fuse holder	25783149	
Q1	Disconnecter	29721008	
Q1.1 – Q1.2	Contact element UL variant	29721016	Mounted on Q1
Q1.1 – Q1.2	Contact element CE variant	29704545	Mounted on Q1
F1	Main fuse with fuse-link 250 A	25783122	ESS – R2
F1	Main fuse with fuse-link 315 A	25783114	ESS – R3

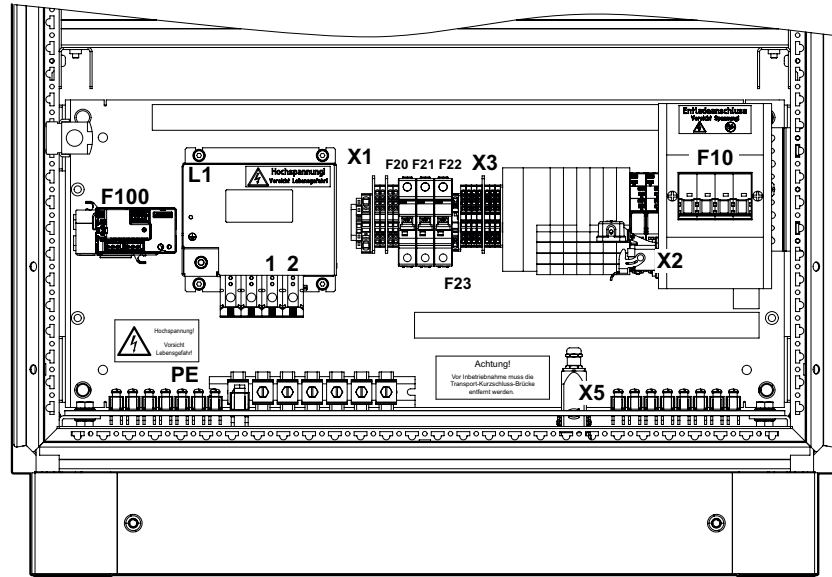
9.1.2 DSK modules



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BMK	Designation	Part number	Comment
C1 – C8	Capacitor LSUM-108R0C-0041F-EA-YD3P G3	25682954	ESS – R2
C1 – C8	Capacitor LSUM-108R0C-0083F-EA-YD3P G3	25682962	ESS – R3

9.1.3 Lower mounting plate



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BMK	Designation	Part number	Comment
F100	MRCD prog. for ESS	28297245	
L1	DC link choke ZK135-0006	18000274	
F23	T2A fuse	25783068	
I/O block	OCE 12C	25664484	SEW I/O modules: Standard temperature variant: 0 °C to 40 °C High temperature variant: 0 °C to 50 °C
	OAI45C	28211987	
	OPV81C	28211847	
	ODI81C	28211936	
	ODO81C	28211944	
	Bus coupler	29659833	Phoenix Contact I/O modules: Low temperature variant: -30 °C to 10 °C Broad temperature variant: -25 °C to 40 °C
	AXL F RTD8 1F (PT100)	29659825	
	DI16/1 DO8/2	29659817	
	Protection cap	29659809	
K10.0 – K10.3	Coupling relay 48.P3 – 10A	25783076	
K10.4	Coupling relay 39.11 – 6A	25783084	
F10/X2	Discharge connection unit, standard variant	28265815	
F10/X2	Discharge connection unit, UL variant	28311213	

BMK	Designation	Part number	Comment
F10	Fuse-link for UL variant	29720869	

9.2 Service work on the energy storage cabinet

INFORMATION



Perform the following work only if the energy storage cabinet is in safe state.

Observe chapter "Discharging energy storage units before service work" for this purpose.



⚠ WARNING

The energy storage units are still charged after the device has been switched off.

Severe or fatal injuries due to electric shock.

- ✓ The energy storage units must be discharged before you perform any work on the device.
- Only electrically skilled persons are permitted to discharge the energy storage unit and install the short circuit connector.



⚠ CAUTION

Risk of injury from arcing during a high-energy discharge (between two conductive metals).

Minor injuries.

- Make sure control cabinets are kept closed unless electrical components are de-energized.
- Disconnect any energy storage units such as accumulators from the electronics. Observe the measures for shutdown of the products used.
- Switch off other voltage sources.
- Before switching on the product, make sure that the protective cover is in place over the connections.
- Ensure that the product is insulated as far as possible and that no conductive foreign bodies can penetrate.



⚠ WARNING

Electric shock when connecting or disconnecting energized power connections.

Severe or fatal injuries.

- Switch off all supply voltages.
- Make sure that the devices of the system are de-energized.
- Never connect or disconnect the power connections while they are energized.
- Never disconnect the power connections if you do not know the actual state of charge of the energy storage unit.
- Discharge the energy storage units to less than 2 V before disconnecting them from the DC link.



⚠ WARNING

Ineffective disconnection from the grid due to charged storage units.

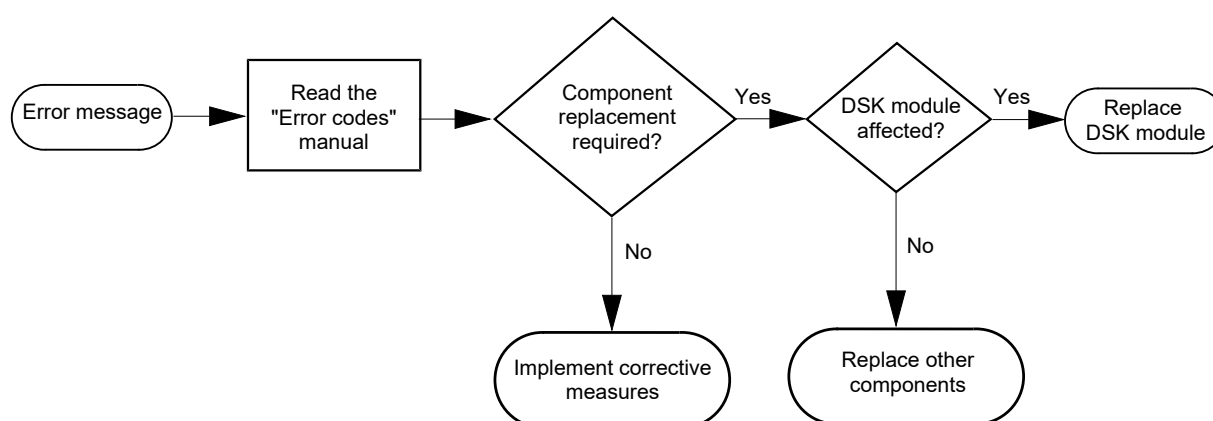
Severe or fatal injuries.

- Disconnect all supply voltages.
- Make sure that the devices of the system are de-energized.
- Discharge the energy storage units using a braking resistor or a discharge unit from SEW-EURODRIVE.
- Short-circuit the energy storage units after discharging.

Observe the causes and corrective measures for the error codes in the "Error Codes – MOVIKIT® Software Modules" manual. They can indicate which parts need to be replaced on the energy storage unit. Perform an error analysis to determine the defective component.

9.2.1 Procedure in the event of a fault

Every SEW-EURODRIVE energy storage system must be monitored by a MOVIKIT® PowerMode or EnergyMode software module. The "Error Codes – MOVIKIT® Software Modules" manual contains a list of all possible errors that can occur with an energy storage system. If an error occurs, observe the following procedure:



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1. Refer to the "Error Codes – MOVIKIT® Software Modules " manual for the meaning and possible corrective measures of the present error.
2. Can the error be rectified with corrective measures from the manual, or is a component replacement required?
 - ⇒ If a component replacement is required, refer to chapter "Replacing other components" (→ 52).
3. If the error indicates a defective DSK module, refer to chapter "Replacing a DSK module" (→ 62).

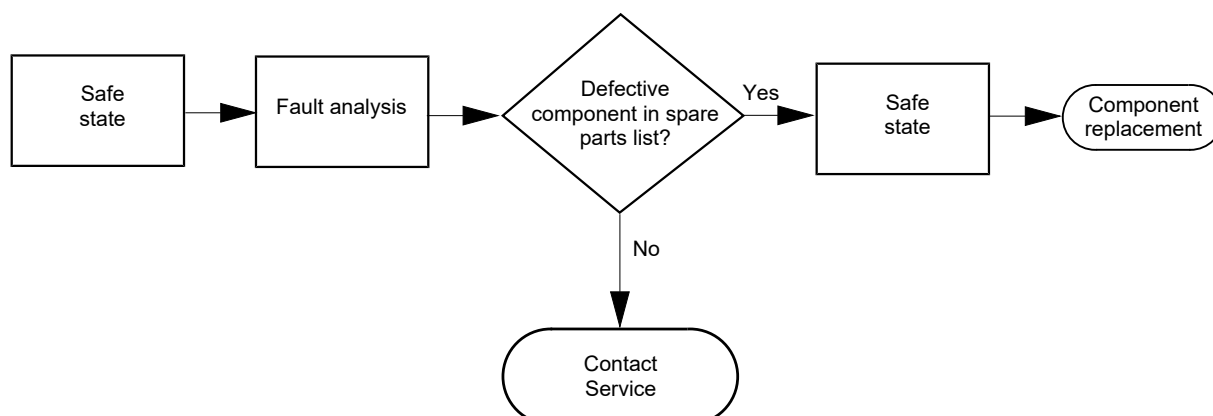
⚠ CAUTION

Note that during the warranty period, you must trigger a GCoM case with SEW-EURODRIVE Service before replacing any components. This also applies if you replace the components yourself.



9.2.2 Replacing other components

Proceed as follows:



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1. Set the energy storage system to a safe state.
 - ⇒ Observe chapter "Discharging energy storage units before service work".
2. Perform an error analysis.
 - ⇒ Be particularly careful when you have to start up the energy storage system and operate it with the door open or without a protective grid.
3. Check whether the missing component is available as a spare part.
 - ⇒ Observe chapter "Spare parts overview".
4. If the component to be replaced is available as a spare part, set the system to a safe state in accordance with the specifications in chapter "Discharging energy storage units before service work".
5. Replace the defective component.
 - ⇒ Observe the information listed below for the respective spare parts.

If you cannot determine the defective component or it is not available as a spare part, contact SEW-EURODRIVE Service.

Replacing a defective F1 fuse

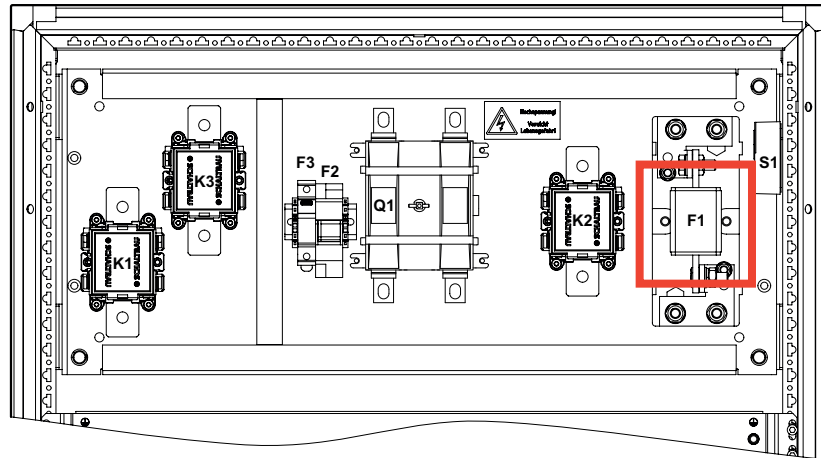
Part number	Designation	Value	Tightening torque	Cabinet size
25783122	250A-1250V fuse	250 A	48 Nm	ESS – R2
25783114	315A-1250V fuse	315 A	48 Nm	ESS – R3

If fuse F1 is defective, additionally check the following components for correct function:

- Contactors K1, K2, K3
- Fuse F2
- Storage bundle
 - Check whether the storage bundle contains defective modules.
- MDP92A

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- Make sure that no error message is present and that the DC link can be regulated to the setpoint.



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Replacing a defective F2 fuse

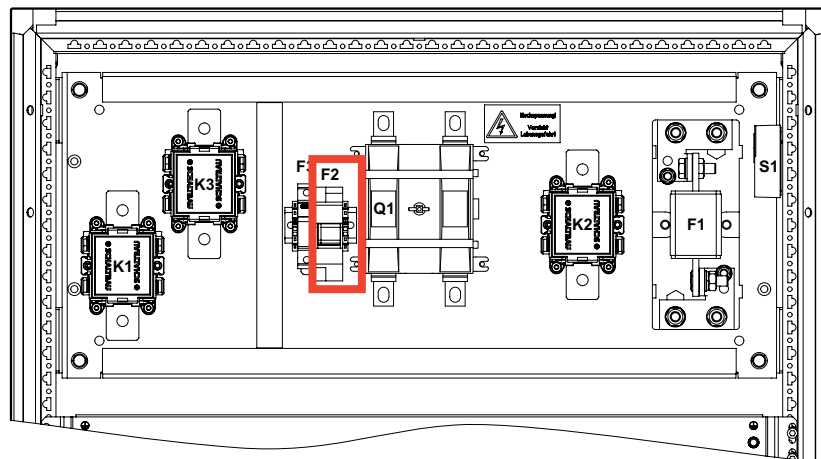
Part number	Designation	Value
25783130	32 A fuse	32 A

If the fuse holder of fuse F2 is defective, replace it.

Part number	Designation	Value
25783149	Fuse holder	–

If fuse F2 is defective, additionally check the following components for correct function:

- Contactors K1, K2, K3
- Fuse F1
- Storage bundle
 - Check whether the storage bundle contains defective modules.
- MDP92A
 - Make sure that no error message is present and that the DC link can be regulated to the setpoint.



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Replacing a defective F3 fuse

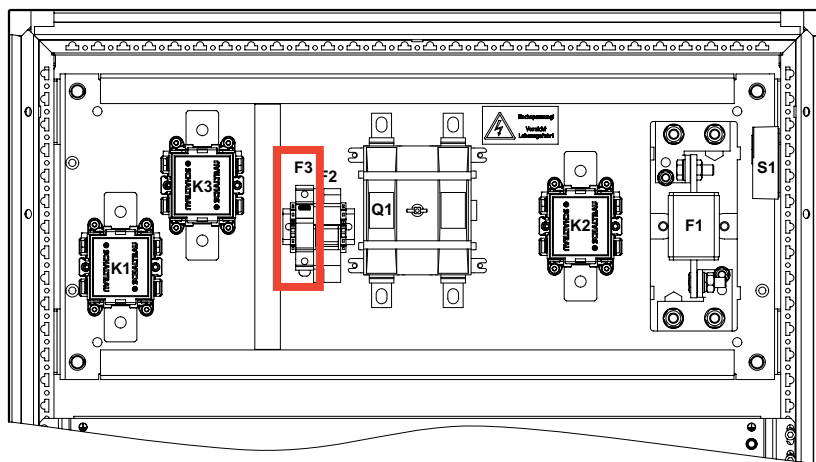
Part number	Designation	Value
08003491	4 A fuse	4 A

If the fuse holder of fuse F3 is defective, replace it.

Part number	Designation	Value
13292196	Fuse holder	—

If fuse F3 is defective, additionally check the following components for correct function:

- Auxiliary contact Q1.1
- MDP92A
 - Make sure that no error message is displayed and that the DC link can be regulated to the setpoint.



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Replacing a defective K1/K2/K3 contactor

Part number	Designation	M10 tightening torque	M5 tightening torque
25691953	Contactor, C310A/300 24I-V	10 Nm	3.5 Nm

If the contactor K1/K2/K3 is defective, additionally check the following components for correct function:

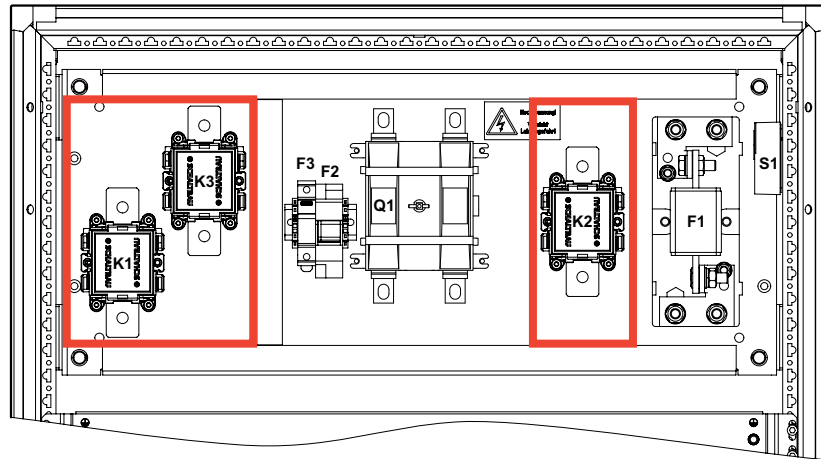
- Fuse F1
- Fuse F2
- Storage bundle (Are there any defective modules in the storage bundle?)

Required tools:

- Hexagon socket: Set
- Wrench: Set
- Torque wrench 0 Nm – 10 Nm

Procedure:

1. Loosen the M10 screws.
2. Remove all electrical connections.
3. Remove the contactor from the mounting plate.
4. Mount the new contactor in reverse order.



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Replacing a defective Q1 disconnecter

Part number	Designation	M8 tightening torque
29721008	Disconnecter OTDC200U11	14 Nm

If disconnecter Q1 is defective, additionally check the following components for correct function:

- Auxiliary contacts Q1.1/Q1.2
- Fuse F1
- Fuse F2
- Fuse F3
- Contactors K1, K2, K3
- Storage bundle (Are there any defective modules in the storage bundle?)

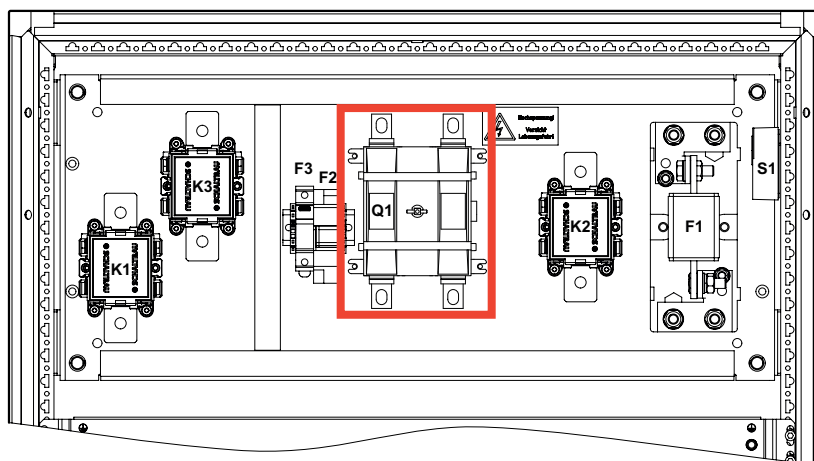
Required tools:

- Hexagon socket: Set
- Wrench: Set
- Torque wrench 0 Nm – 20 Nm

Procedure:

1. To ensure the correct installation depth of the linkage during reinstallation, mark the linkage.
2. Remove the linkage by loosening the set screws.
3. Loosen the M8 screws.
4. Remove the auxiliary contacts.
5. Remove all electrical connections.

6. Remove the disconnecter from the mounting plate.
7. Mount the new disconnecter on the mounting plate.
8. Mount the auxiliary contacts.
9. Restore all electrical connections.
10. Tighten the M8 screws to the specified torque.
11. Install the linkage.



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Replacing a defective auxiliary contact

Part number	Designation	Use
29704545 (CE variant)/ 29721016 (UL variant)	Contact element Q1.1	Separation ES-
29704545 (CE variant)/ 29721016 (UL variant)	Contact element Q1.2	Disconnecter return signal

If the auxiliary contact Q1.1 is defective, additionally check the following components for correct function:

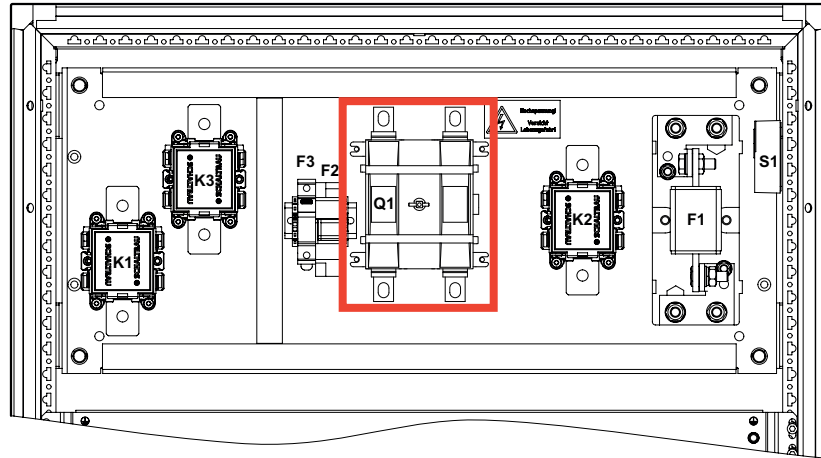
- Auxiliary contact Q1.2
- Disconnecter Q1
- Fuse F3

If the auxiliary contact Q1.2 is defective, additionally check the following components for correct function:

- Auxiliary contact Q1.1
- Disconnecter Q1
- I/O module

Procedure:

1. Remove the cover.
2. Remove the auxiliary contacts in accordance with the instructions from ABB.
3. Disconnect the electrical connections.
4. Mount and install the auxiliary contact in reverse order in accordance with the instructions from ABB.



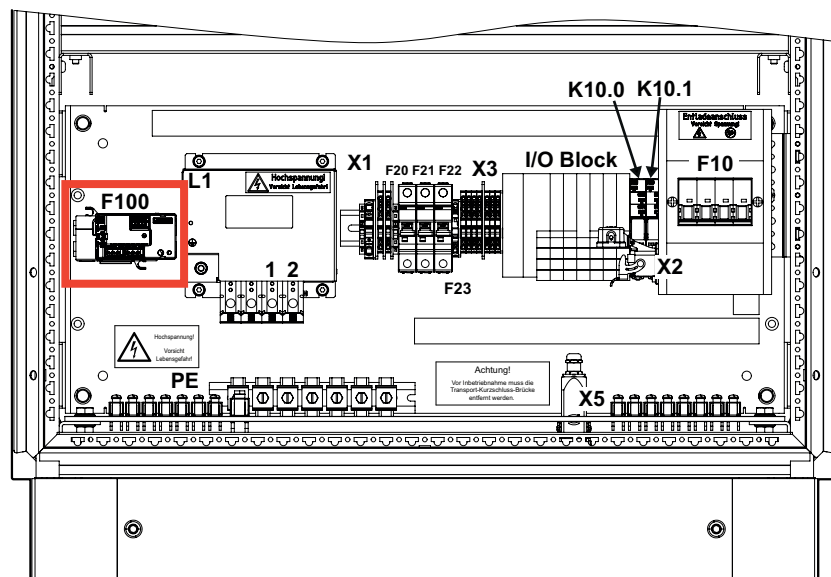
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Replacing a defective MRCD

Part number	Designation
28297245	MRCD prog. for ESS

Procedure:

1. Disconnect the connector on the defective MRCD.
 2. Loosen the DC link connection at the choke.
 3. Remove the defective MRCD.
 4. Insert the DC link connection through the new MRCD core.
 5. Mount the new MRCD on the DIN rail.
 6. Connect the DC link connection to the choke.
 7. Connect the connector to the new MRCD.
- ⇒ Ensure that the litz wires are fitted securely at the terminals.



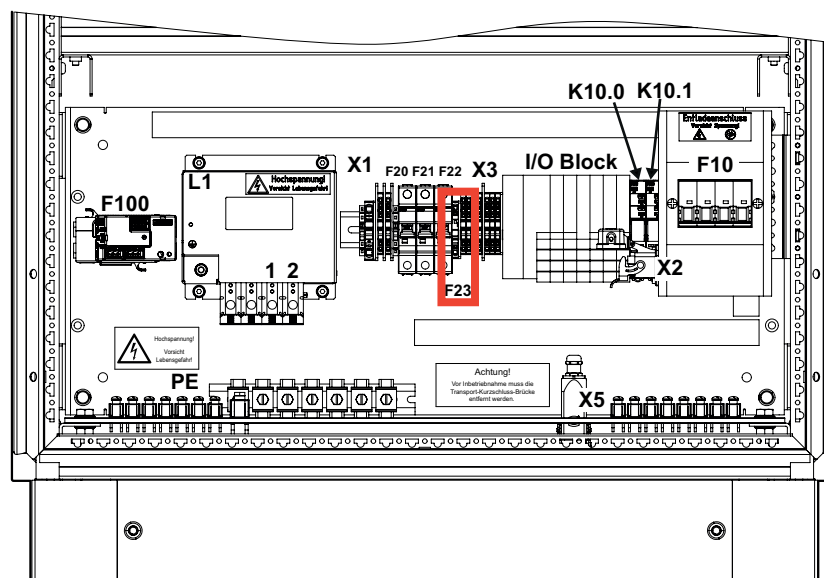
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Replacing a defective F23 fuse

Part number	Designation	Value
25783068	T2A fuse	2 A

Procedure:

1. Disconnect the electrical connections.
2. Remove the terminal.
3. Open the side cover of the terminal.
4. Replace the fuse.
5. Reinstall the fuse in reverse order.



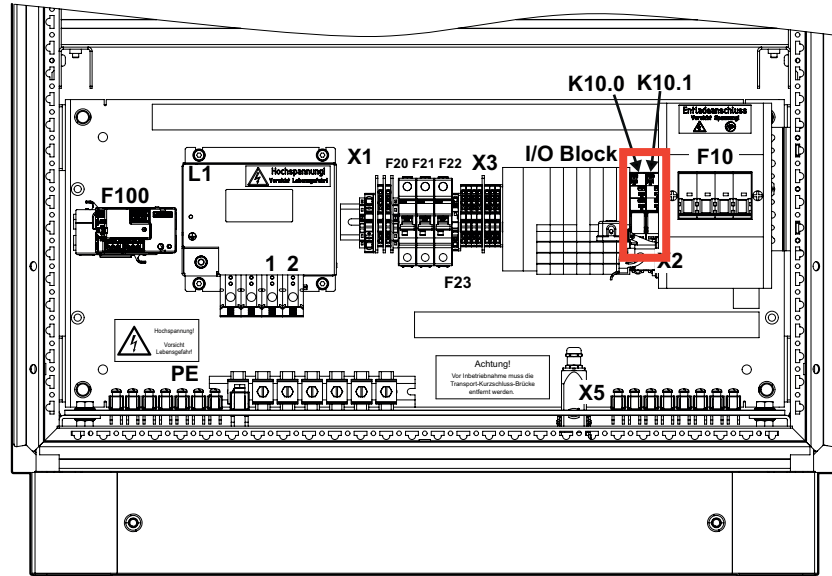
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Replacing a defective K10.0 – K10.4 coupling relay

Part number	Designation	BMK
25783076	Coupling relay type 48.P3 – 10 A	K10.0 – K10.3
25783084	Coupling relay type 39.11 – 6 A	K10.4

Procedure:

1. Disconnect the electrical connections.
2. Remove the defective coupling relay.
3. Mount the new coupling relay on the DIN rail.
4. Connect the electrical connections.



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Replacing a defective discharge connection unit

Part number	Designation	BMK
28265815	Discharge connection unit Standard variant	F10/X2
28311213	Discharge connection unit UL variant	F10/X2

**⚠ DANGER**

Electric shock due to insufficient safety measures.

Severe or fatal injuries.

- Before every discharge process, measure the applied voltage in accordance with the specifications of the operating instructions of the discharge unit from SEW-EURODRIVE.
- Manual discharging of DC voltages of > 120 V may be performed only by persons who have received the special training "Working with live electrical equipment". In addition, special safety precautions must be taken for working with live electrical equipment in such a case. If in doubt, contact SEW-EURODRIVE Service.

The energy storage units must be discharged and short-circuited before you perform any service work. In the event of a defect at the discharge connection, perform the discharge and the short circuit directly at the energy storage unit. In doing so, observe the specifications in the operating instructions of the discharge unit from SEW-EURODRIVE.

Removal

1. Remove the housing cover of the defective discharge connection unit.
2. Disconnect the electrical connections.

U _{Z+} cable	CE: F10:2 UL: F10.1
U _{Z-} cable	CE: F10:8 UL: F10.3
PE	PE busbar

3. Open the cable glands and remove the U_{Z+} and U_{Z-} cables from the discharge connection unit.
4. Loosen the tapping screws that connect the discharge connection unit mechanically to the control cabinet.

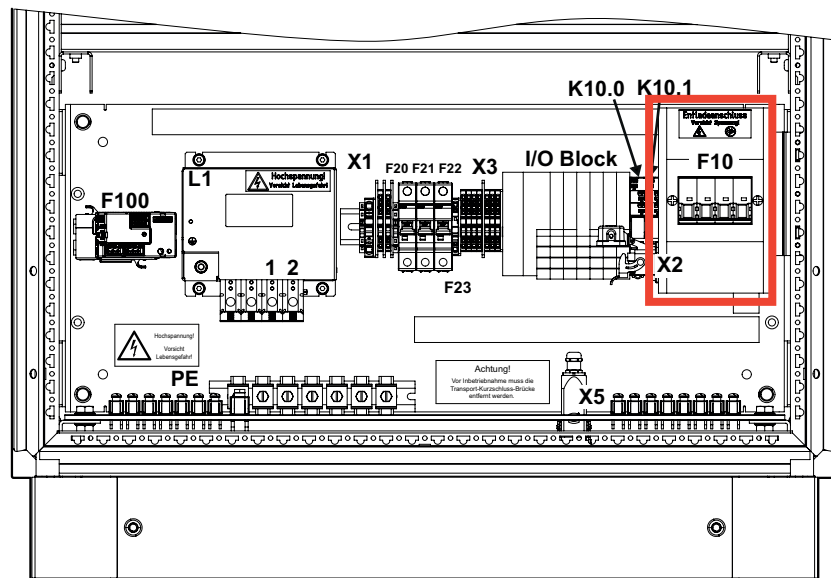
Reinstallation

1. Remove the cover of the new discharge connection unit.
2. Restore the electrical connections.

U _{Z+} cable	CE: F10:2 UL: F10.1
-----------------------	------------------------

U _Z - cable	CE: F10:8 UL: F10.3
PE	PE busbar

3. Establish a mechanical cable relief by tightening the cable glands.
4. Mount and screw the discharge connection unit into the control cabinet at the top position of the system rail.
The screw for the PE connection is equipped with a serrated lock washer.
5. Mount the housing cover on the discharge connection unit.
6. Connect the short-circuit connector to X2 to short-circuit the energy storage unit.
7. Set fuse F10 to "On". This step is omitted for the UL variant.
8. Remove the short-circuit jumper from the energy storage unit.
9. Reinsert the protective grid and screw it in place.



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Replacing defective I/O modules

Proceed with particular care when replacing I/O modules. Incorrectly or improperly connected wiring can disable the overvoltage monitoring of the energy storage units. After I/O modules have been replaced, the correct wiring must therefore be checked with a special test box. Contact SEW-EURODRIVE Service regarding this. During the warranty period, the replacement of I/O modules may be performed only by SEW-EURODRIVE Service.

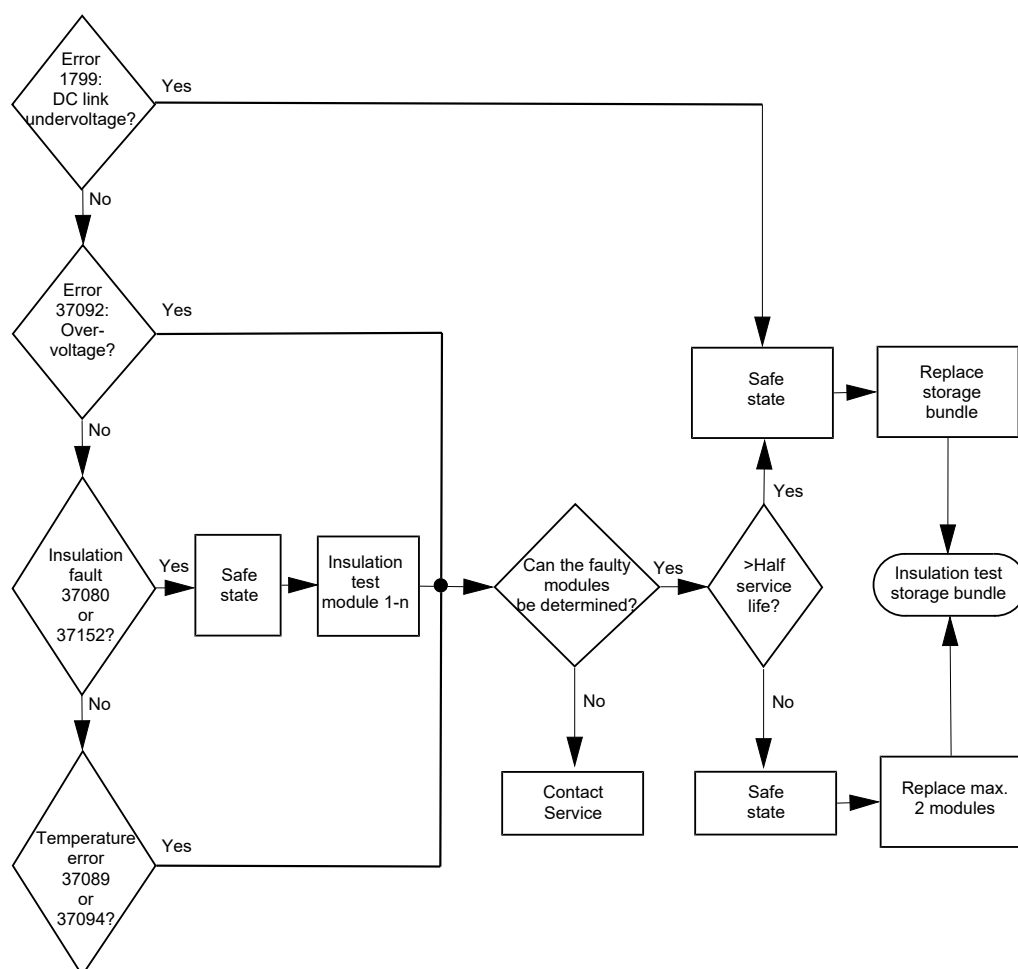
9.2.3 Replacing a DSK module

**▲ WARNING**

Electric shock due to improper use.

Severe or fatal injuries.

- For safety reasons, DSK modules may be replaced only by trained personnel. Contact SEW-EURODRIVE Service.
- During the warranty period, the replacement of DSK modules may be performed only by SEW-EURODRIVE Service.



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If one of the errors shown in the flow diagram above is present, you must replace a DSK module. First, determine whether a DSK module needs to be replaced. The procedure you have to follow depends on the present error. Several errors can also be present at the same time.

If an overvoltage fault or a temperature fault is present, the error message of the MOVIKIT® module indicates which module needs to be replaced. If external influences, such as an excessive ambient temperature, can be excluded as the cause of the fault, replace at least the affected module.

If an insulation fault is present, the error message does not indicate which module triggered the fault. For this reason, you must perform a manual insulation resistance test on site to determine which module triggered the fault, see chapter "Insulation resistance test" (→ 69).

At the end of its useful life, the energy storage unit can no longer provide sufficient power for the application. As a result, a voltage dip occurs at the DC link. This is indicated by the display of error 1799 "Undervoltage at the A-side or B-side". In this case, replace the entire storage bundle.

Set the energy storage system to the safe state before replacing modules or performing an insulation resistance test, see chapter "Discharging energy storage units before service work".

Replacing an individual DSK module or the entire storage bundle?

Due to technological reasons, you must determine in advance whether the entire storage bundle must be replaced whenever a DSK module is replaced. This depends on the age of the storage bundle. If more than half of the projected service life has already elapsed, you must replace the entire storage bundle. If less than half of the projected service life has elapsed, replace a maximum of 2 individual DSK modules. For the projected service life, refer to the result report from the PES simulator. As a rule, the projected service life is 10 years.

If one module has already been replaced during a previous service call, you may replace one further module. If two modules have already been replaced in the past, replace the entire storage bundle.

INFORMATION



Any number of modules can be replaced within the first 8 weeks after startup. These are not included in the calculation for further service calls.

Tools required

Before replacing the DSK modules, ensure that the following tools are available:

- EKD-003 discharge unit (part number: 28265610)
- EKD universal adapter cable UKE11A (part number: 28157214)
- Short-circuit connector (part number: 28149874)
- Multimeter (voltage measurement, CAT III 1000 V/CAT IV 600 V in accordance with IEC 61010-1)
- Two-pole voltage tester in accordance with DIN EN 61243-3
- Multi-function installation tester or high voltage tester for performing an insulation resistance test in accordance with EN 60204-1 and a protective earth connection test in accordance with EN 61800-5-1
- Torque wrench
 - M8 (wrench size 13, tightening torque: 20 Nm)
 - M10 (wrench size 17, tightening torque: 30 Nm)
- Insulated single-core cable (e.g. H07V-K), M8 and M10 forked cable lugs attached to cable ends
 - Cross section: $\geq 2.5 \text{ mm}^2$
 - Length: approx. 1 m

- Standard service tool kit (hexagon socket, open-end wrench, VDE screwdriver set)
- Double-sided adhesive tape

Procedure

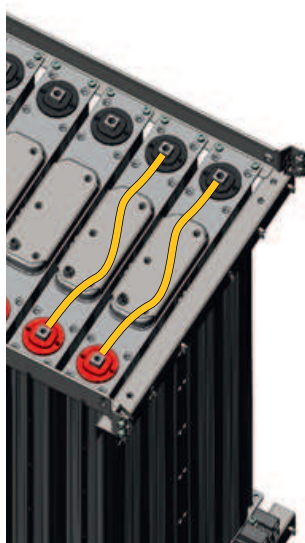
Proceed as follows when replacing the DSK modules.

Short-circuiting modules

Short-circuit all modules of the storage bundle, even if not all modules are to be replaced. The short-circuited poles ensure that the voltage positions are the same when a new energy module is installed and that there are no asymmetries.

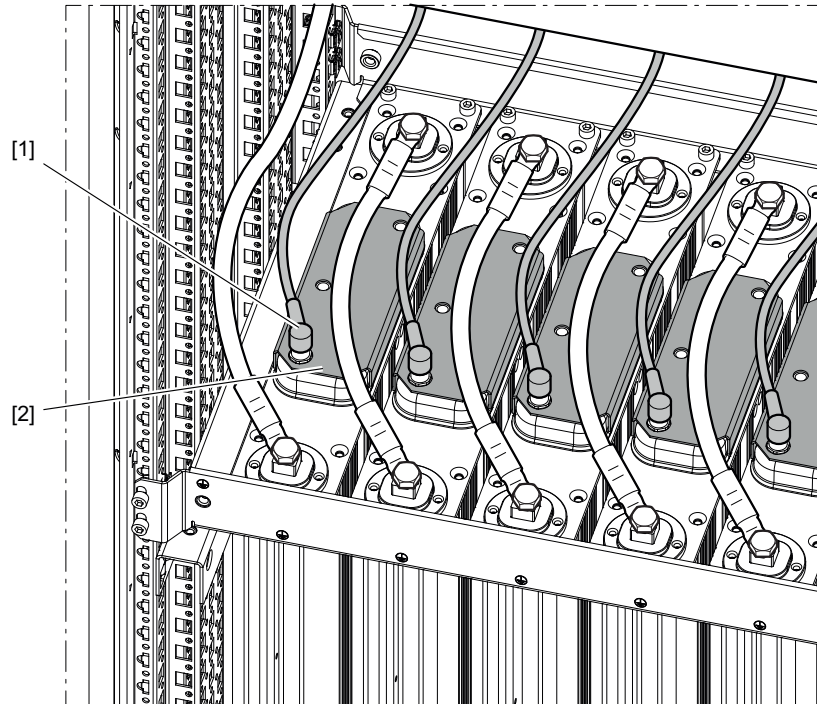
Proceed as follows:

- ✓ You have set the system to a safe state according to the specifications in chapter "Discharging energy storage units before service work".
1. Disconnect the electrical connections on module 1.
 2. Short-circuit module 1 using the insulated single-core cable mentioned above.
 3. Disconnect the electrical connection on the negative pole of module 2.
 4. Short-circuit module 2 using the original connection lead between module 1 and 2.
 5. Perform steps 3 and 4 for all remaining modules of the storage bundle.



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Removing the locking plates

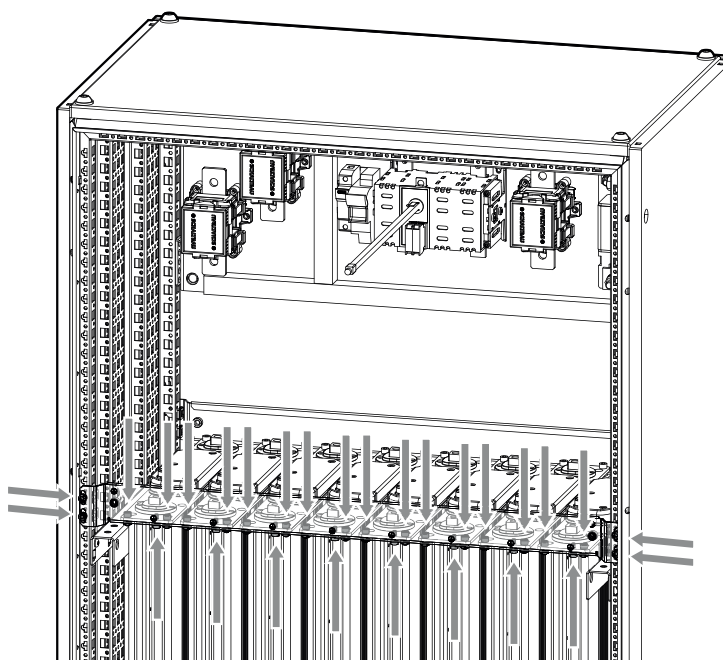


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1. Unscrew the M12 connector [1] of the communication cable on the modules you want to replace.
2. The locking plate [2] is fastened with double-sided adhesive tape. Remove the locking plate and set it aside.
 - ⇒ The locking plate will be required for the replacement module.

Removing the defective module

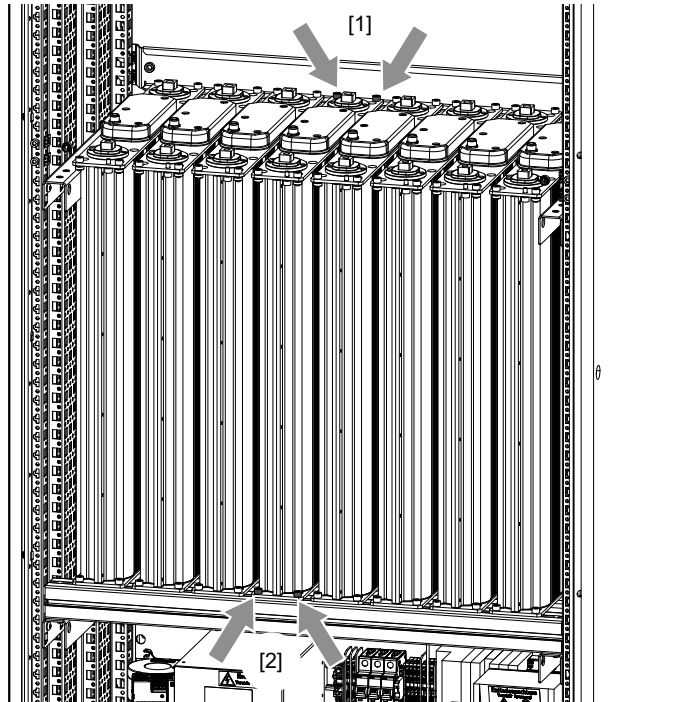
- ✓ You have determined the defective module.
- 1. Remove the mounting rail (part number: 2812688).
- 2. Loosen all front retaining screws and module grounding screws.



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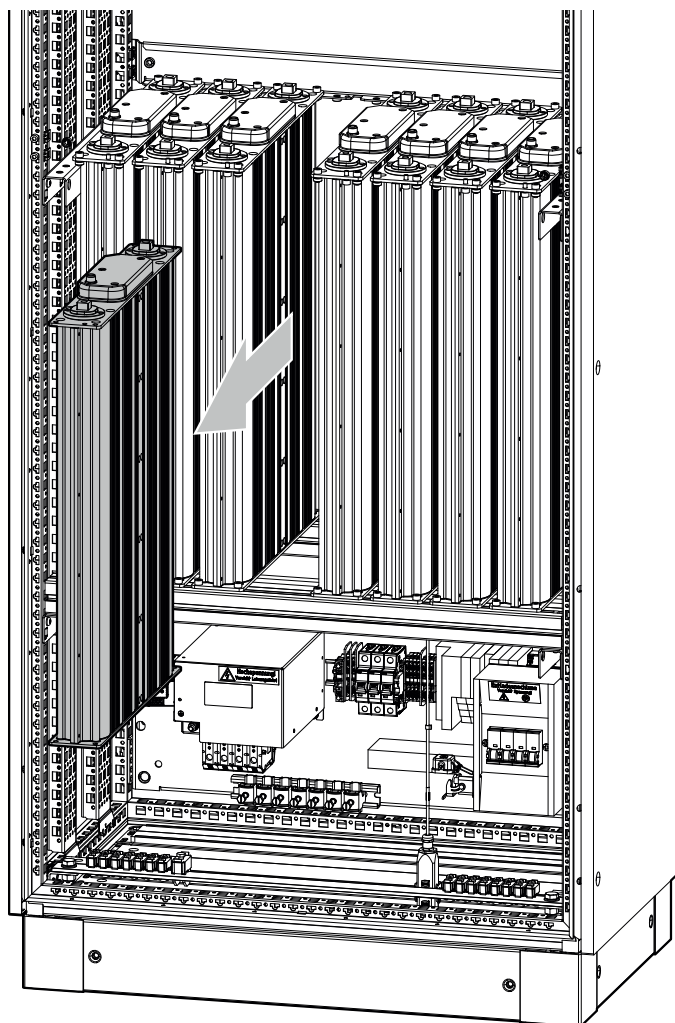
- 3. Remove the PE connection.
- 4. Loosen the 4 screws on the mounting rail.
- 5. Set the rail aside.

6. First loosen the two rear retaining screws [1] at the top and then the two lower retaining screws [2] on the module to be removed.



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7. Pull out the module.



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Installing the new module

Insert the new module by performing steps 1 – 7 in reverse order (7 – 1).

Mark the replaced module with a label or similar. Attach it to the mounting rail. Note the date of the module replacement on it and transfer the number of the module from the removed module, e.g. "C4".

As the new module is delivered with a short-circuit jumper, it has 0 V like all of the other modules in the control cabinet. This means that no asymmetrical voltage distribution can form during startup.

Reconnecting the modules

1. Reuse the locking plate (part number: 28131800) from the removed module for the new one. Use double-sided adhesive tape for fastening.
2. Remove the short-circuit jumpers.

3. Reinstall the connection leads between the modules (35 mm² cable from the negative pole to the positive pole of the next module). At this point, do not connect anything at the DSK+ connection of the first module and at the DSK- connection of the last module.
4. Proceed with an insulation resistance test as described below.

Tightening torques

Connection point	Thread	Tightening torque
DSK+	M8	20 Nm
DSK-	M10	30 Nm

Insulation resistance test

Perform an insulation resistance test of the entire storage bundle in the following cases:

- If errors 37080 and 37152 occur
- After each replacement of DSK modules, before restarting

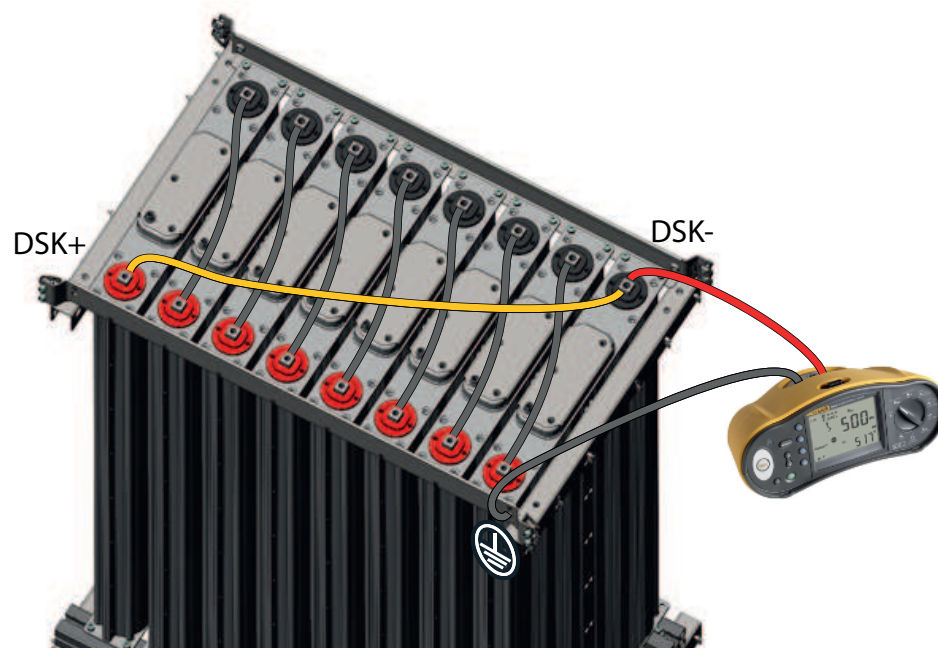
Insulation resistance test of entire storage bundle

Required tools:

- Measuring device for the insulation resistance test
- Insulated single-core cable (e.g. H07V-K), cable ends with M8 and M10 forked cable lugs:
 - Cross section: $\geq 2.5 \text{ mm}^2$
 - Length: approx. 1 m
- Wrench SW 13
- Wrench SW 17

Preparation:

1. Disconnect the DC link connections from the storage bundle (DSK+ on the first module and DSK- on the last module installed).
2. Unscrew all signal monitoring cables.
3. Short-circuit the DSK storage bundle with the prepared insulated single-core cable (yellow cable between DSK+ on module 1 and DSK- on module 8).
4. Perform the insulation resistance test properly and record the measurement result in "Test protocol for service work on the ESS".
5. Select the largest possible value of the test device used.
 - ⇒ Test voltage = at least 500 V_{DC}; ideally up to 2 kV_{DC}



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Measuring points

DSK+/-

PE connection mounting rail

The insulation resistance test is considered as passed if a resistance value of $\geq 10 \text{ MOhm}$ or no conductive connection is displayed at a test voltage of 500 V.

If you measured a measured value less than 10 MOhm during the insulation resistance test of the entire storage bundle, you must measure each module individually. In this case, skip the following steps 6 and 7. Only perform step 5 and then continue with chapter "Insulation resistance test of a single DSK module" (→ 71).

End the insulation resistance test:

6. Remove the short circuit between DSK+ on module 1 and DSK- on module 8 on the storage bundle (yellow cable).
7. Establish the DC link connection on the storage bundle (between DSK+ on module 1 and DSK- on module 8). Observe the correct sequence of the cables and the tightening torques from the following table:

Sequence of the cables

1	Connection pole
2	Storage unit connection 35 mm ²
3	Discharge unit connection 2.5 mm ²
4	Washer
5	Lock washer
6	Screw

Connection point	Thread	Tightening torque
DSK+	M8	20 Nm
DSK-	M10	30 Nm

8. Screw on all signal monitoring cables.

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Insulation resistance test of a single DSK module

Preparation:

1. Disconnect the DC link connections to the adjacent modules (DSK+ and DSK-).
2. Unscrew all signal monitoring cables.
3. Short-circuit the DSK module that you want to test between DSK+ and DSK-.
4. Perform the insulation resistance test properly and record the measurement result in "Test protocol for service work on the ESS".
5. Select the largest possible value of the test device used.
 - ⇒ Test voltage = at least 500 V_{DC}; ideally up to 2 kV_{DC}



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Measuring points	
DSK+/-	PE connection mounting rail

The insulation resistance test is considered as passed if a resistance value of ≥ 10 MOhm or no conductive connection is displayed at a test voltage of 500 V.

Several defective energy modules can also be present in a storage bundle. Replace them.

End the insulation resistance test:

6. Remove the short circuit between DSK+ and DSK-.
7. Restore the DC link connections between the individual DSK modules. Observe the tightening torques specified in the following table:

Connection point	Thread	Tightening torque
DSK+	M8	20 Nm
DSK-	M10	30 Nm

8. Establish the DC link connection on the storage bundle (between DSK+ on module 1 and DSK- on module 8). Observe the correct sequence of the cables and the tightening torques from the following table:

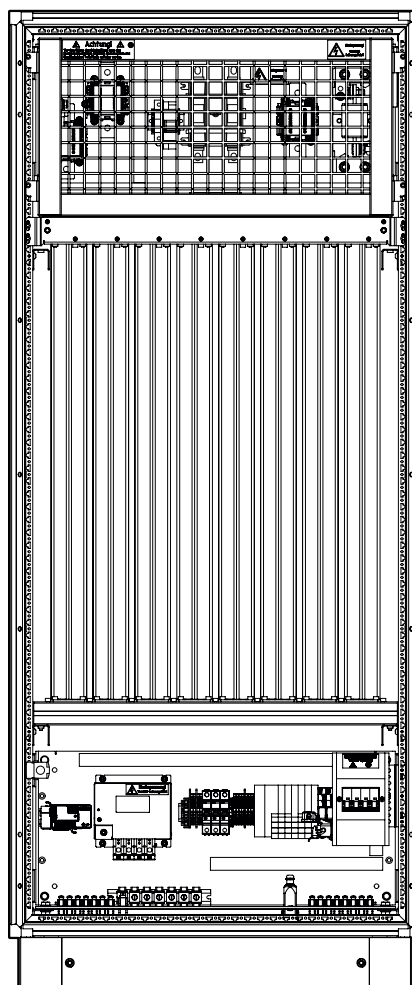
Sequence of the cables		
1	Connection pole	
2	Storage unit connection 35 mm ²	
3	Discharge unit connection 2.5 mm ²	
4	Washer	
5	Lock washer	
6	Screw	

Connection point	Thread	Tightening torque
DSK+	M8	20 Nm
DSK-	M10	30 Nm

9. Screw on all signal monitoring cables.

Inserting the grid again

Install the protective grid before restarting.



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9.3 Standard and broad temperature variant

Regularly check the degree of pollution of the fan filter fleece and replace it if necessary. The degree of pollution is dependent on the environment. As replacement filters, use the filters from Rittal that are intended for this purpose. Select a suitable filter depending on the existing fan from the following table.

Fan	Filter
SK 3241.124	SK 3172.100
SK 3241.724	SK 3172.120

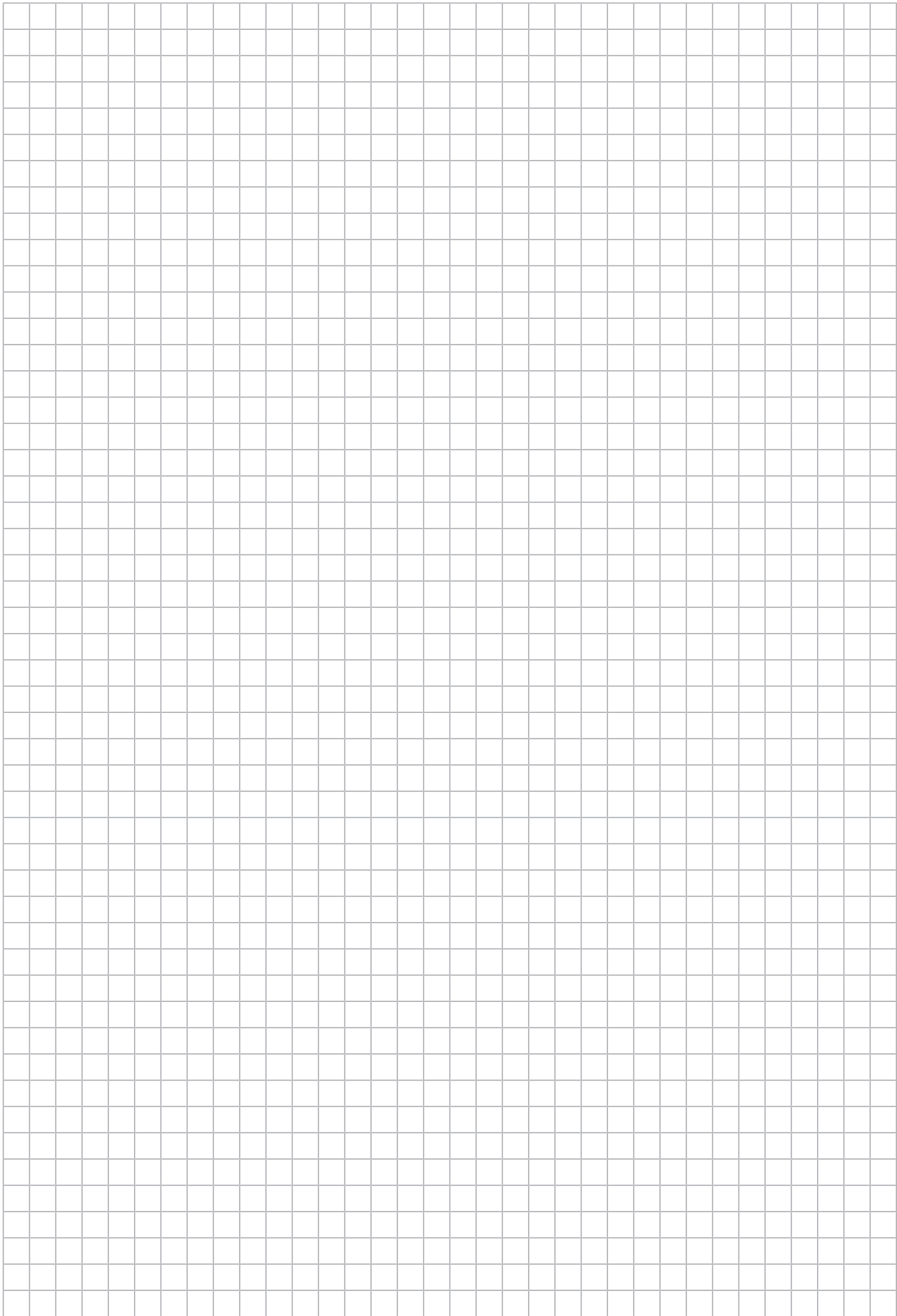
Note that only the lower grille at the air intake is equipped with a filter fleece. In order to ensure the cooling function, fleece must not be used in the grilles at the air outlet.

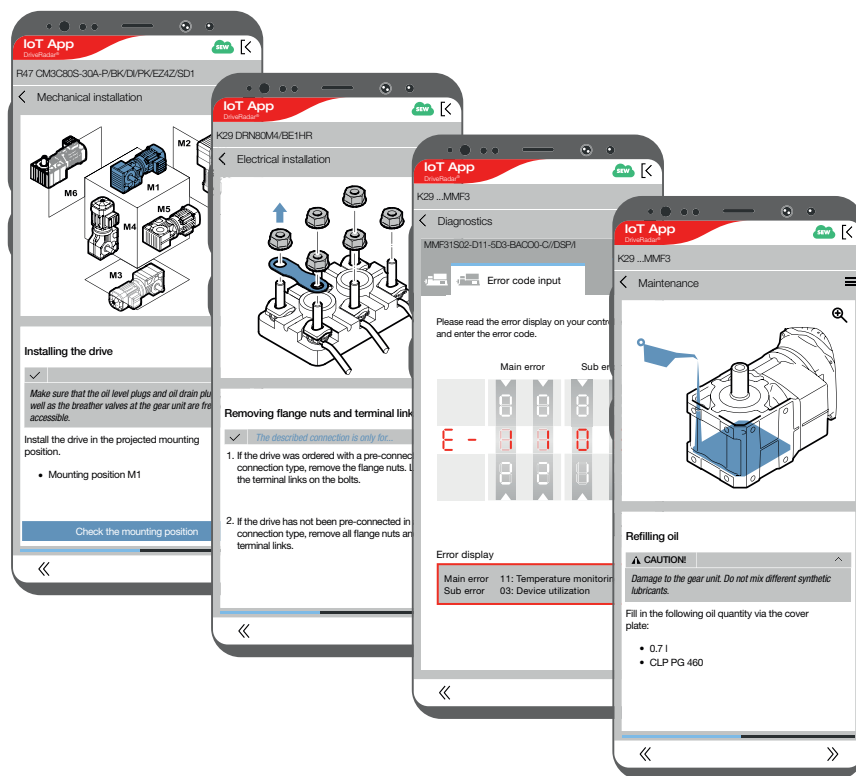
9.4 High temperature variant

Please follow the installation, assembly and operating instructions for "control cabinet cooling unit" from Rittal, item number: SK 3184.840.

9.5 Low temperature variant

Check the heater and the internal fans of the control cabinet for impurities.





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