SEW EURODRIVE

Product Manual

Application Inverter
MOVIDRIVE® modular
Power Supply Module with Supply and Energy Recovery, Block-Shaped

Edition 08/2018

25859536/EN

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1 Product description

With its brand MOVI-C®, SEW-EURODRIVE is launching a new generation of drive and automation technology. MOVI-C® is the modular automation system that enables the highest level of system and machine automation.

MOVI-C® comprises drive technology, MotionControl, control technology and visualization.

MOVIDRIVE® modular is the modular application inverter for all types of applications, ranging from simple open-loop speed control to servo drives with kinematic model.

MOVIDRIVE® modular consists of:

- Supply and energy recovery modules.
- Single-axis and double-axis modules.
- Capacitor and buffer modules.
- 24 V switched-mode power supply module.
- Assembly module for integrating MOVI-C® CONTROLLER advanced into the axis system.
- Accessories for EMC-compliant installation.
- Cards for connecting other I/Os or an additional encoder.
- Cards for functional safety in functionally different versions.
- Accessories for connecting and controlling motors and brakes as well as assembled motor and encoder cables.

For use in harsh environments, the inverters can be supplied with painted PCBs. The coating of the printed circuit boards increases their resistivity against environmental influences.

MOVIDRIVE® modular can be supplemented by connecting MOVIDRIVE® system single-axis devices. These possess functionalities comparable to those of axis modules, but have their own line connection.

Especially in the upper power range up to 588 A/315 kW, MOVIDRIVE® system supplements the modular application inverter. For additional information, refer to the MOVIDRIVE® system product manual.

The key features of MOVIDRIVE® modular and MOVIDRIVE® system are:

- A maximum of 15 axis modules at a power supply module, a maximum of 30 drives for double-axis modules.
- Control mode:
  - U/f: for simple applications with asynchronous motors.
  - VFC^{PLUS}: for precise control of asynchronous motors.
  - CFC: for asynchronous and synchronous servomotors.
  - ELSM®: for synchronous motors without encoders.
- Multi-encoder input in the basic device.
- Speed control, torque control, position control.
- Expansion slots for I/O, multi-encoder, functional safety.
- Very compact device size, reduced space requirements in the control cabinet.

MOVIDRIVE® modular and system are intended for operation at the MOVI-C® CONTROLLER, the controller from SEW-EURODRIVE.

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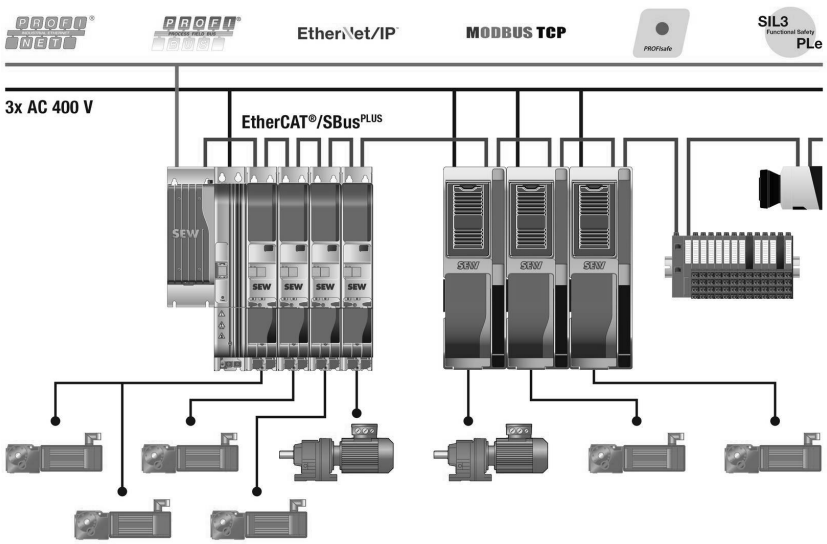
They offer a powerful clock-synchronous connection via the integrated EtherCAT®/ SBus^{PLUS} communication interface. Other EtherCAT® clients from SEW-EURODRIVE or other manufacturers can be controlled and diagnosed by the MOVI-C® CONTROLLER.

The MOVI-C® CONTROLLER offers the following functionalities:

- Freely programmable sequence control in accordance with IEC 6-1131-3 for automating drive and logic tasks.
- Central data storage for all MOVI-C® inverters from SEW-EURODRIVE at the EtherCAT®/SBus^{PLUS}.
- Plug-and-play device replacement through automatic data recovery.
- Central setpoint input for clock-synchronous drives and for auxiliary drives.
- Motion functions: Speed control, torque specification, position specification, phase-synchronous operation, cams, application modules, kinematic models.
- EtherCAT®/SBus^{PLUS} master for SEW-EURODRIVE components and for third-party components.
- Fieldbus device connection to higher-level control systems.
- Diagnostics and visualization of the automation system.



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The new engineering software MOVISUITE® is the central module of the MOVI-C® modular automation system. MOVISUITE® allows for intuitive operation with modern operating concepts.

The central functions of MOVISUITE® are:

- Network scan.
- Device startup and parameterization.
- Data storage and data management.
- Scope and diagnostics.
- Programming environment for the MOVI-C® CONTROLLER.

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- Programming environment for functional safety.
- Parameterization and diagnostics environment for application modules.

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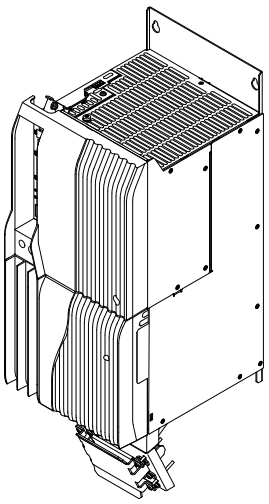
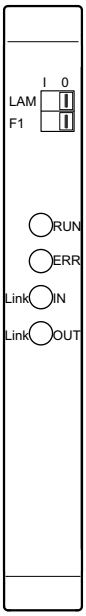
1.1 Devices at a glance

Power supply modules with supply and energy recovery	
MDR91A..	Description: (→ 🗎 9) Technical data: (→ 🗎 11) Dimension drawings: (→ 🗎 16)
	• Performance classes: 50/75 kW • Voltage range: 3 × 380 – 480 V, 50 – 60 Hz • Nominal DC link voltage: DC 560 V • Overload capacity: 225% of nominal power for 1 s • XSE31A EtherCAT®-compatible system bus For further information on this device, refer to the following documents: • "MOVIDRIVE® modular Application Inverters - Power supply module with supply and energy recovery " operating instructions • "MOVIDRIVE® modular Application Inverters - Power supply module with supply and energy recovery " product manual • "MOVIDRIVE® modular application inverter" operating instructions • "MOVIDRIVE® modular application inverter" product manual

Cards	
XSE31A EtherCAT®-compatible system bus	Description: (→ 🗎 10) Technical data: (→ 🗎 17)
	

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1.2 MDR91A energy recovery module product overview

Up to 15 axis modules, single-axis as well as double-axis modules, can be connected to a power supply module with supply and energy recovery. Regenerative energy is fed back into the power supply. If the power supply fails, regenerative energy can be discharged via a braking resistor.

Characteristics

- Performance classes: 50/75 kW.
- Universal use due to a wide voltage range for line connection: 3 × AC 380 – 480 V, 50 – 60 Hz
- Suited for TN/TT voltage supply systems.
- Communication to the axis modules via the module bus.
- High overload capacity of the nominal power of 225% for 1 s.

Device data

Nominal grid voltage According to EN 50160	3 × AC 380 – 480 V
Line frequency	50 – 60 Hz ±5%
Nominal DC link voltage	DC 560 V

Type designation	Nominal power	Nominal DC link current	Maximum DC link current	Nominal line current	Size	Technical data
	kW	A	A	A		
MDR91A-0500-503-4-000	50	94	235	80	4	(→ 11)
MDR91A-0750-503-4-000	75	141	353	121	4	

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1.3 Product overview accessories

1.3.1 XSE31A EtherCAT®-compatible system bus

The XSE31A system bus card is a slave module for connection to EtherCAT® networks. With the XSE31A system bus card, the energy recovery module can communicate with all EtherCAT® master systems.

All standards of ETG (EtherCAT® Technology Group) such as, e.g., for wiring, are supported. This means the cables must be wired at the front by the customer.

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2 Technical data

2.1 Markings

2.1.1 Basic device

The MOVIDRIVE® modular application inverter complies with the following regulations and guidelines:

Marking	Meaning
CE	The CE marking states the compliance with the following European guidelines: • 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 hazardous substances in electric and electronic equipment
EAC	The EAC marking states compliance with the requirements of the technical regulations of the Customs Union of Russia, Kazakhstan, and Belarus.
RCM	The RCM marking sates compliance with the technical regulations of the Australian Communications and Media Authority ACMA.
50	The China RoHS marking states compliance with directive SJ/T 11364-2014 for limiting the use of hazardous substances in electric and electronic equipment.
c UL us LISTED	The UL and cUL marking state the UL approval. cUL is equivalent to CSA approval.

2.1.2 Accessories

Braking resistors BW..

Marking	Definition
CE	The CE marking states the compliance with the following European guidelines: • Low Voltage Directive 2014/35/EU • Directive 2011/65/EU for limiting the use of hazardous substances in electric and electronic equipment
25 e	The China RoHS marking states compliance with directive SJ/T 11364-2014 for limiting the use of hazardous substances in electric and electronic equipment.
c UR us	The cUR marking states the UL approval for this component.

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NF.. line filter

Marking	Definition
–	• Directive 2011/65/EU for limiting the use of hazardous substances in electric and electronic equipment
	The China RoHS marking states compliance with directive SJ/T 11364-2014 for limiting the use of hazardous substances in electric and electronic equipment.
	The cUR marking states the UL approval for this component.

ND.. line choke

Marking	Definition
	The CE marking states the compliance with the following European guidelines: • Low Voltage Directive 2014/35/EU • Directive 2011/65/EU for limiting the use of hazardous substances in electric and electronic equipment
	The China RoHS marking states compliance with directive SJ/T 11364-2014 for limiting the use of hazardous substances in electric and electronic equipment.
	The cUR marking states the UL approval for this component.

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2.2 General technical data

The following table lists the technical data for the power supply modules with supply and energy recovery independently of

- Design
- Size
- Power

MOVIDRIVE® modular	
Interference immunity	Meets EN 61800-3; 2. Environment
Interference emission	Limit value category C2 to EN 61800-3
Ambient temperature ϑ_{amb}	0 °C to +45 °C without derating
Type of cooling	Increased air cooling due to an installed, temperature-controlled fan.

Environmental conditions	
Climatic requirements	• Extended storage: EN 60721-3-1 class 1K2 temperature -25 °C to +70 °C • Transportation: EN 60721-3-2 class 2K3 temperature -25 °C to +70 °C • Operation (fixed installation, weatherproof): EN 60721-3-3 class 3K3 temperature 0 °C to +45 °C
Chemically active substances	• Extended storage: EN 60721-3-1 class 1C2 • Transportation: EN 60721-3-2 class 2C2 • Operation (fixed installation, weatherproof): EN 60721-3-3 class 3C2
Mechanically active substances	• Extended storage: EN 60721-3-1 class 1S1 • Transportation: EN 60721-3-1 class 2S1 • Operation (fixed installation, weatherproof): EN 60721-3-3 class 3S1
Vibration testing	• VDE 160 according to EN 61800-5-1

Degree of protection according to EN 60529	
Power supply modules with supply and energy recovery MDR91A-0500/0750-..	IP20

Pollution class	2 according to IEC 60664-1
Overvoltage category	III according to IEC 60664-1
Installation altitude	Up to h ≤ 1000 m without restrictions. The following restrictions apply to heights > 1000 m: • From 1000 m to max. 3800 m: I_N reduction by 1% per 100 m • From 2000 m to max. 3800 m: To maintain protective separation and the air gaps and to comply with creepage distances according to EN 61800-5-1, an overvoltage protection device must be connected upstream to reduce the overvoltages from category III to category II.

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2.3 Technical data

2.3.1 Performance data

MOVIDRIVE® modular	Unit	MDR91A-...-503-4-...	
Type		**0500**	**0750**
Size		4	
Nominal power P_N	kW	50	75
Input			
Nominal line voltage (to EN 50160) AC V_{line}	V	3 × 380 – 480 V	
Nominal line current AC I_{line}	A	80	121
Line frequency f_{line}	Hz	50 – 60 Hz ±5%	
Nominal power in test/emergency mode – motor mode	kW	50	75
Connection contacts X1_A		Screw M10 × 18 Max. 70 mm²	
Auxiliary supply connection X1_B			
Nominal line voltage (to EN 50160) AC V_{line}	V	1 × 380 – 480 V	
Nominal line current AC I_{line}	A	12	
Line frequency f_{line}	Hz	50 – 60 Hz ±5%	
Connection contacts X1_B		Plug connector Max. 2.5 mm²	
Output (DC link)			
Nominal DC link voltage U_{NDCL}	V	DC 560	
Nominal DC link current DC I_{NDCL}	A	94	141
Max. DC link current DC $I_{DCL\ max}$	A	235	353
Overload capacity		225% × P_N: 1 s for cycle duration 10 s[1)]	
Connection for UZ-/UZ+		CU busbars	
		2 screw, M6 × 16	
PE connection		1 × screw M6 × 16	
Brake chopper and braking resistor			
Minimum braking resistance value R_{BRmin}	Ω	3.5	
Brake chopper power	kW	250% × P_N	
Mean dischargeable power in regenerative operation	kW	25% × P_N	
P_{eff} of the integrated braking resistance	kW	-	-
P_{max} of the integrated braking resistance	kW	-	-
Connection contacts X3		Screw M6 × 16 Max. 35 mm²	
General			
Nominal power loss 24 V	W	45	
Nominal power loss power section	W	300	400
Permitted number of times power may be switched on/ off per minute	min^{-1}	< 1	
Minimum switch-off time for power off	s	10	10
Mass	kg	21	21
Dimensions			
Width	mm	210	
Height	mm	621	
Depth	mm	263	

1) Depending on the line voltage and the relative short-circuit voltage at the connection of the energy recovery module. The connection is the input of the NF line filter.

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2.3.2 Electronics data – signal terminals

MDR91A-...-503-4-...	Terminal	General electronics data
DC 24 V voltage supply	X5	DC 24 V -10%, +20% according to IEC 61131
Cross-section and contacts	X5	Copper busbars, 2 × M4 × 10 screw
Evaluation of temperature sensor at braking resistor	X7.1	DC 24 V auxiliary voltage output to supply X7:2
	X7.2	Sensor input for temperature monitoring of the braking resistor. • Signal contact closed: No overtemperature. • Signal contact open: Overtemperature. Connect isolated signal contacts only.
	X7.3/4	DCOM/GND
Port		Plug connector - 1 core: 0.25 – 0.5 mm^2

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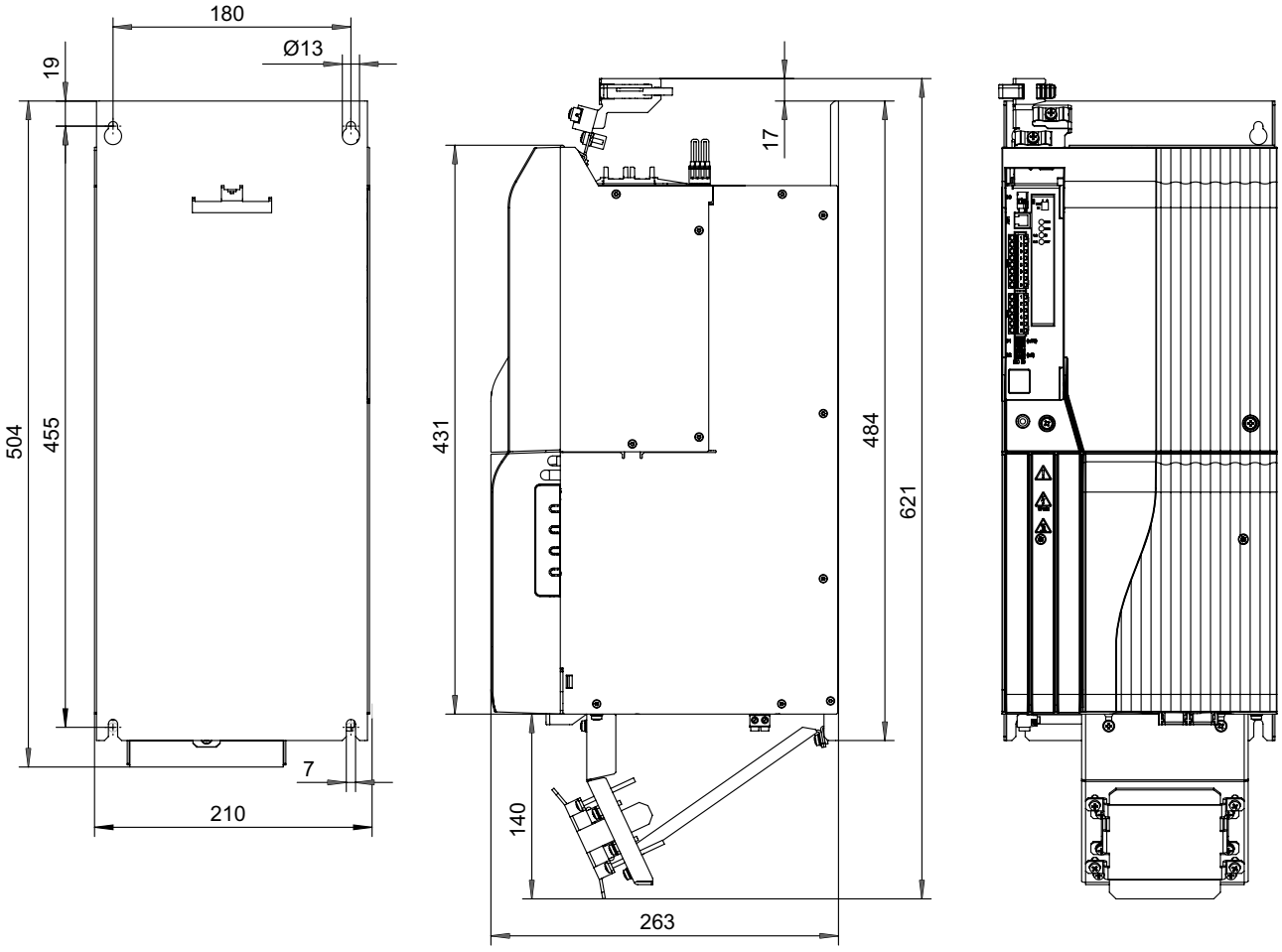
2.4 Dimension drawing



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2.5 Technical data for XSE31A EtherCAT®-compatible system bus

XSE31A	
Standards	IEC 61158, IEC 61784-2
Baud rate	100 MBaud full duplex
Connection technology	2 × RJ45 (8 × 8 modular jack)
Bus termination	Not integrated, as bus termination is activated automatically
OSI layer	Ethernet II
Station address	Setting via EtherCAT® master

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2.6 Technical data of braking resistors, filters and chokes

2.6.1 Braking resistors type BW.../BW...-T

General

The BW... / BW...-T braking resistors are adapted to the technical characteristics of the application inverter.

Braking resistors with different continuous and peak braking powers are available.

The braking resistors can be protected against overload and overtemperature by the customer when a thermal overload relay is used. The tripping current is set to the value I_F, see for this the following "tables" (→ 🗎 19).

The braking resistors of the series BW...-T are equipped with an integrated temperature switch that monitors the temperature. If the nominal operating temperature is exceeded, the temperature switch triggers a signal contact. The temperature switch does not switch off the braking resistor. This is why the temperature switch must be evaluated to avoid thermal overload of the braking resistor.

INFORMATION

Use of protection devices

Use only the protection devices listed in the following section:

- Internal temperature switch -T
- External bimetallic relay

→ See also chapter Protection against thermal overload of the braking resistor.

UL and cUL approval

The listed braking resistors have cRUus approvals independent of the application inverter.

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Technical data and assignment to an inverter

Technical data

Braking resistor	Unit	BW047-002[1)]	BW047-010-T	BW027-016-T	BW027-024-T
Part number		08281661	17983207	17983215	17983231
Nominal power P_N	kW	0.2	1	1.6	2.4
Resistance value R_{BW}	Ω	47 ±10%	47 ±10%	27 ± 10%	
Tripping current I_{trip}	A	1.6	4.6	7.7	9.4
Design		Flat-type resistor	Wire resistor		
Power connections		-	0.75 – 10 mm²		
Tightening torque	Nm	-	1.5 – 1.8		
PE connection		-	M6 stud		
Tightening torque PE	Nm	-	1.8		
Degree of protection		IP65	IP20		
Ambient temperature ϑ_{amb}		-20 °C to +40 °C			
Mass	kg	0.6	4	5.8	8

1) In the documented assignment of inverter and flat-type resistor, flat-type resistors have a thermal protection (non-replaceable fuse) that interrupts the current circuit in the event of overload.

Assignment to an inverter

Braking resistor	Unit	BW047-002	BW047-010-T	BW027-016-T	BW027-024-T
Assignment to MDP90A-..		0100 – 1100			
Assignment to MDR91A-..		0500/0750			

Technical data

Braking resistor	Unit	BW012-016	BW012-024	BW012-050-T
Part number		18213243	17983894	18201407
Nominal power P_N	kW	1.6	2.4	5
Resistance value R_{BW}	Ω	12 ± 10%		
Tripping current I_{trip}	A	11.5	14.1	20.4
Design		Wire resistor		Grid resistor
Power connections		0.75 – 10 mm²		M8 stud
Tightening torque	Nm	1.5 – 1.8		6
PE connection		M6 stud		M6 stud
Tightening torque PE	Nm	1.8		3
Degree of protection		IP20		
Ambient temperature ϑ_{amb}		-20 °C to +40 °C		
Mass	kg	5.8	8	12

Assignment to an inverter

Braking resistor	Unit	BW012-016	BW012-024	BW012-050-T
Assignment to MDP90A-..		0250 – 1100		
Assignment to MDR91A-..		0500/0750		

Technical data

Braking resistor	Unit	BW106-T	BW206-T	BW005-070	BW004-050-01	BW002-070	BW003-420-T
Part number		18200834	18204120	17983282	18200133	17983304	13302345
Nominal power P_N	kW	13.5	18	7	5	7	42
Resistance value R_{BW}	Ω	6 ± 10%		4.7 ± 10%	3.6 ± 10%	2.3 ± 10%	2.5 ± 10%
Tripping current I_{trip}	A	47.4	54.7	38.6	37.3	55.2	135.1
Design		Grid resistor					
Power connections		M8 stud				M8 stud	M12 stud
Tightening torque	Nm	6				6	15.5
PE connection		M6 stud				M6 stud	M10 stud
Tightening torque PE	Nm	3				3	10

Braking resistor	Unit	BW106-T	BW206-T	BW005-070	BW004-050-01	BW002-070	BW003-420-T
Degree of protection		IP20					
Ambient temperature ϑ_{amb}		-20 °C to +40 °C					
Mass	kg	30	40	13	12	33	93

Assignment to an inverter

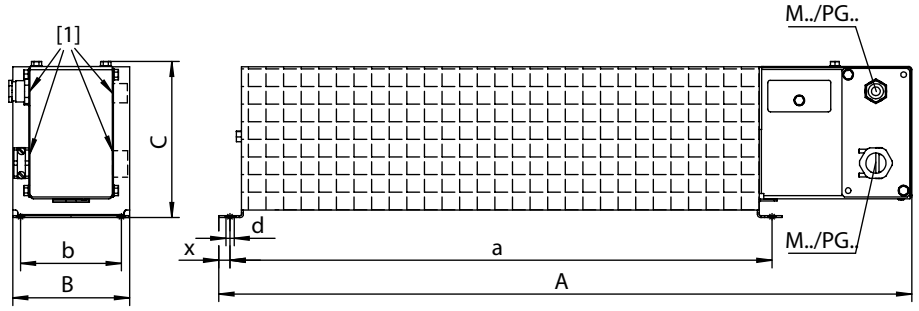
Braking resistor	Unit	BW106-T	BW206-T	BW005-070	BW004-050-01	BW003-420-T	BW002-070
Assignment to MDP90A-..		0500 – 1100			0750 – 1100	1100	
Assignment to MDR91A-..		0500/0750			0750	-	-

Technical data BW..-T signal contact

Specifications for BW..-T signal contact	Design
Connection contacts	0.75 – 2.5 mm²
Tightening torque	0.6 Nm
Switching capacity	DC 2 A / DC 24 V (DC11) AC 2 A / AC 230 V (AC11)
Switch contact (NC contact)	According to EN 61800-5-1

Dimension drawings and dimensions

Wire resistor



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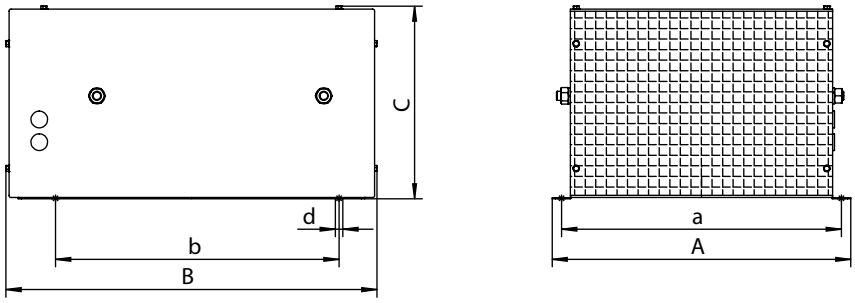
[1] Cable entry is possible from both sides.

Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW47-010-T	749	92	125	630	80	6.5	8	M25+M12
BW027-016-T	649	185	125	530	150	6.5	8	M25+M12
BW027-024-T	649	275	125	530	240	6.5	8	M25+M12
BW012-016	649	185	120	530	150	6.5	8	M25
BW012-024	649	275	125	530	240	6.5	9	M25

Grid resistor mounting position 1



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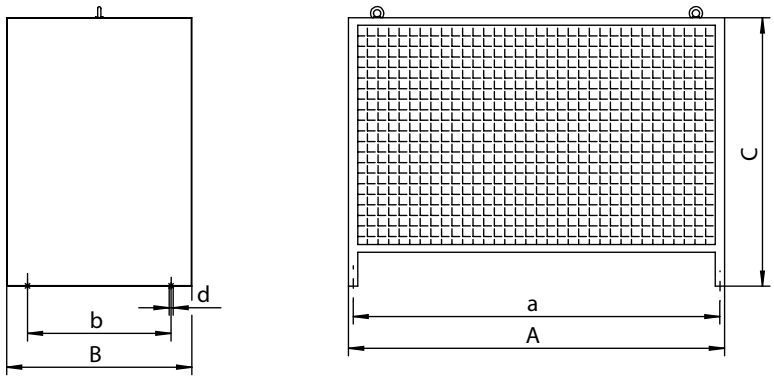
Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW012-050-T	395	490	260	370	380	10.5	-	-
BW106-T	795	490	270	770	380	10.5	-	-
BW206-T	995	490	270	970	380	10.5	-	-
BW005-070	395	490	260	370	380	10.5	-	-
BW004-050-01	395	490	260	370	380	10.5	-	-
BW002-070	395	490	260	370	380	10.5	-	-

Grid resistor mounting position 2



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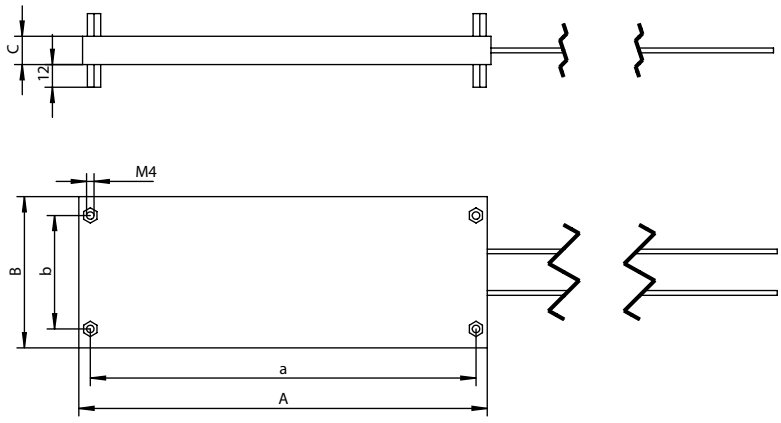
Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW003-420-T	995	490	710	970	380	10.5	-	-

Flat type resistor



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Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW047-002	110	80	15	98	60	-	-	-

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2.6.2 Line filter

Line filters are used to suppress interference emission on the line side of inverters.

UL and cUL approval

The listed line filters have cRUus approvals independent of the application inverter.

Technical data

Line filter	NF0420-513	NF0420-523
Part number	17983789	17983797
Nominal line voltage V_N	Maximum 3 × AC 500 V, 50/60 Hz	
Nominal current I_N	42 A	
Nominal power loss	30 W	37 W
Ambient temperature ϑ_{amb}	0 °C to 45 °C	
Terminal contacts L1/L2/L3 - L1'/L2'/L3'	2.5 – 16 mm²	
Tightening torque L1/L2/L3 - L1'/L2'/L3'	2 – 4 Nm	2 – 2.3 Nm
PE terminal contact	M6	
Tightening torque PE	6 Nm	
Degree of protection	IP20 according to EN 60529	
Weight	3 kg	4.5 kg

Line filter	NF0910-523	NF1800-523
Part number	17987504	17987865
Nominal line voltage V_N	Maximum 3 × AC 500 V, 50/60 Hz	
Nominal current I_N	91 A	180 A
Nominal power loss	51.5 W	89 W
Ambient temperature ϑ_{amb}	0 °C to 45 °C	
Terminal contacts L1/L2/L3 - L1'/L2'/L3'	25 – 50 mm²	16 – 120 mm²
Tightening torque L1/L2/L3 - L1'/L2'/L3'	6 – 8 Nm	12 – 20 Nm
PE terminal contact	M8	M10
Tightening torque PE	12 Nm	23 Nm
Degree of protection	IP20 according to EN 60529	
Weight	5 kg	9 kg

Assignment to an inverter

Line filter	NF0420-513	NF0420-523
Assignment to MDP90A-..	0100, 0250	

Line filter	NF0910-523	NF1800-523
Assignment to MDP90A-..	0500	0750, 1100
Assignment to MDR91A-..	0500	0750

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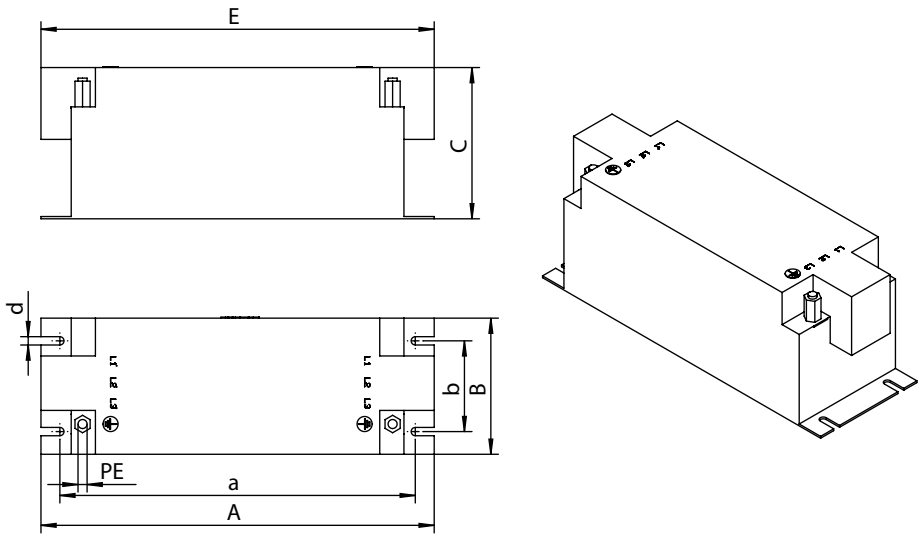
Dimension drawings and dimensions



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Line filter	Main dimensions in mm				Mounting dimensions in mm			
	A	B	C	E	a	b	d	PE
NF0420-513	250	88	97	255	235	60	5.5	M6
NF0420-523	330	83	187	340	314	55	6.5	M6
NF0910-523	270	100	152	320	255	65	6.5	M8
NF1800-523	380	132	185	465	365	102	6.5	M10

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2.6.3 Line choke

- To support overvoltage protection.
- To smoothen the line current, to reduce harmonics.
- For protection in the event of distorted line voltage.
- For limiting the inrush current.

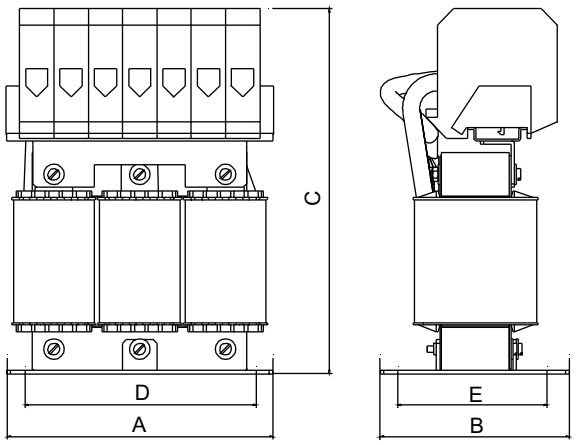
UL and cUL approval

The listed line chokes have cRUus approvals independent of the application inverter.

Technical data

		Unit	Line choke	
			ND085-0053 (50 kW)	ND150-0033 (75 kW)
			17970679	17972396
Nominal line voltage V_{line} (to EN 50160)		V_{AC}	3 × 380 V – 3 × 500 V 50/60 Hz	
Nominal current I_N		A	85	150
Power loss at 50% / 100%		W	20/40	50 / 100
Ambient temperature		°C	-25 °C to +45 °C	
Inductance		µH	50	30
Degree of protection according to EN 60529		–	IP00	
Mass		kg	6.0	15
Max. connection cross-section		mm^2	50	50
Dimensions	A	mm	160	250
	B	mm	125	110
	C	mm	216	282
Fastening dimensions	D	mm	135	180
	E	mm	95	98

Dimension drawing



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3 Project planning

3.1 EMC-compliant installation according to EN 61800-3

The application inverter is designed for use as a component for installation in machinery and systems. The components comply with the EMC product standard EN 61800-3 "Variable-speed electrical drives".

In the event of compliance with the instructions for EMC-compliant installation, the corresponding prerequisites for CE marking for the entire machine/system in which they are installed are thus satisfied on the basis of EMC Directive 2014/30/EU.

All the information on the topic of "EMC-compliant installation" applies to the entire axis system. Observe also the information in the operating instructions of the application inverter.

3.1.1 Interference immunity

With regard to interference immunity, the application inverter meets all the requirements stipulated in EN 61000-6-2 and EN 61800-3.

3.1.2 Interference emission

Higher levels of interference than in residential environments are permitted in industrial environments. In such an environment, it may be possible to dispense with the measures described below, depending on the situation of the supply system and the machine configuration.

Interference emission category

Compliance with category "C2" according to EN 61800-3 (see also chapter "Technical data" (→ 🗎 11)) has been tested on a specified test setup. SEW-EURODRIVE can provide detailed information on request.

⚠ CAUTION

This product may cause high-frequency interferences in residential areas which may then require measures for interference suppression.

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3.2 Project planning for power supply module with supply and energy recovery

The size of a power supply module with supply and energy recovery is defined by the following factors:

- The overload capacity that must be planned, taking into account the line voltage V_{line} and the relative short-circuit voltage u_K of the power supply.
- Total effective power of all axis modules: $P_{rms} < P_N$, motoring and regenerative.
- Continuous power toward the braking resistor: The continuous power must not exceed 25% of the nominal power of the power supply module with supply and energy recovery.
- The maximum permissible axis size is the 140 A axis.
- The total sum rule: The total sum of all nominal currents of the axis modules must not exceed three times the nominal DC link current of the power supply module.

The rated power of the power supply module with supply and energy recovery refers to the effective power; that is, the magnetizing currents of the motors need not be taken into account in this case.

INFORMATION

Important: The total power (DC link power) is the result of the overlapping cycles of the individual connected axis modules.

Changing the assignment of cycles with respect to time significantly affects the motor and regenerative load of the power supply module with supply and energy recovery. It is necessary to take a worst-case scenario into account.

Due to the complexity, the calculation can only be made using software. The software is a tool of the SEW Workbench.

3.3 Project planning for axis modules and motors

The project planning of the axis modules is carried out with SEW-Workbench.

For project planning notes for the axis modules, refer to the "MOVIDRIVE® modular Application Inverters" product manual.

For project planning notes for the motors, refer to the "Synchronous Servomotors" and "AC Motors" catalogs.

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3.4 Line contactors and line fuses

3.4.1 Line contactor

- Only use contactors in utilization category AC-3 (IEC 158-1) as line contactors and precharging contactors.
- The line contactor K11 is intended solely for switching the device on and off.

NOTICE

Non-compliance with the switch-on/switch-off times

Destruction of the device

- Observe a minimum switch-off time of 10 s for the line contactor K11.
- Do not switch on / switch off the line more than once per minute and not more frequently than 10 times within 30 minutes.

The line contactor K11 must always be placed before the line filter of the power supply module with supply and energy recovery.

3.4.2 Line fuse types

Miniature circuit breakers in utilization category gL, gG:

- Nominal fusing voltage ≥ nominal line voltage

Miniature circuit breakers with characteristics B, C and D:

- Nominal voltage of the miniature circuit breakers ≥ nominal line voltage
- The nominal currents of miniature circuit breakers must be more than 10% of the nominal line current of the power supply module with supply and energy recovery.

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3.5 Projecting the power supply

The project planning of the power supply described in this chapter explains a rough dimensioning of the power supply. For the exact project planning, use SEW-Workbench.

For information about the permitted voltage systems, refer to chapter "Permitted voltage supply systems" (→ 🖹 64).

NOTICE

Operating one or more power supply modules with supply and energy recovery on supply systems with power factor correction equipment that is not equipped **with** chokes is not permitted.

Energy recovery requires a stable and sufficiently dimensioned supply system for reliable operation. The following tables list the minimum required short-circuit power of the supply system, taking into account maximum device overload and the general requirements for the supply system.

The u_{K_MDR} value is necessary for determining the required apparent transformer power with respect to cable length.

Table 1: Basic table for the selecting of the u_{K_MDR} value

	P_{max} in %					50 kW	75 kW
u_{K_MDR} in %	380 V (±10%)	400 V (±5%)	400 V (±10%)	460 V (±10%)	480 V (±10%)	S_{K_MDR} in kVA	S_{K_MDR} in kVA
1.50%	125%	225%	175%	175%	150%	3333	5000
2.00%	100%	200%	150%	150%	150%	2500	3750

u_{K_MDR} in %: Relative short-circuit voltage of the power supply at the device connection

P_{max} in %: Current device overload based on the rated device power

S_{K_MDR} in kVA: Min. required short-circuit power of the supply system at the regenerative power supply module input. The connection is the input of the NF line filter. Impedances of the supply cable must be taken into account

General requirements on the power supply system

	MDR91A-0500-…	MDR91A-0750-…
Permitted voltage distortion according to EN 61000-2-4, class 3	THD ≤ 10%	
Permitted frequency change Δf/t in Hz/s	±1% × f_{line}/1 s	
Permitted voltage asymmetry	3% of the negative-sequence component	

The following tables list the minimum required apparent transformer power ratings for a relative short-circuit voltage u_{K_Trafo} = 6% (common in practice) depending on the maximum device overload in % taking account of the transformer line length → line filter → MDR91A.

The specified minimum transformer power values are required for a stable supply system with sufficient capacity, which is the basis for reliable operation of a regenerative power supply unit. They do not indicate the required drive power.

Application example

A high-bay warehouse with 5 storage/retrieval systems (SRS) is equipped with one MDR91A-0500-503-00 supply and energy recovery module per SRS. According to the projected drive, the maximum device overload is 145%, the maximum line length (transformer → NF... line filter input) is 245 m.

The nominal line voltage is 3 x 400 V (±10%), 50 Hz.

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The high-bay warehouse is supplied by a transformer with S = 1500 kVA, 400 V (±10%), 50 Hz, relative short-circuit voltage u_K = 6%.

- Step 1

  Choose the u_{K_MDR} value from the basic table (table 1) depending on the overload requirements and the existing supply system.

- Step 2

  The table in which the required device overload and the given line voltage are listed is selected, depending on the u_{K_MDR} value determined from the basic table (table 1). In this example table 2.

  Example: Table 2

  – 400 V (±10%), 50 Hz

  – u_{K_MDR} = 2%

  – Maximum permitted device overload = 150%

- Step 3

  Determination of the maximum line length from which the minimum required apparent transformer power for a device is derived, in the example: 263 kVA.

Table 2: u_{K_MDR} value chosen in the basis table in %: 2.0

Table 2 MDR91A-0500-…					Cable length in m								
					50	100	150	200	250	300	350	400	500
V_{line} in V		f_{line} in Hz	Max. permitted device overload in %	u_{K_Trafo} in %	Minimum required apparent transformer power in kVA								
380	±10%	50	100%	6%	166	185	210	242	286	350	449	629	3114
400	±5%	50	200%		164	181	202	229	263	310	376	480	1064
400	±10%	50	**150%**		164	181	202	229	**263**	310	376	480	1064
460	±10%	60	150%		163	178	196	218	246	282	330	398	680
480	±10%	60	150%		162	175	191	210	234	263	301	351	528

- Step 4

  Calculation of the minimum required apparent transformer power.

  Example: 5 × 263 kVA = 1315 kVA

- Step 5

  Check whether the installed transformer power is sufficient.

  Example: 1315 kVA < 1500 kVA, which means the apparent transformer power is sufficient for the 5 SRUs.

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3.5.1 50 kW variant

Table 3: u_{K_MDR} value chosen in the basis table in %: 1.5

Table 3 MDR91A-0500-…					Cable length in m								
					50	100	150	200	250	300	350	400	500
V_{line} in V		f_{line} in Hz	Max. permitted device overload in %	u_{K_Trafo} in %	Minimum required apparent transformer power in kVA								
380	±10%	50	125%	6%	229	268	323	406	547	838	–	–	–
400	±5%	50	225%		226	259	305	369	468	639	–	–	–
400	±10%	50	175%		226	259	305	369	468	639	–	–	–
460	±10%	60	175%		223	252	291	342	416	531	734	–	–
480	±10%	60	150%		221	247	280	324	383	468	603	846	–

Table 4: u_{K_MDR} value chosen in the basis table in %: 2.0

Table 4 MDR91A-0500-…					Cable length in m								
					50	100	150	200	250	300	350	400	500
V_{line} in V		f_{line} in Hz	Max. permitted device overload in %	u_{K_Trafo} in %	Minimum required apparent transformer power in kVA								
380	±10%	50	100%	6%	166	185	210	242	286	350	449	629	–
400	±5%	50	200%		164	181	202	229	263	310	376	480	–
400	±10%	50	150%		164	181	202	229	263	310	376	480	–
460	±10%	60	150%		163	178	196	218	246	282	330	398	680
480	±10%	60	150%		162	175	191	210	234	263	301	351	528

3.5.2 75 kW variant

Table 5: u_{K_MDR} value chosen in the basis table in %: 1.5

Table 5 MDR91A-0750-…					Cable length in m								
					50	100	150	200	250	300	350	400	500
V_{line} in V		f_{line} in Hz	Max. permitted unit overload in %	u_{K_Trafo} in %	Minimum required apparent transformer power in kVA								
380	±10%	50	125%	6%	371	484	699	–	–	–	–	–	–
400	±5%	50	225%		362	457	619	959	–	–	–	–	–
400	±10%	50	175%		362	457	619	959	–	–	–	–	–
460	±10%	60	175%		355	436	564	797	–	–	–	–	–
480	±10%	60	150%		350	420	526	702	–	–	–	–	–

Table 6: u_{K_MDR} value chosen in the basis table in %: 2.0

Table 6 MDR91A-0750-…					Cable length in m								
					50	100	150	200	250	300	350	400	500
V_{line} in V		f_{line} in Hz	Max. permitted device overload in %	u_{K_Trafo} in %	Minimum required apparent transformer power in kVA								
380	±10%	50	100%	6%	262	315	394	525	786	–	–	–	–
400	±5%	50	200%		164	303	367	464	633	992	–	–	–
400	±10%	50	150%		164	303	367	464	633	992	–	–	–
460	±10%	60	150%		255	294	347	423	542	754	–	–	–
480	±10%	60	150%		252	287	332	394	486	633	906	–	–

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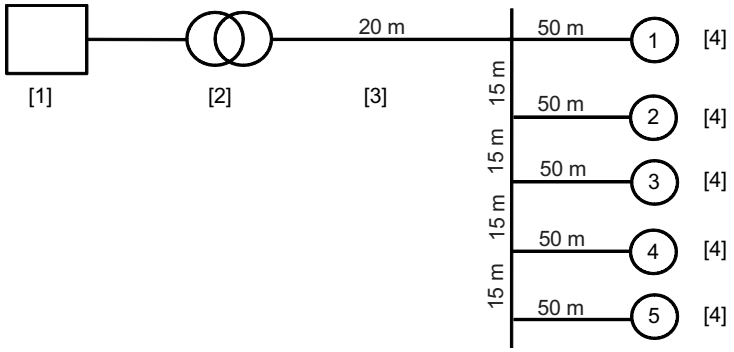
An exact calculation must be made in the event of a differing relative short-circuit voltage u_{K_Trafo} of the transformer or when critical conditions apply. This calculation can be made in the SEW-Workbench or on the basis of the following calculation example.

3.5.3 Project planning example

The following example shows the project planning for five MDR91A-0750-.. power supply modules with supply and energy recovery for storage/retrieval systems (SRS) of a high-bay warehouse.



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[1] Supply system of the electricity supply company
[2] Transformer
[3] Supply cable for sub-distribution unit
[4] Storage/retrieval systems, one MDR91A-.. per SRS

Requirements

- Data of the supply transformer at the system operator:

Rated voltage primary winding U_{Pri}	kV	10
Nominal voltage secondary winding U_N	V	400
Rated frequency f_R	Hz	50
Rated power S_r	kVA	2000
Relative short-circuit voltage u_{k_Trafo}	%	6

Calculation

Calculating the required apparent transformer power:

In the example, the cable length of the last aisle has the following length; see the drawing:

20 m + 4 × 15 m + 50 m = 130 m

To simplify calculation, the same cable length is used five times.

A value of 0.35 µH/m is assumed as a typical average value for the cable inductance. This results in the following k values:

Table k values:

Frequency	k value	Ω/m
50 Hz	2 × π × f × L	1.09955×10^{-4}
60 Hz	2 × π × f × L	1.31946×10^{-4}

k Calculation factor for average line inductance in Ω/m

f Nominal line frequency in Hz

L Average cable inductance 0.35 µH/m

The maximum device overload according to the project planning is 145%; the line voltage is 400 V (±10%) / 50 Hz. The relative short-circuit voltage resulting from the table in section "75 kW variant" (→ 🗎 30) is as follows:

u_{K_MDR} = 2%

Calculation of the required short-circuit power at the connection terminals of the line filter for **one** device:

$$S_{k\_MXR} = \frac{P_N}{u_{k\_MXR}}$$

$$S_{k\_MXR} = \frac{75\ kW}{0{,}025}$$

$$S_{k\_MXR} = 3000\ kVA$$

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P_N Rated device power

S_{k_MDR} Required short-circuit power in kVA

u_{k_MDR} Relative short-circuit voltage MDR based on the rated device power

Calculating the required line impedance Z_{k_MDR} for **one** device:

$$Z_{k\_MXR} = \frac{V^2_{line}}{S_{k\_MXR}}$$

$$Z_{k\_MXR} = \frac{(400\,V)^2}{3000\,kVA}$$

$$Z_{k\_MXR} = 0{,}0533\,\Omega$$

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Z_{k_MDR} Required grid impedance in Ω

V_{line} Nominal line voltage in V

S_{k_MDR} Required short-circuit power in kVA

Calculating the required apparent transformer power in kVA:

$$S_{Trafo} = n \times \left(u_{k\_Trafo} \times \frac{U^2_{Netz}}{Z_{k\_MDR} - k \times l} \right)$$

$$S_{Trafo} = 5 \times \left(0.06 \times \frac{(400V)^2}{0.04267\Omega - 2 \times \pi \times 50Hz \times 0.35 \frac{\mu H}{m} \times 130m} \right)$$

$$S_{Trafo} = 1692kVA$$

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S_{Trafo} Required apparent transformer power in kVA

n Number of devices

u_{k_Trafo} Relative short-circuit voltage of the transformer in %

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V_{line} Nominal line voltage in V

Z_{k_MDR} Required grid impedance in Ω

k k factor for average cable inductance (see k values table)

l Max. line length in m; transformer → MDR91A input terminals

Requirement:

$S_{Trafo} < S_r$ Requirement is fulfilled

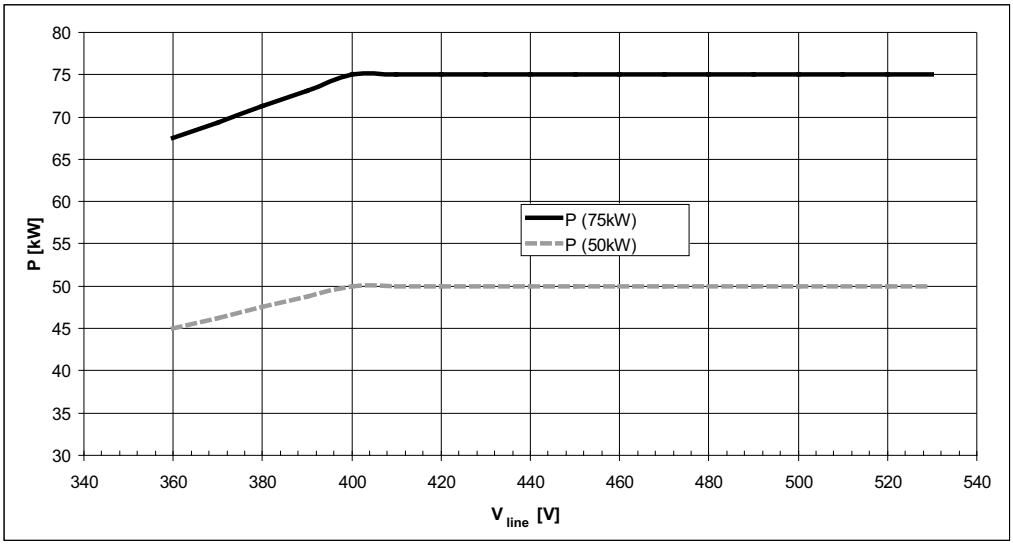
$1692\,kVA < 2000\,kVA$

S_{Trafo} Required apparent transformer power in kVA

S_R Nominal transformer power according to information on the nameplate in kVA

3.5.4 Output power with low line voltage

If the line voltage drops below the rated voltage of 400 V, the output power of the device is reduced.



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3.6 Projecting the cable cross sections

3.6.1 Special regulations

Comply with the **regulations issued by specific countries and for specific machines** regarding fusing and the selection of cable cross-sections. Also comply with the instructions for **UL-compliant installation** as applicable.

3.6.2 Power cable length

The cable length between the power supply module with supply and energy recovery and the line filter must not exceed 1.5 m; see chapter "Wiring diagrams" (→ 🗎 85).

The cable length between the line contactor and line filter must not exceed 5 m; see chapter "Wiring diagrams" (→ 🗎 85).

3.6.3 Cable cross-sections and cable fusing

SEW-EURODRIVE suggests the following cable cross-sections and cable fusing listed in the following chapter for single-core copper cables with PVC insulation laid in cable ducts at ambient temperatures of 40 °C.

3.7 Project planning for emergency braking resistor and braking resistor

The power supply module with supply and energy recovery must be operated with a braking resistor or an emergency braking resistor.

Under normal operating conditions, the power supply module with supply and energy recovery feeds regenerative energy that exceeds the DC link buffer capacity back into the supply system. In practice, however, operating states can occur that prevent the power supply module with supply and energy recovery from feeding back any energy into the supply system, e.g.:

- In the event of power failure
- In the event of the failure of individual line phases (also intermittently)
- In test/emergency mode

Without supply voltage, motor operation of the drives is not possible and the DC link can absorb regenerative energy only to a limited extent. The operating states described above can therefore cause the drives to coast to a halt, or the motor brake (if installed) is applied and stops the drive.

To prevent an uncontrolled stopping of the drives, an optional emergency braking resistor can be connected to the energy recovery module to bring the axes to a controlled stop in the event of such an emergency. The kinetic energy in the drives is then converted into heat energy via the emergency braking resistor.

The decision whether a braking resistor or an emergency braking resistor is used is made in the project planning phase.

A resistor designed as a braking resistor can also be used as an emergency braking resistor if the requirements regarding the amount of energy that can be absorbed are met. Refer to the technical data for the braking resistors.

The project planning for the emergency braking resistor as well as special information is described in the following chapters.

For project planning information for the braking resistor, see chapter "Project planning for emergency braking resistor and braking resistor" (→ 🗎 34) and the product manual of the inverter.

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⚠ WARNING

The connections leading to the emergency braking resistor or braking resistor carry a high DC voltage of up to DC 970 V.

Severe or fatal injuries.

- The emergency braking resistor and braking resistor cables must be suitable for this high DC voltage.
- Install the cables of the emergency braking resistor or braking resistor lines according to regulations.

⚠ WARNING

The surfaces of emergency braking resistors or braking resistors reach high temperatures of 100 °C or more when the braking resistor is loaded with P_N. Emergency braking resistors and braking resistors can usually be relied upon to provide their rated power for an extended period of time.

Risk of burns and fire.

- Choose a suitable installation location. Emergency braking resistors and braking resistors are usually mounted on top of the control cabinet.
- Do not touch the emergency braking resistor or braking resistor.
- Adhere to the necessary cool-down time of at least 5 minutes.
- This means that the ventilation, the size of the installation site, and the distance to components and parts at risk must be provided accordingly.

NOTICE

The **maximum permissible line length** between the energy recovery module and emergency braking resistor or braking resistor is **100 m**.

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3.7.1 Notes regarding emergency braking resistors

NOTICE

The data given in this chapter applies to BW... braking resistors if they are used as emergency braking resistors.

INFORMATION

Under normal operating conditions, the optional emergency braking resistor is not cyclically loaded but only in the described emergencies. The braking resistor can therefore be designed as an emergency braking resistor.

If an emergency braking resistor is used, test/emergency mode is possible only to a limited extent, e.g.:

- With reduced speed
- With reduced load
- With reduced acceleration and braking ramps

The following sequence shows the procedure for the project planning of an emergency braking resistor.

3.7.2 Selecting the emergency braking resistor

Selection criteria

The emergency braking resistor is selected based on the following criteria:

- Peak braking power
- Thermal braking power

Peak braking power

The DC link voltage and the emergency braking resistor value determine the maximum braking power P_{peak} that can be discharged from the DC link.

The peak braking power is determined as follows:

$$P_{peak} = \frac{U_{DC}^2}{R \times 1.4}$$

U_{DC} is the maximum DC link voltage and is DC 970 V.

The peak braking power P_{peak} for each braking resistor is listed in the table of emergency braking resistors.

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Determining the maximum emergency braking resistor power

Condition 1

The maximum power of the emergency braking resistor P_{peak} is greater than the maximum regenerative power P_{max} that is generated during emergency braking.

$P_{peak} \geq P_{max}$

P_{peak}	Maximum power according to the table (power which the emergency braking resistor can convert to heat energy).
P_{max}	Maximum power that the emergency braking resistor must discharge through the DC link.

Condition 2

The previously determined amount of regenerative energy W_{gen} is used for checking whether the emergency braking resistor can convert this energy into heat and to ensure the emergency braking resistor is not thermally overloaded.

$W_{max} \geq W_{gen}$

W_{max}	Maximum amount of energy that the emergency braking resistor can absorb.
W_{gen}	Total amount of energy of the application regenerated during emergency braking.

Thermal emergency braking power

The thermal load on the emergency braking resistor must be taken into account in the project planning for the emergency braking resistor.

The thermal load is calculated using the amount of energy of the entire emergency braking sequence.

- Determination of the maximum regenerative energy from the sum total of the travel profiles of all connected axes (taking into account the set emergency stop ramps and time sequences).

Protecting the emergency braking resistor

NOTICE

The emergency braking resistor has to be protected against thermal overload.

Do not use a motor protection switch.

For suitable protective measures, refer to chapter "Protection of the braking resistor and emergency braking resistor against thermal overload" (→ 🗎 65).

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Operating the supply and regenerative module in the event of supply system failure

NOTICE

Supply system failures, such as power failures, can cause the brake chopper to respond and load the braking resistor. This happens if the DC link cannot buffer any more regenerative energy. As a result, the mean utilization of the connected resistor might be exceeded, which will trigger the preventive measure (protection of the braking resistor).

The supply system quality can be a reason for this, for example. The supply system quality influences project planning for the braking resistor, especially if the resistor is designed as an emergency braking resistor.

If the braking resistor is designed as an emergency braking resistor, the following situations could occur, depending on the amount of regenerative energy:

- The thermal preventive measure triggers.
- Due to this load, the emergency braking resistor is no longer capable of converting the regenerative energy into heat energy in the event of an actual emergency. In this case, the thermal preventive measure trips.

3.7.3 Notes regarding braking resistors

For information on the braking resistors, refer to the "MOVIDRIVE® modular Application Inverters" product manual.

3.7.4 Selecting the braking resistor

For information on configuring a braking resistor, refer to the "MOVIDRIVE® modular Application Inverters" product manual.

3.7.5 Table of emergency braking resistors

Braking resistor	Part number	Resistance	Continuous power	Peak power	Tripping current	Amount of energy that can be absorbed
		Ω	kW	kW	A	kWs
BW027-016-T	17983215	27	1.6	25	7.7	55
BW027-024-T	17983231	27	2.4	25	9.4	71
BW012-016	18213243	12	1.6	56	12	37
BW012-024	17983894	12	2.4	56	14.1	71
BW012-050-T	18201407	12	5	56	20	500

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3.8 Selecting the 24 V supply

For information on dimensioning the 24 V supply, refer to the "MOVIDRIVE® modular Application Inverters" product manual.

3.9 Checklist for project planning

The use of a regenerative power supply unit involves certain demands on the quality of the supply system in order to ensure fault-free operation. The checklist includes the most important requirements. The check list supplements the product-specific documentation. Its objective is to verify important basic requirements for the operation of a regenerative power supply.

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3.9.1 Checklist

Technical data of the supply system (the transformer) on which the power supply module with supply and energy recovery is to be operated:

Power supply / transformer		
Rated power	kVA	:
Nominal grid voltage	V	:
Nominal line frequency	Hz	:
Rated short-circuit voltage V_k	%	:
Network configuration, e.g. TT, TN		:
THD value (contact your utility company, if necessary)	%	:
Are other power supply modules with supply and energy recovery operated on this supply system (transformer)?		:
If yes: • How many? • What is their total power?		:
Power factor correction equipment installed?		:
If yes, it is equipped with chokes?		
Cable length to supply system (transformer)	m	:
Ambient conditions		
Installation location (city, country)		:
Ambient conditions	°C	:
Installation altitude (above sea level)	m	:
Relative humidity	%	:
General information		
What has been your experience with the operation of power supply modules with supply and energy recovery?		:
Is a generator (such as emergency diesel generator) or a UPS installed in the supply system that is/are operated at the same time as the energy recovery?		:
Other, Comments		

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4 General information

4.1 About this documentation

The current version of the documentation is the original.

This documentation is an integral part of the product. The documentation is written for all employees who assemble, install, start up, and service this product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the machinery and its operation as well as persons who work on the product independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation or require further information, contact SEW-EURODRIVE.

4.2 Structure of the safety notes

4.2.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded
⚠ **DANGER**	Imminent hazard	Severe or fatal injuries
⚠ **WARNING**	Possible dangerous situation	Severe or fatal injuries
⚠ **CAUTION**	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the product or its environment
INFORMATION	Useful information or tip: Simplifies handling of the product.	

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4.2.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:

SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

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 hot surfaces
	Warning of risk of crushing
	Warning of suspended load
	Warning of automatic restart

4.2.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

⚠ **SIGNAL WORD** Type and source of hazard. Possible consequence(s) if disregarded. Measure(s) to prevent the hazard.

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4.3 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the product.

4.4 Content of the documentation

This documentation contains additional safety-related information and conditions for operation in safety-related applications.

4.5 Other applicable documentation

Observe the corresponding documentation for all further components.

4.6 Product names and trademarks

The brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

4.7 Copyright notice

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5 Safety notes

5.1 Preliminary information

The following general safety notes serve the purpose of preventing injury to persons and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components, also observe the relevant warning and safety notes.

5.2 Duties of the user

As the user, you must ensure that the basic safety notes are observed and complied with. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it.

As the user, you must ensure that all of the work listed in the following is carried out only by qualified specialists:

- Setup and installation
- Installation and connection
- Startup
- Maintenance and repairs
- Shutdown
- Disassembly

Ensure that the persons who work on the product pay attention to the following regulations, conditions, documentation, and information:

- National and regional safety and accident prevention regulations
- Warning and safety signs on the product
- All other relevant project planning documents, installation and startup instructions, and wiring diagrams
- Do not assemble, install or operate damaged products
- All system-specific specifications and conditions

Ensure that systems in which the product is installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical work equipment and accident prevention regulations.

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5.3 Target group

Specialist for mechanical work

Any mechanical work may only be performed by adequately qualified specialists. Specialists in the context of this documentation are persons familiar with the design, mechanical installation, troubleshooting, and maintenance of the product who possess the following qualifications:

- Qualification in the mechanical area in accordance with the national regulations
- Familiarity with this documentation

Specialist for electrotechnical work

Any electrotechnical work may only be performed by electrically skilled persons with a suitable education. Electrically skilled persons in the context of this documentation are persons familiar with electrical installation, startup, troubleshooting, and maintenance of the product who possess the following qualifications:

- Qualification in the electrotechnical area in accordance with the national regulations
- Familiarity with this documentation

Additional qualification

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 units, systems, and circuits in accordance with the standards of safety technology.

Instructed persons

All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately. The purpose of the instruction is that the persons are capable of performing the required tasks and work steps in a safe and correct manner.

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5.4 Functional safety technology

The product must not perform any safety functions without a higher-level safety system, unless explicitly allowed by the documentation.

5.5 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.
- Before transportation, cover the connections with the supplied protection caps.
- Only place the product on the cooling fins or on the side without connectors during transportation.
- Always use lifting eyes if available.

If necessary, use suitable, sufficiently dimensioned handling equipment.

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

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5.6 Installation/assembly

Ensure that the product is installed and cooled according to 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 components are not deformed and that insulation spaces are maintained, particularly during transportation. Electric components must not be mechanically damaged or destroyed.

Observe the notes in the chapter "Mechanical installation" of the documentation.

5.6.1 Restrictions of use

The following applications are prohibited unless explicitly permitted:

- Use in potentially explosive areas
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, and radiation
- Operation in applications with impermissibly high mechanical vibration and shock loads in excess of the regulations stipulated in EN 61800-5-1
- Operation at installation altitudes above 3800 m above sea level

The product can be used at altitudes above 1000 m asl up to 3800 m asl under the following conditions:

- Taking the reduced continuous rated current into consideration, see chapter "Technical data" of the documentation.
- Above 2000 m asl, the air and creeping distances are only sufficient for overvoltage class II according to EN 60664. If the installation requires overvoltage category III according to EN 60664 you have to reduce the overvoltages on the system side from category III to II using additional external overvoltage protection.
- If a protective electrical separation is required, then implement this outside the product at altitudes of more than 2000 m above sea level (protective separation in accordance with EN 61800-5-1 and EN 60204-1)

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5.7 Electrical installation

Ensure that all of the required covers are correctly attached after carrying out 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).

5.7.1 Required preventive measure

Make sure that the product is correctly attached to the ground connection.

5.7.2 Stationary application

Necessary preventive measure for the product is:

Type of energy transfer	Preventive measure
Direct power supply	• Ground connection

5.7.3 Regenerative operation

The drive is operated as a generator due to the kinetic energy of the system/machine. Before opening the connection box, secure the output shaft against rotation.

5.8 Protective separation

The product meets all requirements for protective separation of power and electronics connections in accordance with EN 61800-5-1. To ensure protective separation, all connected circuits must also meet the requirements for protective separation.

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5.9 Startup/operation

Observe the safety notes in the chapters "Startup" and "Operation" in the documentation.

Make sure that the present transport protection is removed.

Do not deactivate monitoring and protection devices of the machine or system even for a test run.

Make sure the connection boxes are closed and screwed before connecting the supply voltage.

Depending on the degree of protection, products may have live, uninsulated, and sometimes moving or rotating parts, as well as hot surfaces during operation.

Additional preventive measures may be required for applications with increased hazard potential. You have to check the protection devices after each modification.

When in doubt, switch off the product whenever changes occur in relation to normal operation. Possible changes are e.g. increased temperatures, noise, or oscillation. Determine the cause. Contact SEW-EURODRIVE if necessary.

When the device is switched on, dangerous voltages are present at all power connections as well as at any connected cables and terminals. This also applies even when the product is inhibited and the motor is at standstill.

Do not separate the connection to the product during operation.

This may result in dangerous electric arcs damaging the product.

If you disconnect the product from the voltage supply, do not touch any live components or power connections because capacitors might still be charged. Observe the following minimum switch-off time:

10 minutes.

Observe the corresponding information signs on the product.

The fact that the operation LED and other 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.

Mechanical blocking or internal safety functions of the product can cause a motor standstill. Eliminating the cause of the problem or performing a reset may result in the drive re-starting automatically. If, for safety reasons, this is not permitted for the drive-controlled machine, first disconnect the product from the supply system and then start troubleshooting.

Risk of burns: The surface temperature of the product can exceed 60 °C during operation.

Do not touch the product during operation.

Let the product cool down before touching it.

5.9.1 Energy storage unit

Products with a connected energy storage unit are not necessarily de-energized when they have been disconnected from the supply system. Usually, the energy storage unit stores sufficient energy to continue operation of the connected motors for a limited period of time. It is not sufficient to observe a minimum switch-off time.

Perform a shutdown as described in the documentation in chapter "Service" > "Shutdown".

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6 Device structure, axis system structure

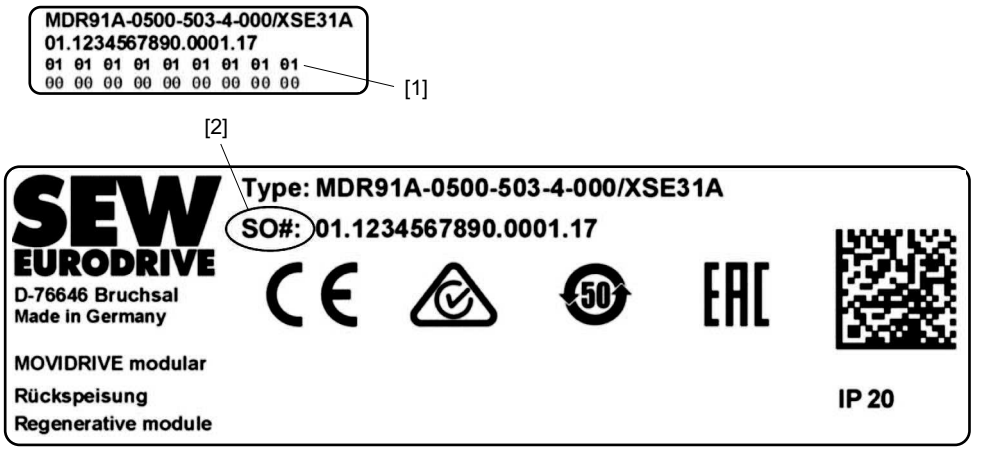
6.1 Connection variants

The MDR91A power supply module with supply and energy recovery can be installed in an axis system like an MDP90A power supply module.

For the implementation of an axis system as well as possible implementation variants, refer to the "MOVIDRIVE® modular Application Inverters" operating instructions.

6.2 Nameplates

6.2.1 System nameplate



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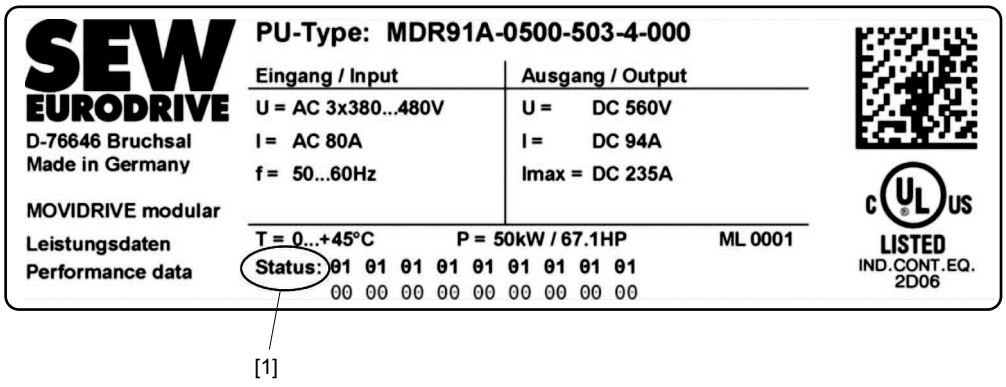
[1] Device status

[2] Serial number

6.2.2 Performance data nameplate



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[1] Device status

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6.3 Type code

The following type code applies to the power supply module with supply and energy recovery .

Example: MDR91A-0500-503-4-000		
Product name	MD	• MD = MOVIDRIVE®
Device type	R	• R = Power supply module with supply and energy recovery
Series	91	• 91 = Block-shaped energy recovery
Version	A	• A = Version status A
Performance class	0500	• 0500 = 50 kW • 0750 = 75 kW
Connection voltage	5	• 5 = AC 380 – 480 V
EMC variant of power section	0	• 0 = Basic interference suppression integrated
Number of phases	3	• 3 = 3-phase connection type
Operating mode	4	• 4 = 4Q operation (with brake chopper)
Designs	0	• 0 = Not relevant
Designs	00	• 00 = Standard design
Options		The following list serves as an example: • /XSE31A = EtherCAT®-compatible system bus • /XSE31B = EtherCAT®-compatible system bus

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6.4 Device structure

⚠ WARNING

Some of the modules shown in this chapter are depicted without touch guards. Touch guards secure the live parts such as DC link, line connections and braking resistor connections.

Uncovered power connections.

Severe or fatal injuries from electric shock

- Never start up the application inverter without installed closed touch guards.

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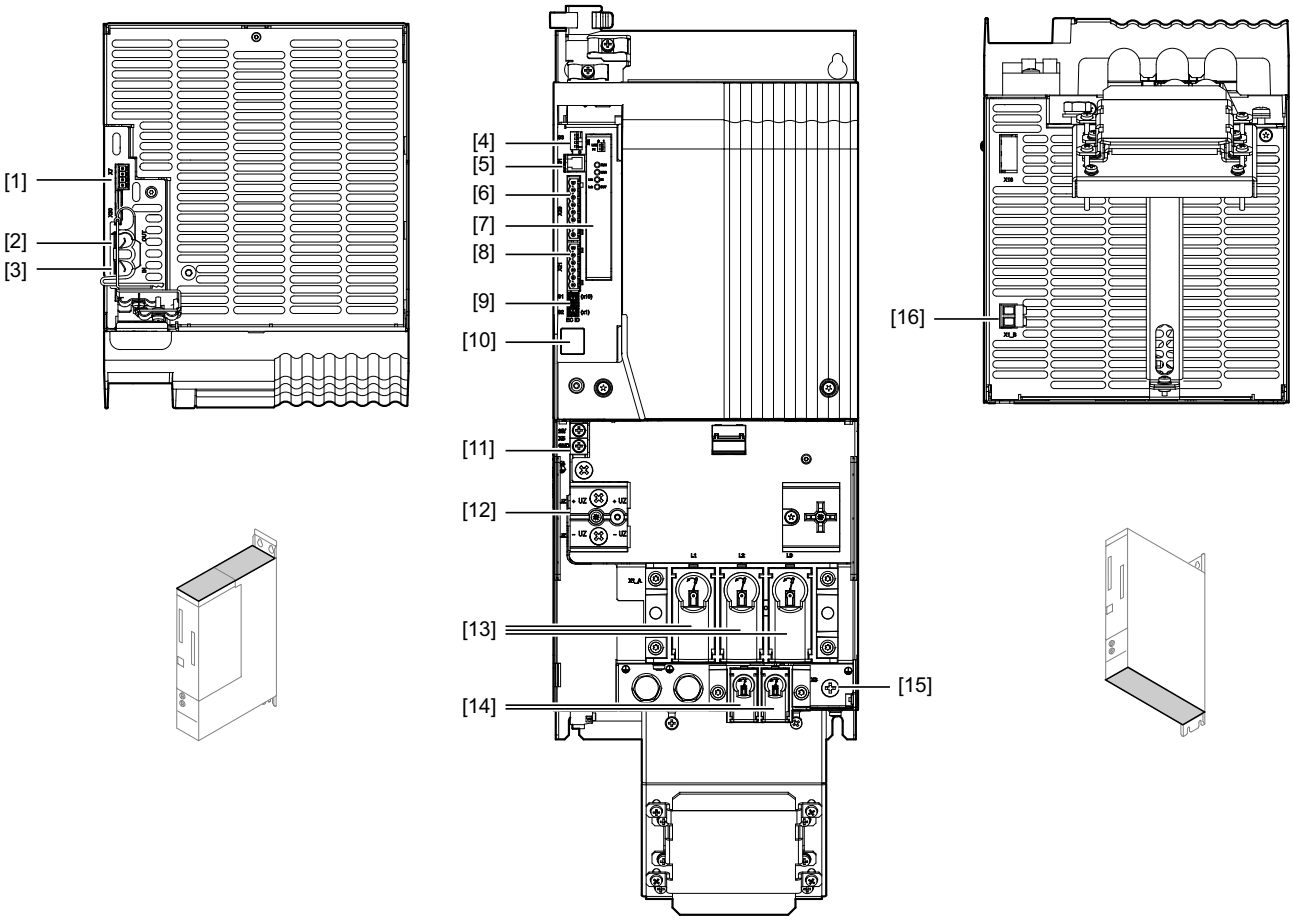

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A: View from top

[1] X7: Braking resistor temperature monitoring

[2] X30 OUT: System bus

[3] X30 IN: System bus

B: View from front

[4] S3: DIP switches for supply system settings

[5] X31: SEW-EURODRIVE Service interface

[6] X20: Digital inputs

[7] XSE31A card: EtherCAT®-compatible system bus

[8] X21: Digital outputs

[9] S1, S2: EtherCAT® ID switch

[10] 7-segment display

[11] X5: Connection +24 V supply voltage

[12] X4: DC link bus connection

[13] X1_A: Line connection

[14] X3: Braking resistor connection

[15] PE connection housing

C: View from bottom

[16] X1_B: Auxiliary supply via precharging contactor K9

6.5 Use of cards

The power supply module with supply and energy recovery can be equipped with the "EtherCAT®-compatible system bus" XSE31A card as an option.

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7 Installation

7.1 Installation accessories

7.1.1 Standard accessories

The listed standard accessories are included in the scope of delivery.

Standard accessories – mechanical accessories

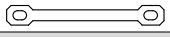
Designation	Power supply module with MDR91A-... supply and energy recovery
	0500, 0750
Electronics shield clamp	1×

Designation	Power supply module with MDR91A-... supply and energy recovery
	0500, 0750
Power shield clamp	1×

The mechanical accessories can be ordered with the following part numbers:

Module	Part number accessory pack
MDR91A-...	0500, 0750: 28247558

Standard accessories – electrical accessories

Designation	Power supply module with MDR91A-... supply and energy recovery
	0500, 0750
+24 V supply voltage	
	2×

Designation	Power supply module with MDR91A-... supply and energy recovery
	0500, 0750
DC link connection, PE connection	
	3×

Designation	Power supply module with MDR91A-... supply and energy recovery
	0500, 0750
8-pole module bus cable, system bus EtherCAT®/SBus^{PLUS}	
	1×

Designation	Power supply module with MDR91A-... supply and energy recovery
	0500, 0750
DC link closing cover	
	1×

Designation	Power supply module with MDR91A-... supply and energy recovery
	0500, 0750
Power connection closing cover	
	1×

The electrical accessories can be ordered using the following part numbers:

Module	Part number	
	Accessory pack[1)]	Module bus cable
MDR91A-	0500, 0750: 28247566	18167012

1) Accessory pack contains module bus cable

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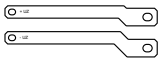
7.1.2 Available accessories

Adapter connectors of the DC link connection

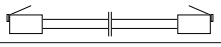
To be able to establish an axis system in which modules with DC link bars of different widths are used, adapter connectors must be used at the transition from wide to narrow or narrow to wide. These adapter connectors are listed in the following table.

The necessary touch guards are included with the adapter connectors.

From module	To module	Adapter connectors	Part number
MDR91A-0500-.. – MDR91A-0750-..	MDA90A-1400-.. – MDA90A-1800-..		28249208

Adapter connectors are not included in the scope of delivery and must be ordered.

Cable

Designation	Length	Connector	Part number
			
4-pole system bus cable, system bus EtherCAT®/SBus^{PLUS}	• 0.75 m • 1.5 m • 3 m • 5 m • 10 m	2 × RJ45	• 18167039 • 18179975 • 18167047 • 18179983 • 18179991

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7.2 Permitted tightening torques

Screw connection		Tightening torque in Nm	
		MDR91A-	
		0500	0750
Line connection	X1	18 – 22	
Braking resistor connection	X3	3 – 4	
DC link connection	X4	3 – 4	
PE connection	X4	3 – 4	
Connection 24 V voltage supply	X5	1.2 – 1.5	
Safety cover, bottom		0.6 – 0.8	
Safety cover, top		1.2 – 1.4	

NOTICE

Non-compliance with the stipulated tightening torques.

Possible damage to the application inverter.

- Always adhere to the stipulated tightening torques. Otherwise, excessive heat can develop which would damage the application inverter.
- An excessively high tightening torque may cause damage.

7.3 Mechanical installation

⚠ CAUTION

Risk of injury to persons and damage to property.

Never install defective or damaged application inverters.

- Before installing modules, check them for external damage. Replace any damaged modules.

NOTICE

Risk of damage to property due to mounting surface with poor conductivity.

Damage to the application inverter.

- The mounting plate in the control cabinet must be conductive over a large area for the mounting surface of the application inverter (metallically pure, good conductivity). EMC compliant installation of the application inverter can only be accomplished with a mounting plate that is conductive over a large area.

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7.3.1 Minimum clearance and mounting position

When installing the modules in the control cabinet, observe the following:

- To ensure unobstructed cooling, leave a minimum clearance of 100 mm above and below the module housings. Make sure air circulation in the clearance is not impaired by cables or other installation equipment.
- Make sure that the units are not subjected to heated air from nearby components.
- The axis system must be assembled without gaps.
- Install the modules only vertically. You must not install them horizontally, tilted or upside down.

INFORMATION

Special bending spaces are required according to EN 61800-5-1 for cables with a cross section of 10 mm^2 and larger. This means the clearance must be increased if required.

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7.3.2 Hole pattern

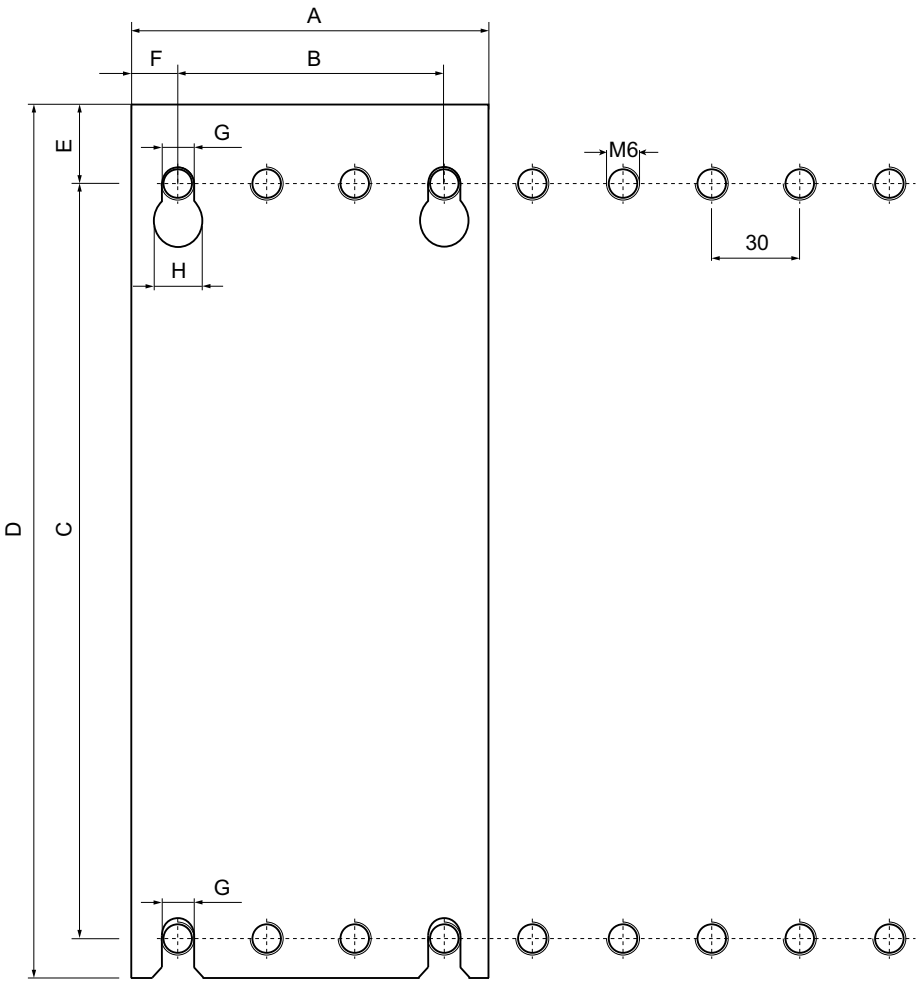
Preparing the control cabinet

You can prepare the control cabinet for the installation of differently assembled axis systems by drilling tapped holes every 30 mm for mounting the modules. The modules can be attached to this grid irrespective of their width, see figure below.

Dimensions
Device base plate

Modules	Dimensions of the device base plate in mm							
	A	B	C	D	E	F	G	H
MDR91A-0500	210	180	455	484	19	15	7	13
MDR91A-0750	210	180	455	484	19	15	7	13

Mounting grid



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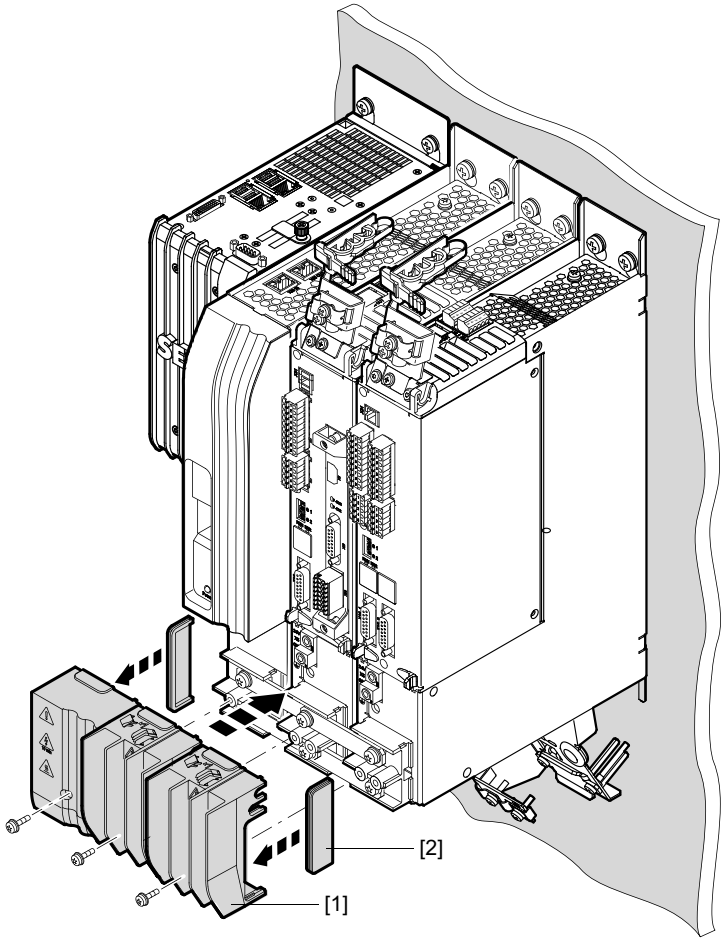
For dimension sheets of the application inverters, refer to chapter "Technical data".

7.4 Covers

The attachment and removal of the different covers are shown as examples with certain modules types. The procedure is the same for all modules.

7.4.1 Touch guards



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1. Insert closing covers [2] into the touch guards covers [1] of the first and last module in the axis system.
2. Attach the touch guard covers [1] to the modules. Insert the screws and tighten them securely with the specified tightening torque .

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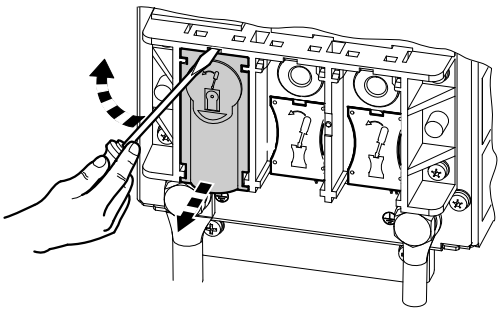
7.4.2 Protection caps

To achieve degree of protection IP20 according to EN 60529 with the following modules, a protection cap must be used to secure the connectors against being touched. The protection caps are included in the accessory bag.

- Power supply modules MDP90A-0500-.. and larger, line connection X1, braking resistor connection X3
- Power supply modules with energy recovery, MDR91A-0500-.. and larger: Line connection X1, braking resistor connection X3
- Axis modules MDA90A-0640-.. and larger: Motor connection X2

Attached protection caps can be remove as depicted in the following figures.

Line connection, motor connection



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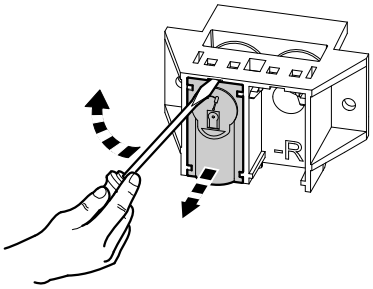
Braking resistor connection



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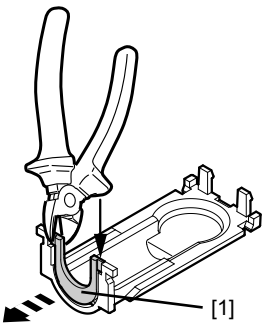
To ensure degree of protection IP20, the protection caps must be reinstalled after the cables are connected.

Breaking out templates

In order to attach the protection caps in case of cables with large cross section or in case of connection with 2 cables, the template in the protection caps must be broken out.

- Cut out the plastic templates [1] in the protection cap using diagonal cutting pliers as depitcted in the figure.



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7.5 Control cabinet installation

The modules are installed as described in the "Control cabinet installation" chapter of the "MOVIDRIVE® modular Application Inverters" operating instructions.

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7.6 Electrical installation

⚠ DANGER

Dangerous voltage levels may still be present inside the device and at the terminal strips up to 10 minutes after the complete axis system has been disconnected from the supply system.

Severe or fatal injuries from electric shock.

To prevent electric shocks:

- Disconnect the axis system from the supply system and wait 10 minutes before removing the safety covers.
- After maintenance work, do not operate the axis system unless you have re-mounted the safety covers, because the device has only a IP00 degree of protection with the safety cover removed.

⚠ DANGER

A leakage current > 3.5 mA can occur during operation of the MOVIDRIVE® modular application inverter.

Severe or fatal injuries from electric shock.

To avoid shock currents according to EN 61800-5-1, strictly observe the following:

- Supply system cable < 10 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 – 16 mm^2:
  - Route a copper PE conductor with the cable cross-section of the supply system cable.
- Supply system cable 16 mm^2 – 35 mm^2:
  - Route a copper protective earth conductor with a cable cross-section of 16 mm^2.
- Supply system cable > 35 mm^2:
  - Route a copper protective earth conductor with half the cross-section of the supply system cable.
- If an earth leakage circuit breaker is used for protection against direct and indirect contact in isolated cases, it must be universal current-sensitive (RCD type B).

INFORMATION

Installation with protective separation.

The application inverter meets all requirements for protective separation of power and electronics connections in accordance with EN 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.

7.6.1 General information

- Take suitable measures to prevent the motor starting up inadvertently, for example by removing the electronics terminal block X20 on the axis module. Take additional safety measures depending on the application to prevent possible injuries to people and damage to machinery.
- SEW-EURODRIVE recommends to use only closed cable lugs for connection to the bolts in order to prevent litz strands from escaping.

7.6.2 Permitted voltage supply systems

- The power supply module with supply and energy recovery is intended to be operated on voltage supply systems with a directly grounded star point (TN and TT power systems).
- Operation on voltage supply systems with a non-grounded star point (for example IT power systems) is not permitted.
- Autonomous power systems are not permitted.

An autonomous power system has no connection to the public grid.

7.6.3 Line contactor and cable cross sections

NOTICE

Line contactor utilization category

Use a line contactor **and a precharging contactor of utilization category AC-3** (IEC 158-1) or better.

The precharging contactor K9 is only for precharging the energy recovery module.

The line contactor K11 is only intended for switching the energy recovery module on and off.

- Supply system cable: **Cross-section according to nominal input current I_{line}** at nominal load.

NOTICE

Switch-on/switch-off times of the line contactor and supply system

Observe the specified times and intervals:

Observe a minimum switch-off time of 10 s for the relays K9, K11.

Do not switch on / switch off the line more than once per minute and not more frequently than 10 times within 30 minutes.

The line contactor K11 must always be placed before the line filter of the power supply module with supply and energy recovery.

7.6.4 Connecting braking resistor and emergency braking resistor

NOTICE

When using a braking resistor, observe the notes in the "Project Planning" chapter.

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Protection of the braking resistor and emergency braking resistor against thermal overload

INFORMATION

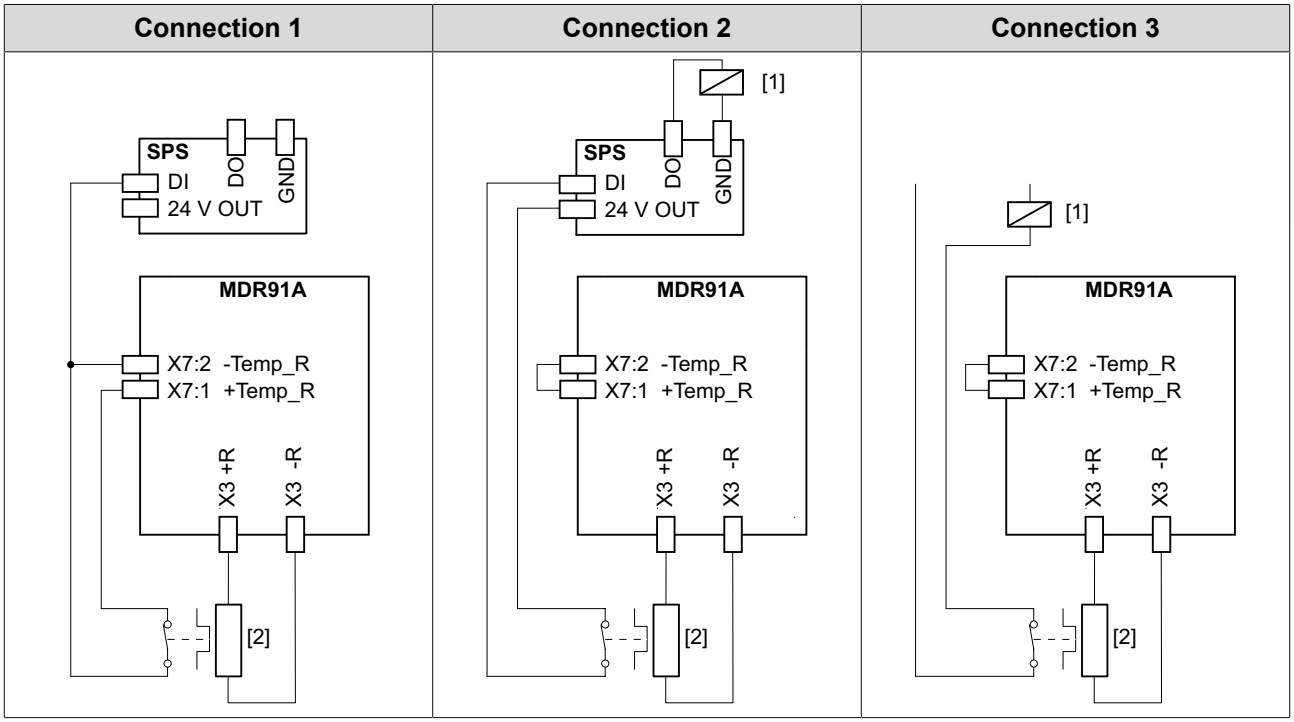
Guards for power supply modules with supply and energy recovery

It is not permitted to separate the connection between the power supply modules with supply and energy recovery and the braking resistor. Guards, such as fuses or miniature circuit breakers are not permitted.

Internal temperature switch -T

MDR91A-0500/0750-.. power supply module with supply and energy recovery

If a BW...-T braking resistor with internal temperature switch is used with an MDR91A power supply module with supply and energy recovery, there are 3 possible connections.



[1] Optional contactor (K7) "MDR ON/OFF"

[2] Braking resistor

Note that the reference potential GND of the digital input control must be the same as the reference potential of the application inverter when connection 1 is used.

- Connection 1 (without optional contactor (K7) "MDR ON/OFF")
  - If the thermal circuit breaker trips, the signal in the power supply module and in the PLC is evaluated.
  - If the thermal circuit breaker trips, the MDR device automatically disconnects from the power supply by deactivating the line contactor (K11).
  - If the thermal circuit breaker trips, the power supply module switches all axis modules to "Output stage inhibit".
- Connection 2 (with optional contactor (K7) "MDR ON/OFF")
  - If the thermal circuit breaker trips, the signal is evaluated only in the PLC.

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  - If the thermal circuit breaker trips, the PLC must interrupt the power supply.
  - If the thermal circuit breaker trips, there is no response in the power supply module and the axis modules.
  - With connection 2, it is possible that the PLC finishes the current travel cycle although the thermal circuit breaker has tripped. Only then is the power supply disconnected. In this case, the residual braking energy $W_{Rest} = P_{BRnom} \times 20$ s must not be exceeded.
- Connection 3 (with optional contactor (K7) "MDR ON/OFF")
  - If the thermal circuit breaker trips, the signal directly acts on the optional contactor (K7) "MDR ON/OFF" and disconnects the device from the power supply.
  - This does not require a response by the PLC.
  - If the thermal circuit breaker trips, there is no response in the power supply module and the axis modules.

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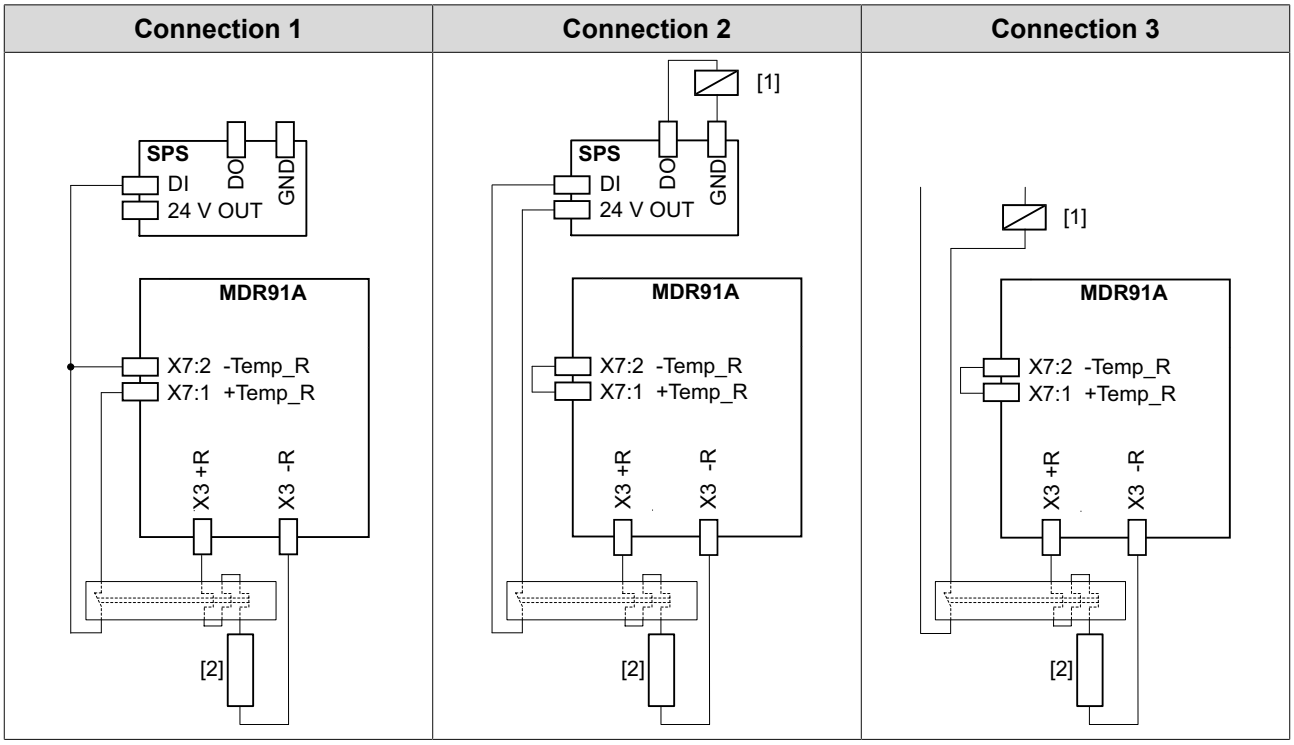
External bimetallic relay

MDR91A-0500/0750-.. power supply module with supply and energy recovery

If an external bimetallic relay is used with an MDR91A power supply module with supply and energy recovery, there are 3 possible connections.



[1] Optional contactor (K7) "MDR ON/OFF"

[2] Braking resistor

Note that the reference potential GND of the digital input control must be the same as the reference potential of the application inverter when connection 1 is used.

- Connection 1 (without optional contactor (K7) "MDR ON/OFF")
  - If the thermal circuit breaker trips, the signal in the power supply module and in the PLC is evaluated.
  - If the thermal circuit breaker trips, the MDR device automatically disconnects from the power supply by deactivating the line contactor (K11).
  - If the thermal circuit breaker trips, the power supply module switches all axis modules to "Output stage inhibit".
- Connection 2 (with optional contactor (K7) "MDR ON/OFF")
  - If the thermal circuit breaker trips, the signal is evaluated only in the PLC.
  - If the thermal circuit breaker trips, the PLC must interrupt the power supply.
  - If the thermal circuit breaker trips, there is no response in the power supply module and the axis modules.
  - With connection 2, it is possible that the PLC finishes the current travel cycle although the thermal circuit breaker has tripped. Only then is the power supply disconnected. In this case, the residual braking energy $W_{Rest} = P_{BRnom} \times 20$ s must not be exceeded.
- Connection 3 (with optional contactor (K7) "MDR ON/OFF")

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– If the thermal circuit breaker trips, the signal directly acts on the optional contactor (K7) "MDR ON/OFF" and disconnects the device from the power supply.
– This does not require a response by the PLC.
– If the thermal circuit breaker trips, there is no response in the power supply module and the axis modules.

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7.6.5 Line fuses, fuse types

Line fuses and miniature circuit breakers are used for fusing the supply system cables of the axis block. In case of a fault, these components protect the power supply module against short-circuits. For fusing, use fuses and miniature circuit breakers with the following properties:

Type class	Prerequisite
Miniature circuit breakers of utilization categories gL, gG	Fusing voltage ≥ nominal line voltage
Miniature circuit breaker with characteristics B, C, D	• Nominal miniature circuit breaker voltage ≥ nominal line voltage • Nominal miniature circuit breaker currents must be 10% above the nominal line current of the power supply module

Adhere to the country-specific and system-specific regulations when carrying out the fusing.

7.6.6 Line connection

NOTICE

Observe a minimum switch-off time of 10 s for the application inverter. Do not switch on / switch off the line more than once per minute and not more frequently than 10 times within 30 minutes.

Irreparable damage to the application inverter or unforeseeable malfunctions.

The specified times and intervals must be observed.

- Observe the minimum switch-off time of 10 s before switching the power back on.
- Do not switch on / switch off the line more than once per minute and not more frequently than 10 times within 30 minutes.

- The line contactor K11 must always be placed before the line filter of the power supply module with supply and energy recovery.
- Use only line contactors of utilization category AC-3 (EN 60947-4-1) or higher.
- Do not use the line contactor for jog mode, but only for switching the application inverter on and off. For jog mode, the FCB 20 "Jog" must be used.
- Observe the required dimensioning of the cable cross-section for UL-compliant installing.

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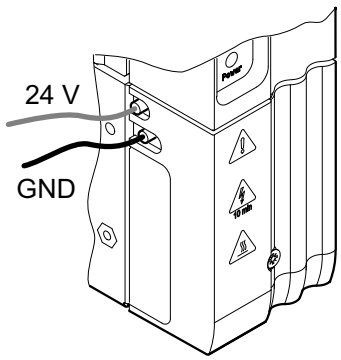
7.6.7 24 V supply voltage without master module

MOVIDRIVE® modular requires an external 24 V supply voltage. Us the following installation material for the connection:

- M4 fork-type or ring lugs with insulating collar and a cable cross-section of maximum 4 mm²,

  or

- M4 tubular cable lugs with insulating heat shrink tubing and a cable cross-section of maximum 6 mm².



14476866443

Select the cross-section of the supply cable according to the power demand of the device to be supplied. Note the additionally required power of the directly supplied 24 V brakes for CMP motors with BK or BP brake without brake control.

The maximally permitted length of the 24 V supply cable is 30 m.

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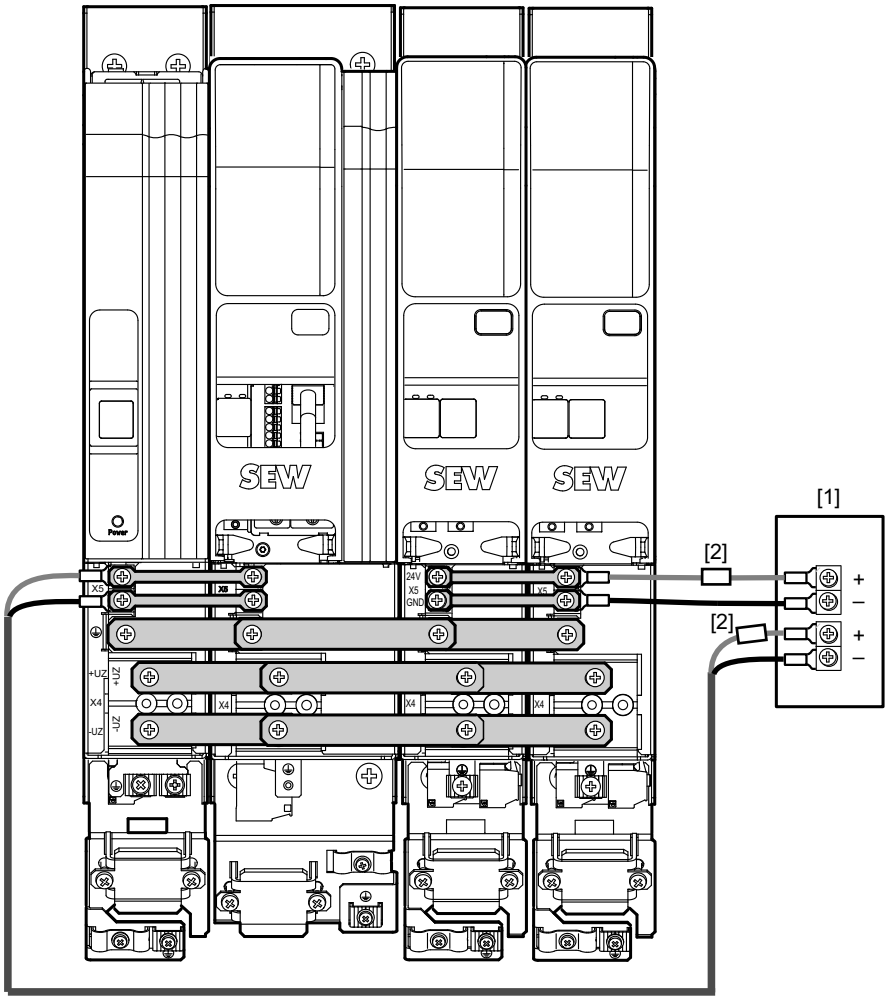
The connection is established either one-sided at the power supply module, or two-sided at the power supply module and the last axis module in the axis system, see the following figure for more details.



18014414154550283

[1] External DC 24 V voltage supply

[2] DC 24 V fuse

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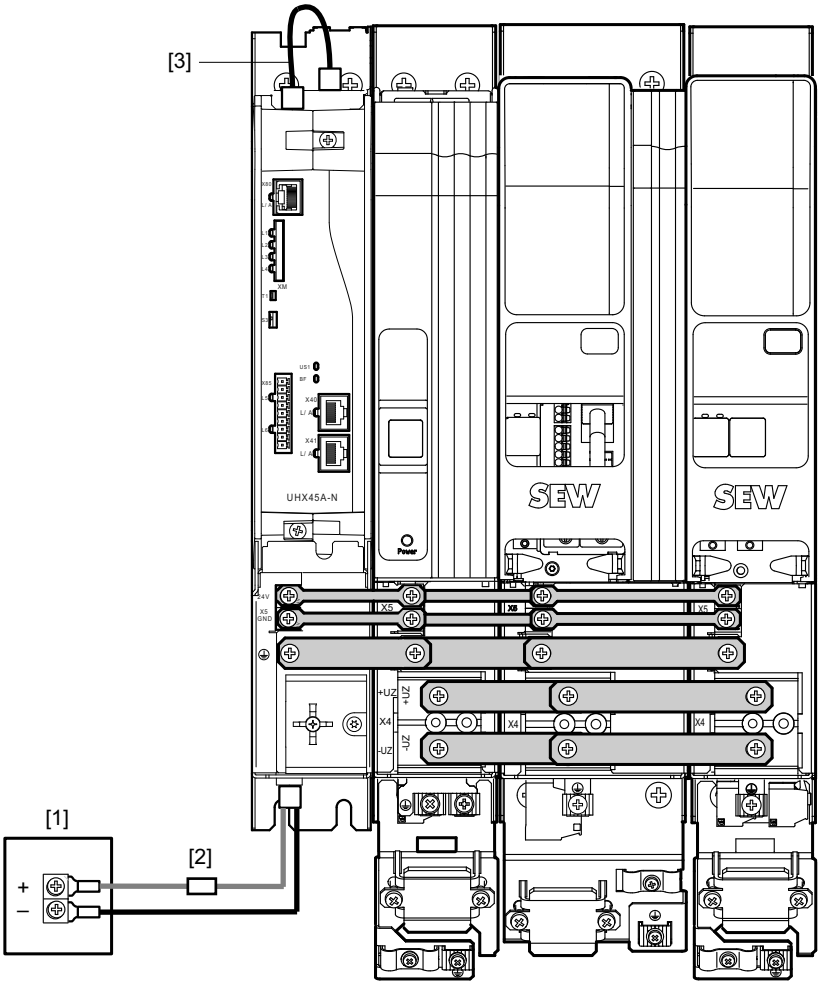
7.6.8 24 V supply voltage with master module UHX45A/MDM90A



9007220204831115

[1] External DC 24 V supply at X5_A

[2] DC 24 V fuse

[3] X5_B → X5: DC 24 V supply voltage UHX45A

Only use the connection cable included in the delivery to connect the 24 V supply of the MOVI-C CONTROLLER® advanced.

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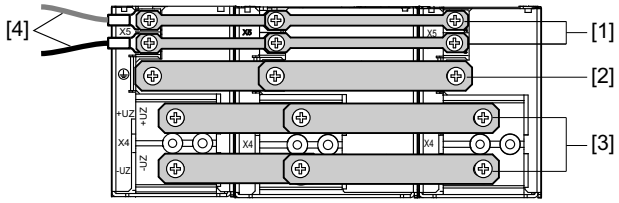
7.6.9 Connection of an axis system



27021611563769099

[1] Connection +24 V supply voltage

[2] PE connection

[3] X4: DC link connection

[4] Connection external 24 V supply voltage

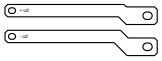
For information on how to connect a DC link, refer to chapter Installing the busbar.

Particularities of the connection of the DC link

Adapter connectors of the DC link connection

To be able to establish an axis system in which modules with DC link bars of different widths are used, adapter connectors must be used at the transition from wide to narrow or narrow to wide. These adapter connectors are listed in the following table.

The necessary touch guards are included with the adapter connectors.

From module	To module	Adapter connectors	Part number
MDR91A-0500-.. – MDR91A-0750-..	MDA90A-1400-.. – MDA90A-1800-..		28249208

Adapter connectors are not included in the scope of delivery and must be ordered.

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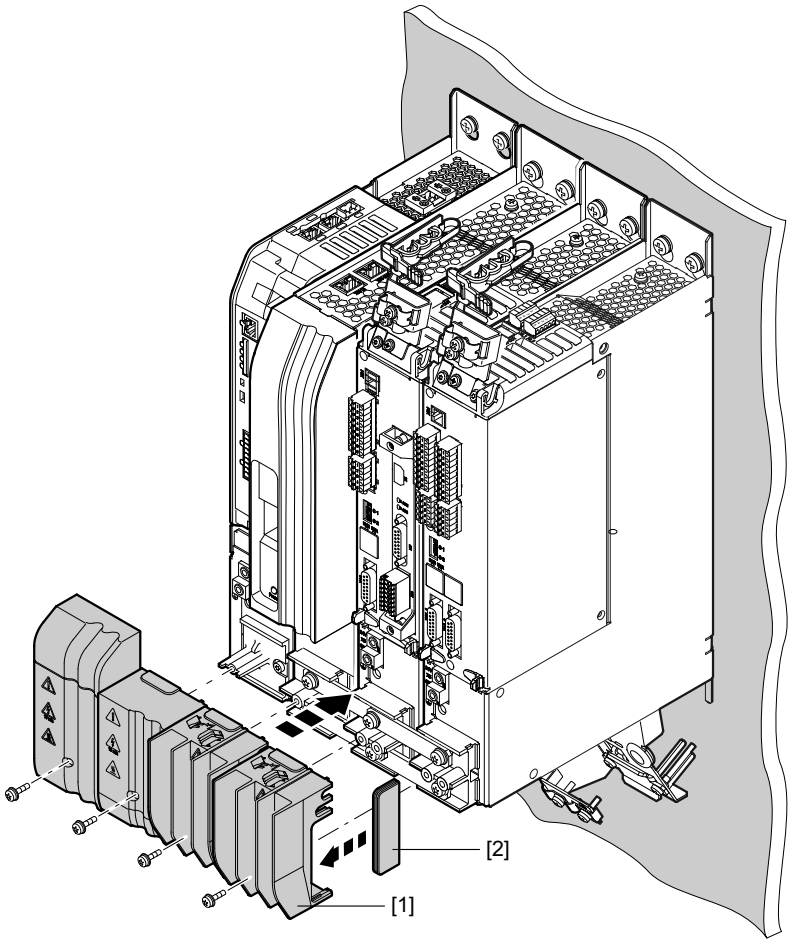
7.6.10 Installing touch guards and closing covers

All modules of the application inverter are equipped with touch guards [1] and the outer modules of the axis system have closing covers [2], see the following figure. If the axis system contains a master module, the closing cover [2] only needs to be attached at the last module in the axis system.

With master module



20918974091

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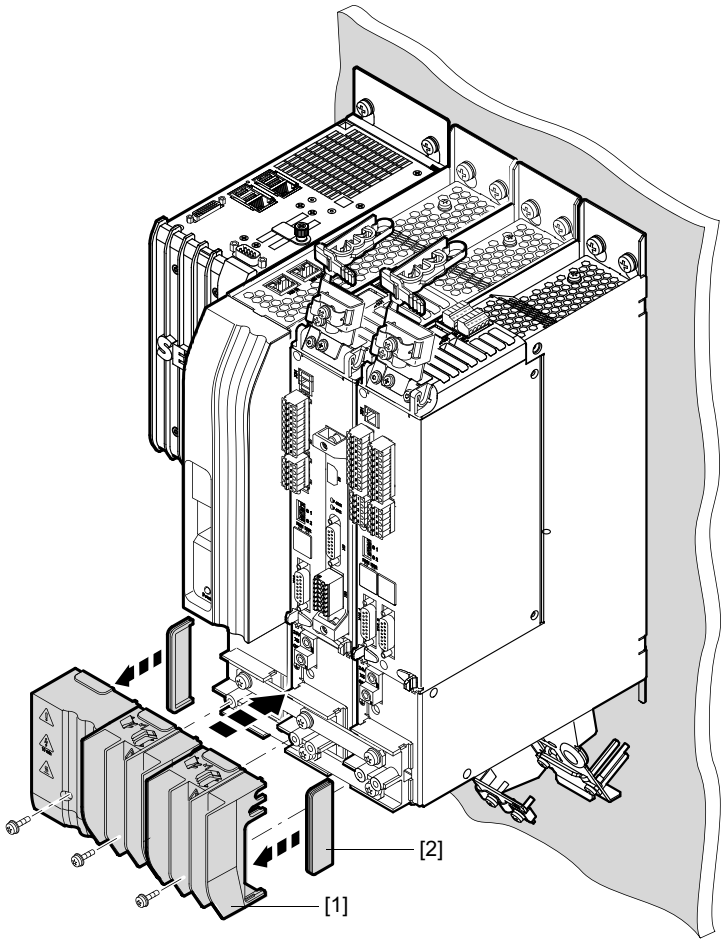
Without master module



18014412466136331

[1] Touch guard

[2] Closing cover

Reinstall all touch guards [1] after installation work.

1. Insert the closing cover [2] into the touch guard [1].
2. Install the touch guard [1] on the respective module. Insert the screws and tighten them securely with the specified tightening torque .

Install one closing cover [2] each at the outer modules of the axis system. The closing covers prevent the DC link from being touched. Two closing covers are included with each power supply module.

⚠ WARNING

Missing touch guards and closing covers

Severe or fatal injuries from electric shock

- Install all touch guards.
- Install closing covers at the first and last module in the axis system.

7.6.11 System bus EtherCAT®/SBus^{PLUS}

For connecting the EtherCAT®/SBus^{PLUS} system bus, SEW-EURODRIVE recommends using only prefabricated cables from SEW-EURODRIVE.

NOTICE

Use of wrong cables

Damage to the application inverter

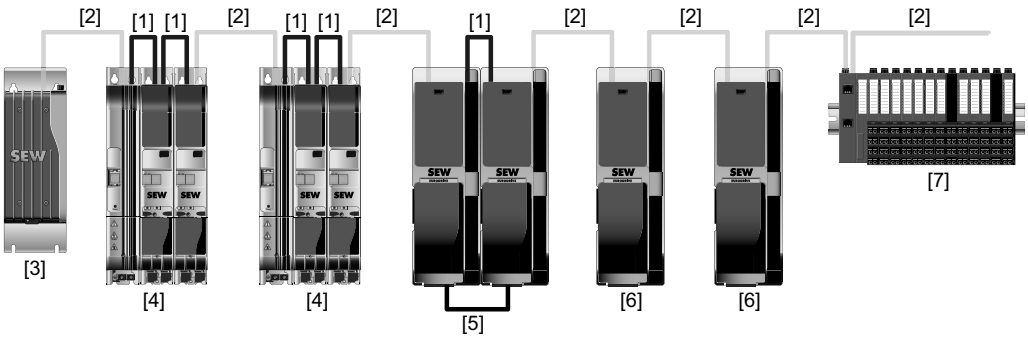
Only 4-pole cables are permitted to be used as system bus cables [2]. If an 8-pole cable is used, malfunctions or failures may occur at the connected devices.

INFORMATION

The mounting plates on which the axis systems are mounted must have a sufficiently large ground connection, e.g., a ground strap.

System bus and module bus cabling

Example of a system bus and module bus cabling



9007217271733643

[1] Module bus cable, 8-pin, color: anthracite gray.

[2] System bus cable, 4-pin, color: light gray.

[3] MOVI-C® CONTROLLER power UHX8x

[4] MOVIDRIVE® modular

[5] MOVIDRIVE® system with DC link connection

[6] MOVIDRIVE® system

[7] Other EtherCAT® stations at the EtherCAT®/SBus^{PLUS}

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Correct cabling

Module bus cable

In the case of MOVIDRIVE® modular, the 8-core module bus cable connects the power supply module to the first axis module and the axis modules to one another; see figure (→ 🗎 76).

In the case of MOVIDRIVE® modular, in addition to the system bus communication, the module bus is routed in the cable for information inside the device. The module bus cable is delivered in the length required as part of the accessories for the axis modules.

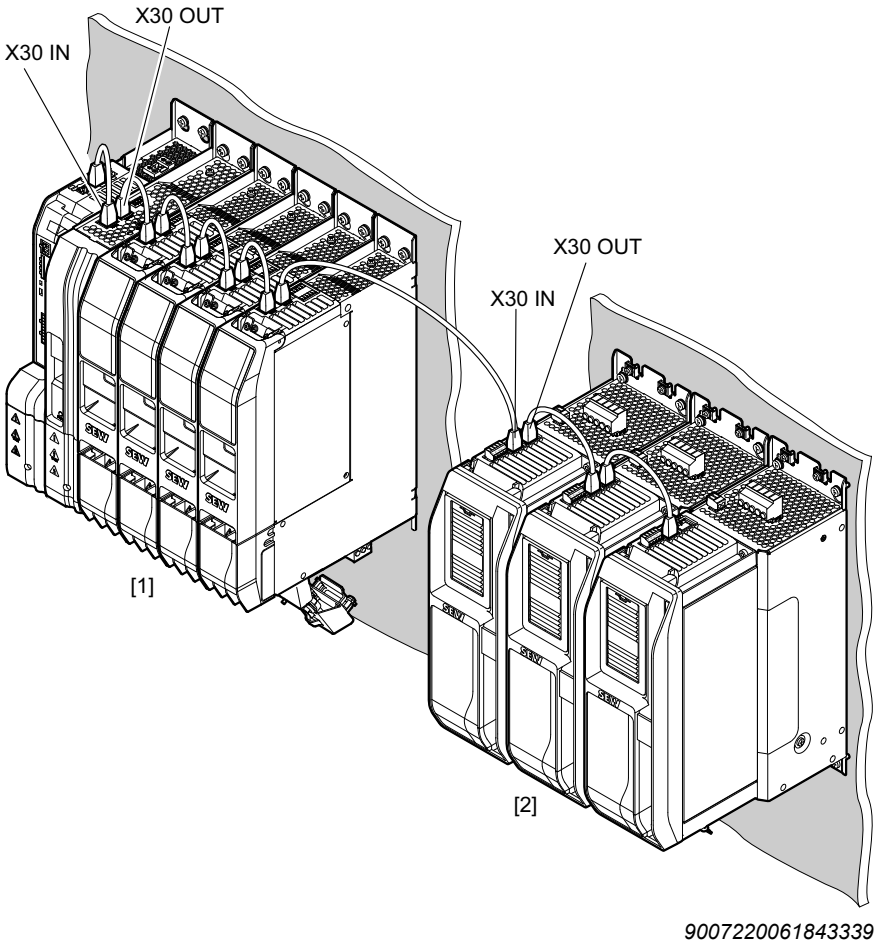
The connectors of the module bus cables are red and black to simplify correct attachment of the cables; see the following figure.

- The black connectors must be plugged into the bus input X30 IN.
- The red connectors must be plugged into the bus output X30 OUT.

System bus cable

The 4-pole system bus cable is used between automation components; see figure (→ 🗎 76). Some of these components are listed here as examples:

- MOVI-C® CONTROLLER
- MOVIDRIVE® modular/system application inverter
- PC with MOVISUITE® engineering software
- MOVI-PLC® I/O system
- Other EtherCAT® stations at the EtherCAT®/SBus^{PLUS}



9007220061843339

[1] MOVIDRIVE® modular

[2] MOVIDRIVE® system

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7.7 Installation of options

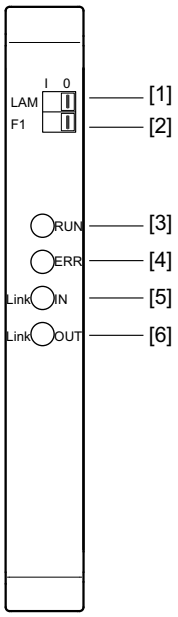
7.7.1 EtherCAT® XSE31A system bus

The EtherCAT® XSE31A system bus serves to connect the supply and energy recovery module to controllers with EtherCAT® master. The control can be implemented via EtherCAT® as an alternative to digital inputs and outputs. Status and diagnostics information is also available to the control via process data.

The supply and energy recovery module does not need any startup; there are no parameters to be set.

Because the supply and energy recovery module is used, there is no connection to MOVISUITE®, the EtherCAT® XSE31A system bus card is only for connection to a control with EtherCAT® master.

The process data assignment is permanently preset and cannot be changed. The following control and diagnostics options are available with the XSE31A EtherCAT® option card:



[1] LAM switch
- must be at 0

[2] F1 switch
- must be at 0

[3] LED RUN; color: green/orange

[4] LED ERR; color: red

[5] LED Link IN; color: green

[6] LED Link OUT; color: green

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7.8 Line filter

- Install the line filter close to the application inverter but outside the minimum clearance for cooling. The line filter must not be heated by the exhaust air of the application inverter.
- Do not wire any other consumers between the line filter and the line choke and the application inverter.
- The connection cable between line filter and the line choke and application inverter does not need to be shielded.
- Limit the length of the cable between the line filter and the application inverter to the absolute minimum needed.
- Do not switch between the line filter and application inverter.

7.9 Line choke

Install the line choke close to the application inverter but outside the minimum clearance for cooling. The line choke must not be heated by the exhaust air of the application inverter.

- Install the line choke between the line filter and the power supply module with supply and energy recovery.
- The connection cable between line choke and line filter does not need to be shielded.
- Limit the length of the cable between the line choke and the line filter to the absolute minimum needed.

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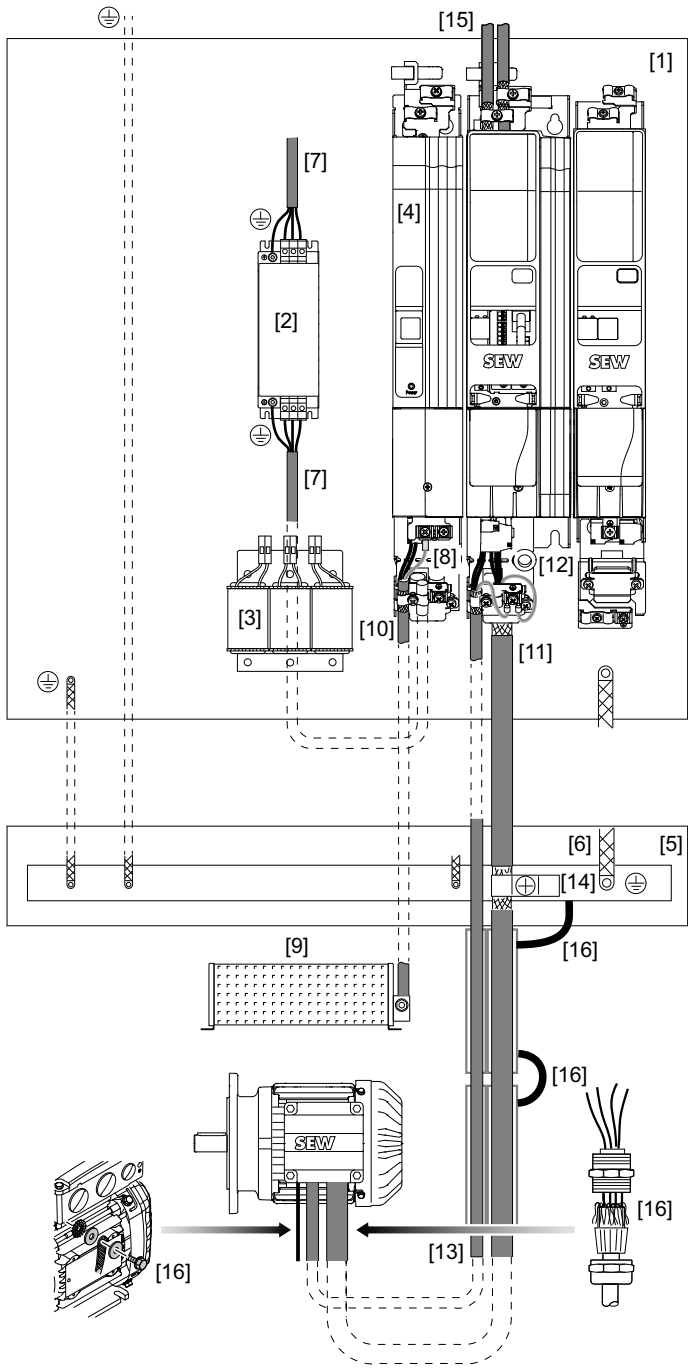
7.10 EMC-compliant installation



20114481931

[1] Galvanized mounting plate
[2] Line filter
[3] Line choke
[4] Inverter
[5] PE busbar
[6] HF connection of PE busbar/mounting plate
[7] Supply system cable
[8] Power shield plate at the power supply module
[9] Braking resistor
[10] Braking resistor cable
[11] Motor cable
[12] Power shield plate at the axis module
[13] Brake cable
[14] Grounding clamp
[15] Electronics shield plate
[16] HF connection

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The information in this chapter will help you to optimize the system with respect to electromagnetic compatibility, or to eliminate already existing EMC interferences.

The notes in this chapter are not legal regulations, but rather recommendations for improving the electromagnetic compatibility of your plant.

For further notes on EMC-compliant installation, refer to the publication Drive Technology - Practical Implementation, edition "EMC in Drive Technology– Basic Theoretical Principles – EMC-Compliant Installation in Practice".

7.10.1 Control cabinet

Use a control cabinet with conducting (galvanized) mounting plate. In cased more than one mounting plate is used, connect the plate over a large area.

Mount line filter and inverter on a shared mounting plate. Make sure they are connected over a large area and with good conductivity.

7.10.2 HF equipotential bonding in the system

In general, a suitable equipotential bonding between system, control cabinet, machine structure, cable ducts, and drives must be ensured.

Connect the individual sections in a HF-compatible manner.

From an electrical safety perspective, the PE busbar is the star point. The PE conductor replaces neither HF grounding nor shielding.

In terms of EMC, it is advantageous if the mounting plate is used as a star point with respect to HF equipotential bonding.

Perform the following measures for a suitable HF equipotential bonding:

- Connect the PE busbar to the mounting plate in a HF-compatible manner.
- Connect the shield metal cable ducts to the control cabinet in a HF-compatible manner.
- Connect the cable ducts with the mounting plate in the control cabinet using an HF litz wire.
- Connect the parts of the shield metal cable ducts in a HF-compatible manner.
- Connect the shield metal cable ducts to the gearmotor in a HF-compatible manner.

7.10.3 Cable installation

Route the power cables, such as motor cable and brake cable separated from the supply system cable and the control cables.

Route all cables as close to the reference potential as possible, e.g. the mounting plate.

All cables must be as short as possible. Avoid spare loops.

7.10.4 Connection for supply system cable / line filter

The supply system cable can be connected to the line filter using either twisted unshielded single conductors or unshielded cables.

If necessary, shielded cables can improve EMC.

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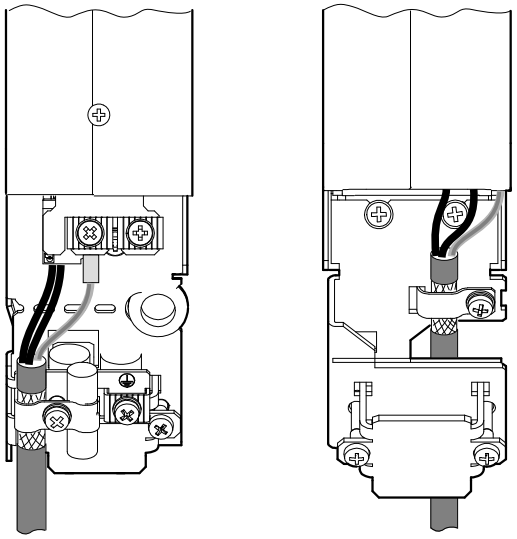
7.10.5 Line filter / line choke / MDR91A connection

Connection leads between line filter and line choke as well as the power supply module with supply and energy recovery must be limited to the absolutely necessary length.

In general, filtered and unfiltered cables must not be routed together. For this reason, route incoming and outgoing line filter cables separately.

7.10.6 Braking resistor connection

For connecting braking resistors, use 2 closely twisted conductors or a shielded power cable. Connect the braided shields of shielded cables over the entire circumference. Use the designated shield plates at the basic device to connect the shield.

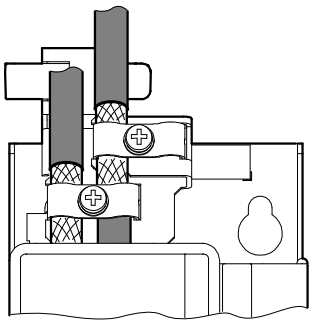


19500969867

7.10.7 Control cable connection

The digital inputs can be connected using an unshielded single conductor. Shielded cables increase the EMC. Use the designated shield plates to connect the shield.

For routing outside of the control cabinet shielded cables must be used.



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7.10.8 Shielding connection

Ensure a shield connection suitable for HF, e.g. by using grounding clamps, or EMC cable glands, so that the braided shield has a large connection surface.

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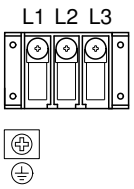
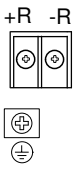
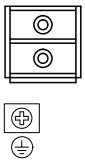
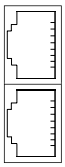
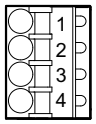
7.11 Terminal assignment

Representation	Terminal	Port	Short description
	X1_A:1	L1	MDR 50/75 kW line connection
	X1_A:2	L2	
	X1_A:3	L3	
	⏚	PE	PE connection
	X1_B:1	V1	Auxiliary supply via precharging contactor K9
	X1_B:2	V2	
	X3:+R	+R	MDR 50/75 kW braking resistor connection
	X3:-R	-R	
	⏚	PE	PE connection
	X4: $+V_{DC\ link}$	$+V_{DC\ link}$	DC link connection
	X4: $-V_{DC\ link}$	$-V_{DC\ link}$	
	⏚	PE	PE connection
	X5:24 V	V_I24 V	+24 V supply voltage
	X5:GND	GND	
	X30 OUT		System bus
	X30 IN		
	X31		SEW-EURODRIVE Service interface
	X7:1	+TEMP_R	DC 24 V auxiliary voltage output In the delivery state there is a jumper from X7:1 to X7:2
	X7:2	-TEMP_R	Sensor input for temperature monitoring of the braking resistor
	X7:3	DCOM	Reference potential for digital inputs DI00 – DI05 In the delivery state there is a jumper from X7:3 to X7:4
	X7:4	GND	Reference potential of the DC 24 V voltage supply

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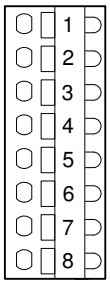
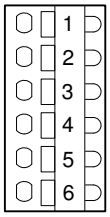
Representation	Terminal	Port	Short description
	X20:1	DI00	Output stage enable
	X20:2	DI01	Enable/charge
	X20:3	DI02	Error reset
	X20:4	DI03	Feedback of precharging contactor K9
	X20:5	DI04	Feedback of line contactor K11
	X20:6	DI05	Activation of test/emergency mode
	X20:7	DI06	GND
	X20:8	DI07	DC 24 V voltage supply
	X21:1	DO00	Ready
	X21:2	DO01	Activation of precharging contactor K9
	X21:3	DO02	Activation of line contactor K11
	X21:4	DO03	Fault
	X21:5	DO04	Test/emergency mode active
	X21:6	DO05	GND

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7.12 Wiring diagrams

7.12.1 Power connection

NOTICE

Incorrectly placed components and incorrect wiring

Destruction of the power supply module.

- Do not install any other components between the line filter and the power supply module.
- Precharging contactor K9 and line contactor K11 must not be confused with one another or used interchangeably.
- Ensure correct wiring.

NOTICE

Overtemperature of line filter and line choke

Destruction of line filter and line choke.

- Make sure line filter and line choke are not heated by warm exhaust air from other devices.

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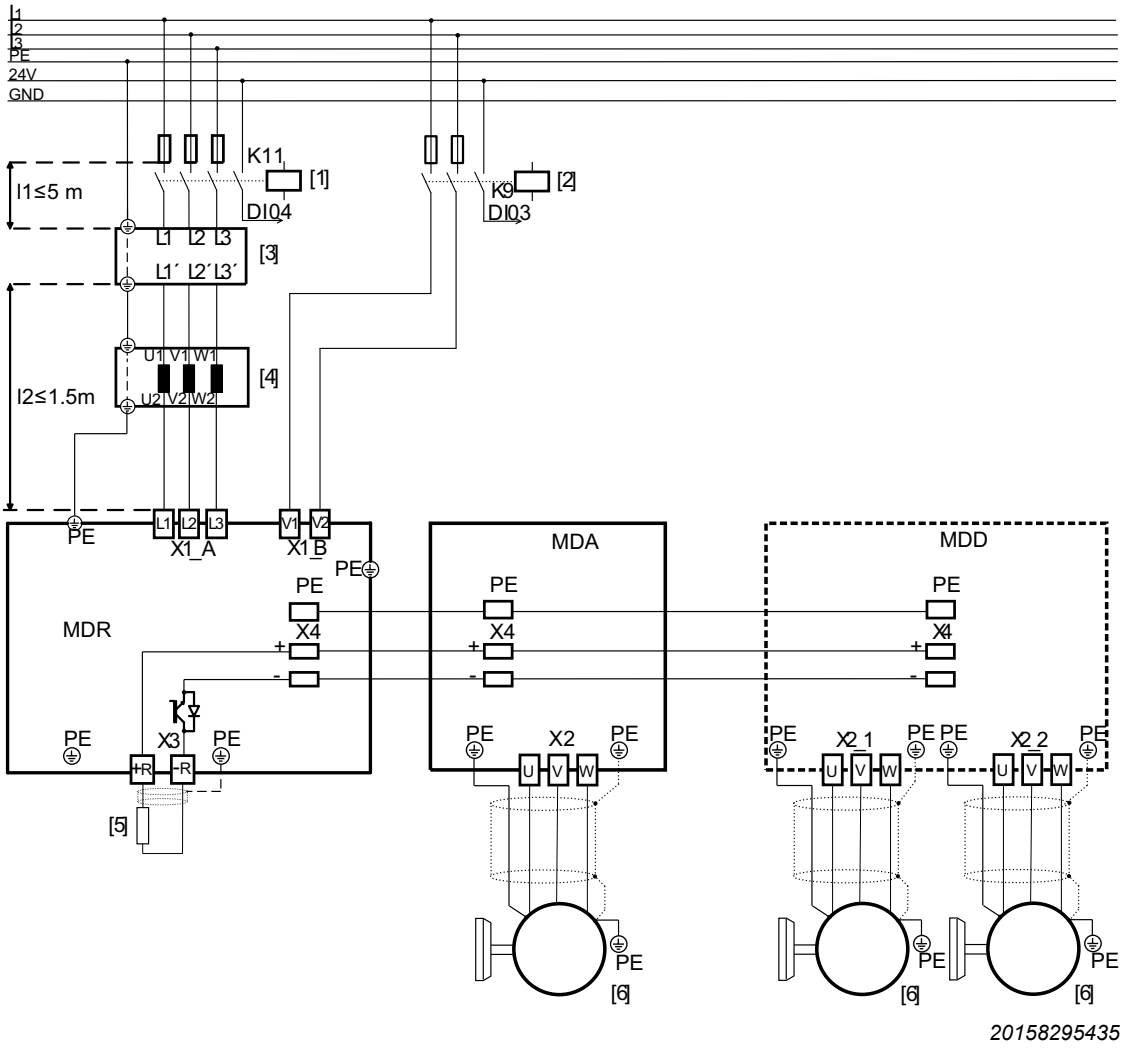

[1] Line contactor K11

[2] Precharging contactor K9

[3] Line filter

[4] Line choke

[5] Braking resistor connection[1)]

[6] Motor

1) The energy recovery module must not be operated without a braking resistor

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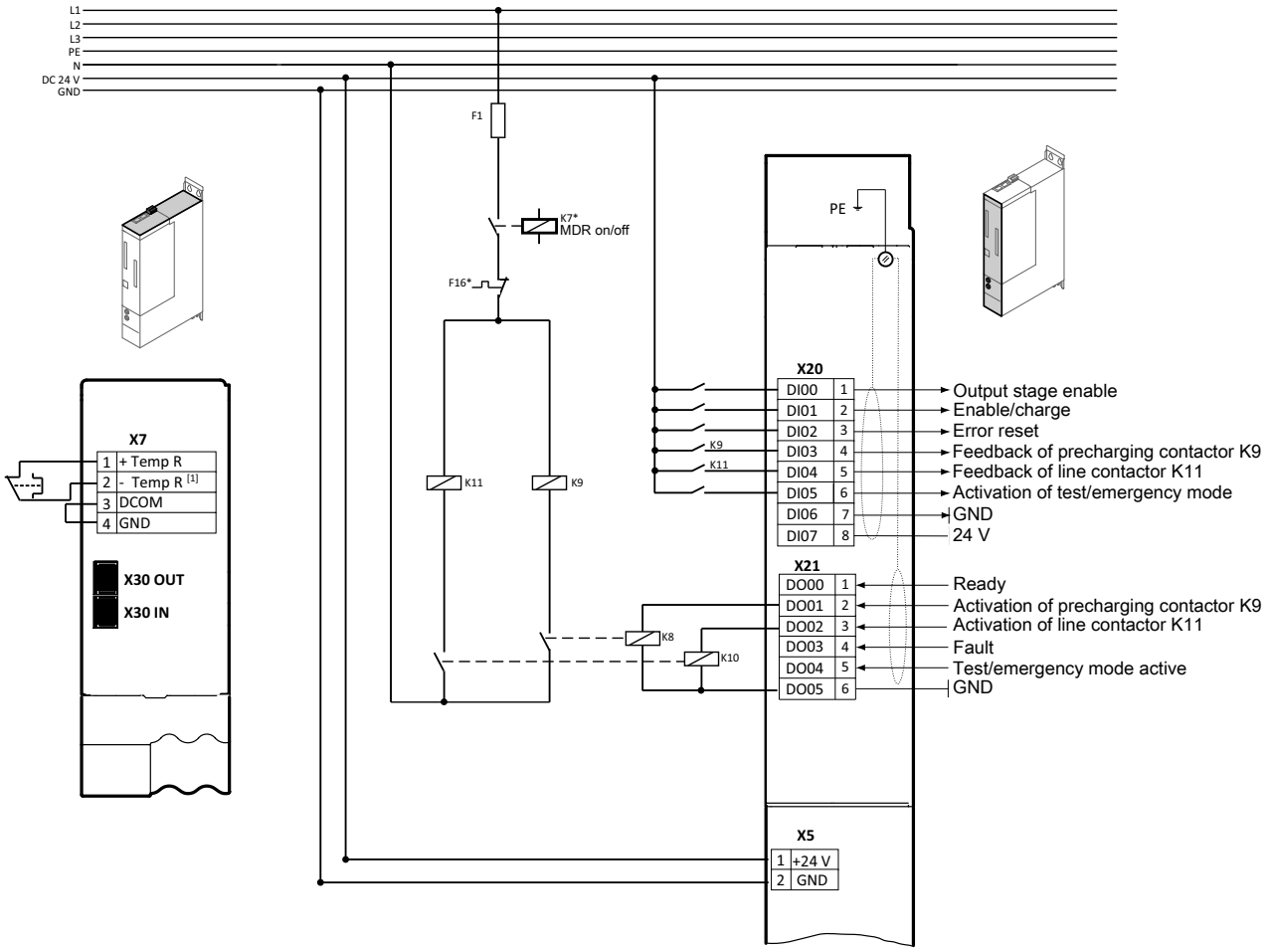
7.12.2 Electronics connection

Wiring the control electronics

For the terminal assignment and connections, refer to chapter "Terminal assignment" (→ 🗎 83).

Control circuit connection with 230 V



9007223155494667

[1]	Signal contact of the thermal monitoring of the braking resistor	X30	System bus
X5	Connection +24 V supply voltage	K8	Coupling relay K8 for precharging contactor K9
X7	Temperature monitoring of braking resistor, reference potential of digital inputs	K9	Precharging contactor K9
X20	Digital inputs	K10	Coupling relay K10 for line contactor K11
X21	Digital outputs	K11	Line contactor K11

*optional

K7	Contactor for MDR On/Off	F16	Braking resistor trip contact

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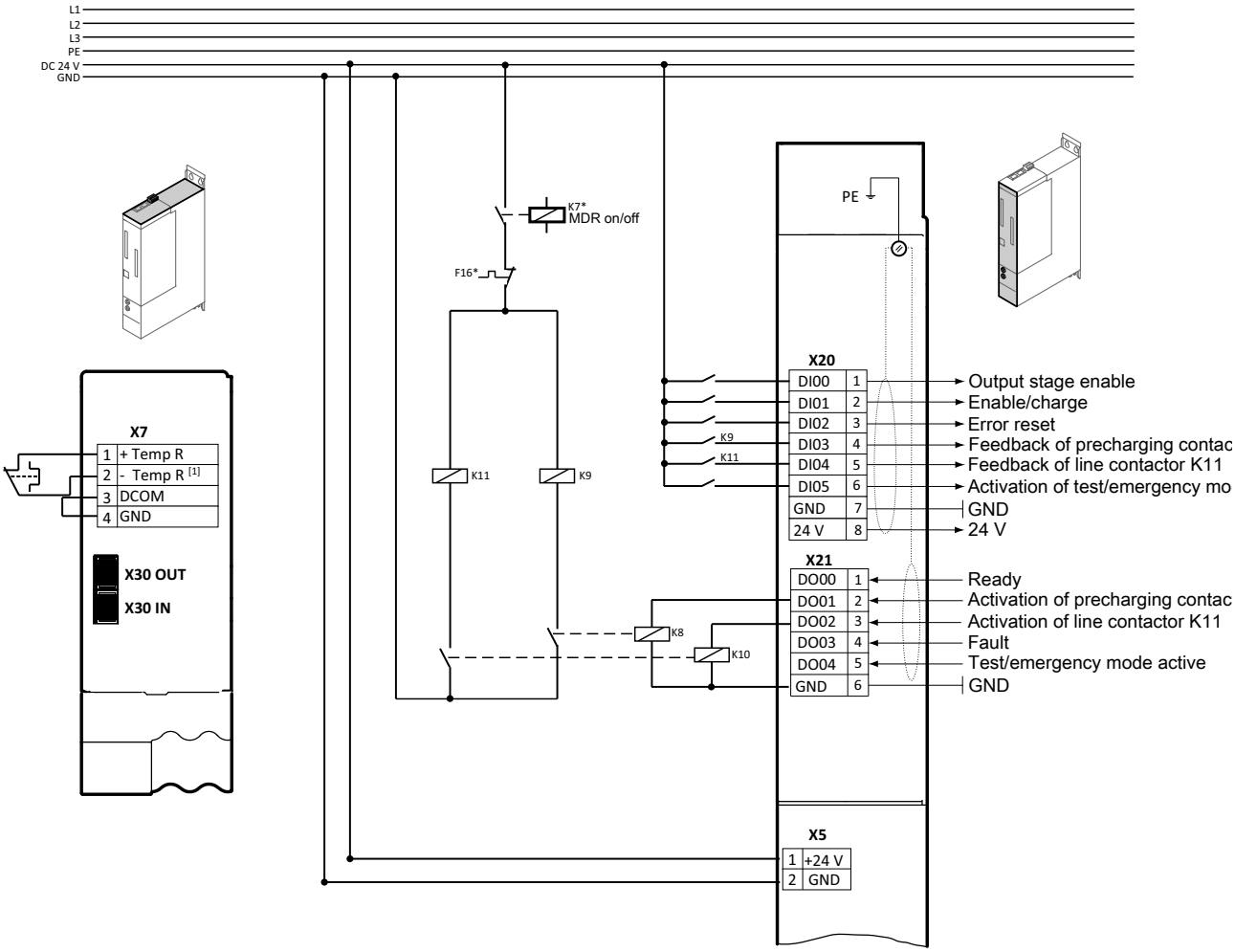
Control circuit connection with 24 V



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[1] Signal contact of the thermal monitoring of the braking resistor

X5 Connection +24 V supply voltage

X7 Temperature monitoring of braking resistor, reference potential of digital inputs

X20 Digital inputs

X21 Digital outputs

X30 System bus

K8 Coupling relay K8 for precharging contactor K9

K9 Precharging contactor K9

K10 Coupling relay K10 for line contactor K11

K11 Line contactor K11

*optional

K7 Contactor for MDR On/Off

F16 Braking resistor trip contact

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7.13 Information regarding UL

INFORMATION

Due to UL requirements, the following chapter is always printed in English independent of the language of the documentation.

7.13.1 Electrical ratings

The Regenarative Power Module is rated:

Model	Input			Output		
	Volts AC	Ph	Amperes (FLA)	Volts DC	Ph	Amperes (FLA)
MDR91A-0500-X-X[1)]	380 – 480	3	80 A	560 V	2	94 A
MDR91A-0750-X-X[1)]	380 – 480	3	121 A	560 V	2	141 A
	Volts DC					
MDR91A-0500-X-X[1)]	24	1	7.5 A			
MDR91A-0750-X-X[1)]						

1) X - may represent up to three characters

The Regenerative Power Modules are rated 3 Ph, 50/60 Hz input, DC output at a maximum surrounding air temperature of 45 °C.

The ratings tabulated above, are for operation at line voltage of 400 V and a surrounding air temperature of 45 °C. To determine max output current rating at higher than 400 V, the output current should be de-rated 0.2 % per V (to max 480 V).

7.13.2 Short Circuit Current Rating

Regenerative Power supply modules MDR91A-..	SCCR: 65 kA/480 V when protected by:	
	Fuses JDDZ/7 (currents are maximum values)	Inverse-time circuit breaker (currents are maximum values)
0500	600 V/100 kA Class T, RK1 150 A	150 A max/480 V min
	Class J 150 – 200 A	
0750	600 V/100 kA Class T, RK1 150 A	150 A max/480 V min
	Class J 150 – 225 A	

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7.13.3 Other UL requirements

1. Use 60/75 °C copper wire only.
2. Tighten terminals to 160 – 196 in-lbs. (18 – 22 Nm) for Main Input, 10.5 – 13.4 in-lbs. (1.2 – 1.5 Nm) Control in-lbs. or Nm.
3. Suitable for use on a circuit capable of delivering not more than 65.000 Amperes rms symmetrical amperes when protected by when protected by fuses and circuit breakersas described in the ratings section. This marking also includes the maximum voltage rating of the device.
4. The branch circuit protection shall be specified in the installation instructions.
5. Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
6. The Overload Protection trip current percentage (150 %).
7. WARNING – The opening of the branch circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electrical shock, current-carrying parts and other components of the controller should be examined and replaced if damaged. If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced.
8. For use in Pollution Degree 2 environment.
9. For use only in a center earth TN supplied grid.

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8 Startup

8.1 General

⚠ DANGER

Uncovered power connections.

Severe or fatal injuries from electric shock.

- Install the touch guards at the modules.
- Install the closing covers according to the regulations.
- Never start up the application inverter unless touch guards are installed and closing covers are inserted.

NOTICE

Connecting the power supply modules with supply and energy recovery

The power supply module with supply and energy recovery may be switched on only when the motors are at a standstill.

8.1.1 Lifting applications

⚠ WARNING

Danger of fatal injury if the hoist falls.

Severe or fatal injuries.

- The application inverter is not designed for use as a safety device in lifting applications. Use monitoring systems or mechanical protection devices to ensure safety.

8.1.2 Connecting power

NOTICE

Undercutting the minimum switch-off time of the line contactor.

Irreparable damage to the application inverter or unforeseeable malfunctions.

The specified times and intervals must be observed.

- Observe a minimum switch-off time of 10 s for the relays K9, K10.
- Do not switch on / switch off the line more than once per minute and not more frequently than 10 times within 30 minutes.

8.1.3 Connecting cables

NOTICE

Disconnecting lines under voltage.

Irreparable damage to the application inverter or unforeseeable malfunctions.

- The following plug-in connections must always be disconnected in a de-energized state: Motor, supply system, braking resistor, brake, encoder.

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8.2 Startup requirements

The following requirements apply to startup:

- You have installed the application inverter correctly, both mechanically and electrically.
- You have configured the application inverter and connected drives correctly.
- Safety measures prevent accidental drive startup.
- Safety measures prevent danger to persons or machines.

Required hardware components:

- PC or laptop with Ethernet interface.
- Standard Ethernet cables for connection between PC and MOVI-C® CONTROLLER.
- MOVI-C® CONTROLLER with completed startup.

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8.3 Adjusting the line voltage

The line voltage is adjusted at the DIP switches as shown in the following.

S3/1	S3/2	S3/3	S3/4	Voltage in V
0	0	0	0	380
0	0	0	1	385
0	0	1	0	390
0	0	1	1	395
0	1	0	0	400
0	1	0	1	405
0	1	1	0	410
0	1	1	1	415
1	0	0	0	420
1	0	0	1	430
1	0	1	0	440
1	0	1	1	450
1	1	0	0	460
1	1	0	1	470
1	1	1	0	475
1	1	1	1	480

The line frequency is detected automatically.

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8.4 Switch-on/off sequence of the supply and regenerative module

8.4.1 Switching on the device

The switch-on sequence is started when the "End stage enable" and "Enable/upload" signals are activated.

The switch-on sequence is automatically run through when the input/output signals, the coupling relay, the line contactor, and the precharging contactor are correctly wired.

8.4.2 Switching off the device

The device is switched off when the "Enable/upload" signal is removed and the device is disconnected from the line voltage.

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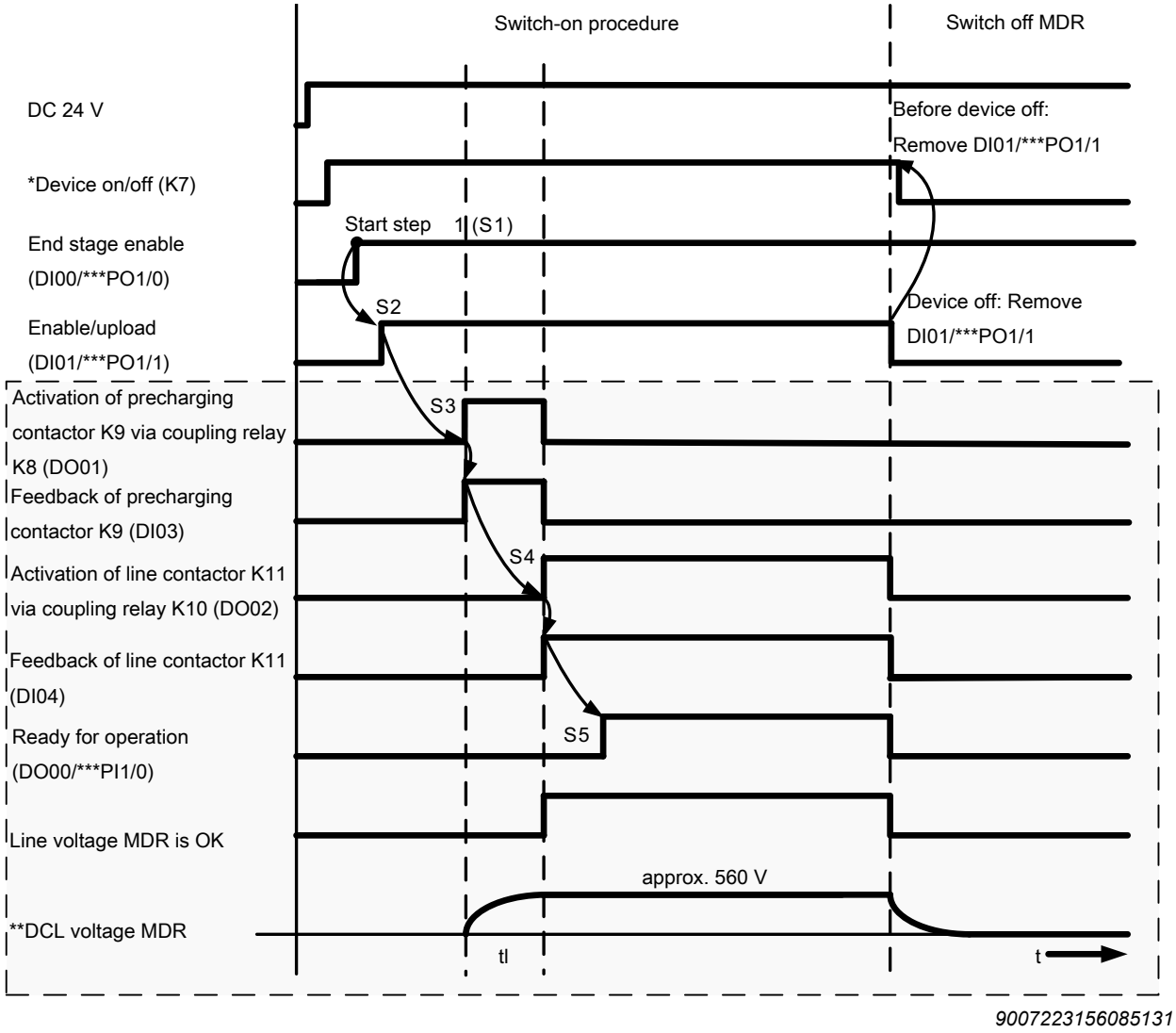
8.4.3 Switch-on/switch-off sequence diagram



tl Charging time via AC auxiliary supply takes approx. 3 s

* Option K7: external contactor for "Device ON/OFF"

** With a line voltage of 400 V

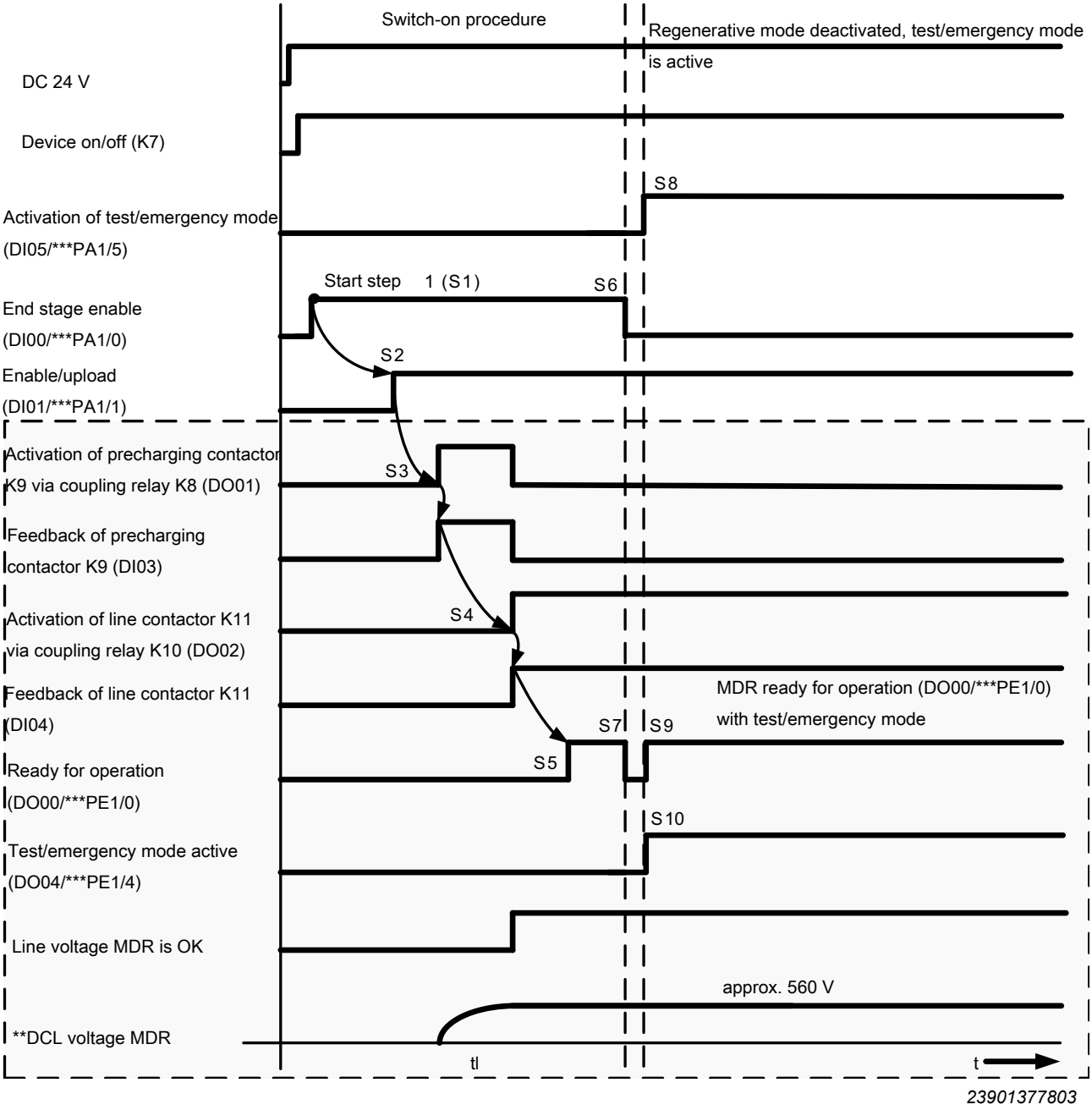
*** When controlled via fieldbus (PO1/0 acts inversely, i.e., the feedback mode is deactivated with high signal)

Step 1 and step 2 must be implemented by the customer

Section highlighted in gray from step 3 on: Automatic sequence until MDR reports "ready for operation"

Output and input signals must be wired by the customer

8.4.4 Test/emergency mode



tl Charging time via AC auxiliary supply takes approx. 3 s

* Option K7: external contactor for "Device ON/OFF"

** With a line voltage of 400 V

*** When controlled via fieldbus (PO1/0 acts inversely, i.e., the feedback mode is deactivated with high signal)

Step 1 and step 2 must be implemented by the customer

Section highlighted in gray from step 3 on: Automatic sequence until MDR reports "ready for operation"

Output and input signals must be wired by the customer

Test/emergency mode is shown by "Ld" flashing on the operating displays

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8.4.5 Troubleshooting

When a fault occurs according to "Fault at power supply module with supply and energy recovery" (→ 🗎 103), the "MDR ready for operation" signal is switched off.

In this case, the system must be brought to a standstill in an application-specific emergency mode.

The brake resistor can be used to shut the axes down in a controlled manner.

The error responses of the axis modules are found in the "MOVIDRIVE® modular Application Inverters" operating instructions.

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8.5 Process data assignment of card XSE31A

The process data assignment cannot be changed.

For additional information on integrating an EtherCAT® slave, refer to document "MOVI-C® CONTROLLER with EtherCAT®/SBus^{PLUS} system bus".

8.5.1 Process output data PO

Process data assignment PO1 (control word)	
Bit 0	Output stage enable "High": Output stage inhibited "Low": Output stage enable can be activated via terminal
Bit 1	Enable/charge
Bit 2	Error reset
Bit 3	Not assigned
Bit 4	Not assigned
Bit 5	Activation of test/emergency mode

8.5.2 Process input data PI

Process data assignment PI1 (status word)	
Bit 0	Ready
Bit 1	Activation of precharging contactor K9
Bit 2	Activation of line contactor K11
Bit 3	Fault
Bit 4	Test/emergency mode active

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9 Operation

9.1 General information

⚠ DANGER

Dangerous voltages present at cables and motor terminals

Severe or fatal injuries from electric shock.

- Dangerous voltages are present at the output terminals and the cables and motor terminals connected to them when the device is switched on. This also applies even when the device is inhibited and the motor is at standstill.
- Check whether the device is disconnected from the supply system before you start work on the power connections.
- After disconnecting from the supply system, wait at least 10 minutes and establish zero voltage before you start working on the power connections.
- The fact that the operation LEDs are no longer illuminated does not indicate that the application inverter no longer carries any voltage.
- Observe the general safety notes in chapter "Safety notes" (→ 🗎 44).

⚠ DANGER

Risk of crushing if the motor starts up unintentionally.

Severe or fatal injuries.

- Ensure that the motor cannot start inadvertently, for example, by removing the electronics terminal block X20.
- Additional safety precautions must be taken, depending on the application, to avoid injury to personnel and damage to machinery.

NOTICE

Switching the motor output at the application inverter with enabled output stage.

Damage to the application inverter.

- The motor output of the application inverter may be switched or disconnected only when the output stage is inhibited.

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9.2 Operating modes

9.2.1 Normal operation

Normal operation means production operation.

9.2.2 Test/emergency mode

In test/emergency mode, the connected axes of a machine or system can be moved, for example, for test purposes during startup or in emergency cases.

In this operating mode, the energy recovery module does not feed back regenerative energy into the power grid but converts the energy instead into heat energy via a braking resistor. The energy recovery module works in test/emergency mode as a power supply module only.

Requirements:

- A sufficiently dimensioned braking resistor is connected.
- Test/emergency mode can be activated after the switch-on/off sequence has been run through (DO00=1 MDR ready for operation/PI1/0=1), i.e.:
  - "Regenerative mode enable" is switched off: DI00 = 0 (low), PO1/0 = 1 (PO1/0 acts inversely, i.e., when a high signal is present, regenerative mode is deactivated).
  - "Enable/upload" (DI01/PO1/1)=1 must be active.
  - The digital input for the activation of test/emergency mode is activated, DI05 = 1 (high) or PO1/5 = 1.
- Next the energy recovery module reports "Test/emergency mode active" (DO04/ PI1/4). This state is displayed with "Ld" (flashing) on the operation and state display of the two-digit 7-segment display.

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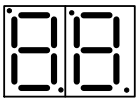
9.3 7-segment display

9.3.1 Operating displays



- The two 7-segment displays indicate the operating state of the power supply modules and axis modules.
- The displays for the axis modules and the power supply modules are therefore described separately.

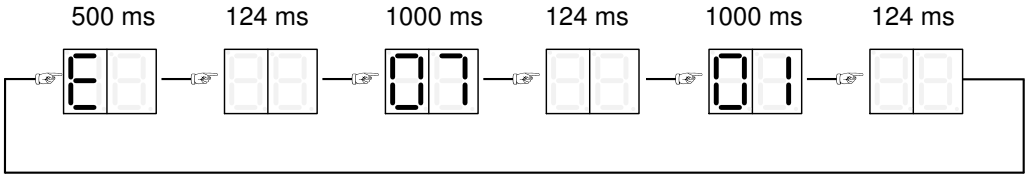
9.3.2 Fault display

The application inverter detects any faults that occur and displays them as fault code. Each fault is clearly defined by its fault code and corresponding attributes, as shown below:

- Fault response
- Final state after executing the fault response
- Type of reset response.

The fault codes are indicated as flashing numeric values in the axis and power supply module.

The fault code is displayed in the following display sequence:



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In the example, a 2-digit fault code with subfault is shown at the axis module, fault 07.01 in this example.

9.4 Operating displays

9.4.1 Operating displays on the power supply module with supply and energy recovery

Display	Description	State	Comment/action
Displays during boot process			
b0 b2 br	Device passes through several states when loading the firmware (boot) in order to become ready for operation.	• Status: Not ready. • Output stage is inhibited. • No communication possible.	• Waiting for boot process to finish. • Device stays in this condition: Device is defective.
Displays of different device statuses			

Display	Description	State	Comment/action
00	DC link voltage missing.	• Status: Not ready. • Output stage is inhibited. • Communication is possible.	Check the supply system.
dC hI Flashing alternately	Dangerous voltage in the DC link (> 20 V).		No enable, line contactor open.
C2	24 V supply of the power supply module with supply and energy recovery or internal switched-mode power supply unit of energy recovery not ready for operation.		Check 24 V or device is defective.
C3	Synchronization with bus is incorrect. Process data processing not available.		• Check the bus connection. • Check synchronization setting at device and controller. • Check process data settings at device and controller. • Check for missing PDO.
Ch	Energy recovery not ready and DC link pre-charge active.		Waiting for charging to finish.
Ch Flashing	System waits until precharging is possible		After successful precharging, it is necessary to wait 60 s until precharging can be done again
Co	Energy recovery not ready, line contactor can be energized.		–
Ld	Energy recovery not ready, line contactor energized and DC link charging active.		Output stage still inhibited.
Ld Flashing	Device is in test/emergency mode		
rd	Energy recovery ready.		–
Displays during initialization processes (parameters will be reset to default values)			
d0	Basic initialization.	• Status: Not ready. • Output stage is inhibited. • Communication is possible.	Waiting for initialization to finish.
d1	Initialization at delivery state.		
d2	Initialization of factory setting.		
d3	Initialization of customer-specific set 1.		
d4	Initialization of customer-specific set 2.		
Cd Flashing	Parameter download (via Vardata) active.		

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9.5 Fault at power supply module with supply and energy recovery

9.5.1 Fault 1 Output stage monitoring

Subfault: 1.2 **Description: Overcurrent in output stage**	
Response: Output stage inhibit	
Cause	Measure
Motor current too high.	Connect a smaller motor.
Current supply	Check the current supply.
Current transformer	Check the current transformer.
Ramp limit deactivated and set ramp time too short.	Increase the ramp time.
Phase module defective.	Check the phase module.
24 V supply voltage unstable.	Check the 24 V supply voltage.
Interruption or short circuit on signal lines of phase modules.	Check the signal lines.

9.5.2 Fault 3 Ground fault

Subfault: 3.1 **Description: Ground fault**	
Response: Output stage inhibit	
Cause	Measure
Ground fault in the motor lead.	Eliminate ground fault in motor lead.
Ground fault in the inverter.	Eliminate ground fault in inverter.
Ground fault in the motor.	Eliminate ground fault in motor.
Ground fault in line components.	Eliminate ground fault in line components.

9.5.3 Fault 4 Brake chopper

Subfault: 4.1 **Description: Brake chopper overcurrent**	
Response: Output stage inhibit	
Cause	Measure
Excessive regenerative power.	Extend deceleration ramps.
Short circuit detected in braking resistor circuit.	Check supply cable to braking resistor.
Braking resistance too high-impedance.	Check technical data of braking resistor.

9.5.4 Fault 6 Line fault

Subfault: 6.1 **Description: Line phase failure**	
Response: Output stage inhibit	
Cause	Measure
Missing line phase detected.	Check the supply system cable.
DC link voltage periodically too low.	Check the project planning of the supply system.
Inadequate line voltage quality.	Check the supply (fuses, contactor).

Subfault: 6.2 **Description: Power failure**	
Response: Output stage inhibit	
Cause	Measure
Power failure detected.	Check the supply system cable.

Subfault: 6.3 **Description: Line overvoltage**	
Response: Output stage inhibit	
Cause	Measure
Line voltage exceeds permitted upper threshold value.	Check the nominal line voltage in the project planning.
Inadequate line voltage quality.	Check the quality of the power system.

Subfault: 6.4 Description: Line undervoltage		
	Response: Output stage inhibit	
	Cause	Measure
	Line voltage falls below permitted lower threshold value.	Check the nominal line voltage in the project planning.
	Inadequate line voltage quality.	Check the quality of the power system.
	Supply system cable missing.	Check the wiring.

Subfault: 6.5 Description: Grid quality		
	Response: Output stage inhibit	
	Cause	Measure
	Insufficient line voltage quality.	Check the quality of the power system.

Subfault: 6.10 Description: Supply system cables erroneously switched		
	Response: Output stage inhibit	
	Cause	Measure
	Supply system cables have been erroneously switched.	Check the wiring of the line components.

Subfault: 6.11 Description: Fault in supply system cable or output stage		
	Response: Output stage inhibit	
	Cause	Measure
	Supply system cable missing.	Check the wiring.
	Faulty branch of output stage.	Check the device.

9.5.5 Fault 7 DC link

Subfault: 7.1 Description: DC link overvoltage		
	Response: Output stage inhibit	
	Cause	Measure
	The maximum permitted DC link voltage limit has been exceeded, and the output stage has been inhibited by the hardware.	– Extend deceleration ramps. – Check supply cable to the braking resistor. – Check technical data of the braking resistor.

Subfault: 7.3 Description: Permitted tolerance range of the voltage Vz to PE exceeded		
	Response: Output stage inhibit	
	Cause	Measure
	The permitted tolerance range of the voltage -Vz to PE has been exceeded.	– Reduce dynamic load change from motoring operation to regenerative operation. – Check the project planning with line filter. – Check the wiring.

Subfault: 7.4 Description: DC link undervoltage		
	Response: Output stage inhibit	
	Cause	Measure
	DC link voltage has dropped below the lower limit and output stage has been inhibited by the hardware	– Reduce the dynamic load change from regenerative operation to motoring operation. – Check previous error, e.g. line phase failure or supply system off in motor mode.

Subfault: 7.5 Description: DC link overcurrent		
	Response: Output stage inhibit	
	Cause	Measure
	DC link current too high in motor or regenerative operation.	– Motoring operation: load too high / check project planning. – Regenerative operation: Braking resistance too low-impedance or short circuit in braking resistor.

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9.5.6 Fault 11 Temperature monitoring

Subfault: 112-132S Description: Heat sink overtemperature		
	Response: Output stage inhibit	
	Cause	Measure
	The maximum permitted heat sink temperature has been exceeded. The capacity utilization is possibly too high.	– Reduce the load. – Reduce the rms value of the current. – Reduce the PWM frequency. – Ensure sufficient cooling. – Reduce the ambient temperature.

Subfault: 11.2 Description: Heat sink utilization – prewarning		
	Response: Output stage inhibit	
	Cause	Measure
	High thermal load on heat sink of device, and prewarning threshold reached.	– Reduce the load. – Reduce the rms value of the output current. – Reduce the PWM frequency. – Ensure sufficient cooling. – Reduce the ambient temperature.

Subfault: 11.3 Description: Device utilization		
	Response: Output stage inhibit	
	Cause	Measure
	The temperature has reached or exceeded the switch-off threshold. Possible causes: Mean output current too high.	Reduce the load.
	PWM frequency too high.	Reduce the PWM frequency.
	Ambient temperature too high.	Ensure sufficient cooling.
	Unfavorable air convection.	Check the air convection.
	Fan is defective.	Check fan and replace if necessary.

Subfault: 11.5 Description: Electromechanical capacity utilization		
	Response: Output stage inhibit	
	Cause	Measure
	Electromechanical components of device overloaded by excessively high continuous current.	Reduce the load. If necessary, reduce the rms value of the current.

Subfault: 11.6 Description: Electromechanical capacity utilization – prewarning		
	Response: Output stage inhibit	
	Cause	Measure
	High load on electromechanical components of device due to high continuous current. Prewarning threshold reached.	– Reduce the load. – Reduce the PWM frequency. – Reduce the rms value of the current. – Reduce the ambient temperature.

Subfault: 11.8 Description: Short circuit at the temperature sensor of the heat sink		
	Response: Output stage inhibit	
	Cause	Measure
	Short circuit at the temperature sensor of the heat sink.	Contact SEW-EURODRIVE Service.

9.5.7 Fault 17 Internal processor fault

Subfault: 17.7 Description: Exception fault		
	Response: Output stage inhibit	
	Cause	Measure
	Exception trap in CPU.	Contact SEW-EURODRIVE Service.

9.5.8 Fault 18 Software error

Subfault: 18.4 Description: Task system		
	Response: Remote – critical fault System state: Fault acknowledgment with CPU reset	
	Cause	Measure
	A fault was detected during the processing of the internal task system. This can for example be a timeout for cyclic tasks.	– Switch the device off and on again. – Contact the SEW-EURODRIVE Service if the fault persists.

Subfault: 18.9 Description: Internal software fault		
	Response: Remote – critical fault System state: Fault acknowledgment with CPU reset	
	Cause	Measure
	The software signals an unexpected event.	– Switch the device off and on again. – If the fault occurs repeatedly, replace the device and send it together with the fault number to SEW-EURODRIVE. For further support, contact SEW-EURODRIVE Service.

Subfault: 18.12 Description: Configuration data		
	Response: Remote – critical fault System state: Fault acknowledgment with CPU reset	
	Cause	Measure
	Configuration data not plausible or cannot be interpreted by active firmware version.	Perform a firmware update or load valid configuration data.

9.5.9 Fault 25 Parameter memory monitoring

Subfault: 25.10 Description: Power section configuration data – version conflict		
	Response: Emergency stop + output stage inhibit	
	Cause	Measure
	Wrong version of configuration data of power section.	Contact SEW-EURODRIVE Service.

Subfault: 25.12 Description: Power section configuration data – CRC fault		
	Response: Emergency stop + output stage inhibit	
	Cause	Measure
	Faulty configuration data of power section.	Contact SEW-EURODRIVE Service.

Subfault: 25.20 Description: Initialization fault – basic unit memory		
	Response: Emergency stop + output stage inhibit	
	Cause	Measure
	Initialization fault of basic unit memory.	Contact SEW-EURODRIVE Service.

Subfault: 25.21 Description: Runtime fault – basic unit memory		
	Response: Emergency stop + output stage inhibit	
	Cause	Measure
	Runtime fault in basic unit memory.	Contact SEW-EURODRIVE Service.

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9.5.10 Fault 26 External fault

Subfault: 26.4 Description: External braking resistor fault		
	Response: Remote – critical fault	
	Cause	Measure
	External braking resistor's temperature switch connected to terminal tripped.	– Check the resistor mounting position. – Clean the resistor. – Check the project planning of the resistor. – Install a larger resistor. – Check the trip switch settings. – Optimize travel cycle so that less regenerative operation energy arises.

9.5.11 Fault 32 Communication

Subfault: 32.2 Description: EtherCAT®/SBusPLUS process data timeout		
	Response: No response	
	Cause	Measure
	Process data timeout during EtherCAT®/SBusPLUS communication.	– Check the wiring of the system bus and module bus. – Check that the EtherCAT®/SBusPLUS configuration is correctly set in the MOVI-C® CONTROLLER. – Check EtherCAT®/SBusPLUS timeout configuration in the device.

Subfault: 32.3 Description: Faulty synchronization signal		
	Response: No response	
	Cause	Measure
	Faulty synchronization signal period.	Check that the EtherCAT®/SBusPLUS configuration is correctly set in the MOVI-C® CONTROLLER.

Subfault: 32.4 Description: No synchronization signal		
	Response: No response	
	Cause	Measure
	No synchronization signal present.	Check that the EtherCAT®/SBusPLUS configuration is correctly set in the MOVI-C® CONTROLLER.

Subfault: 32.5 Description: Synchronization timeout		
	Response: No response	
	Cause	Measure
	Timeout while synchronizing to synchronization signal.	Check that the EtherCAT®/SBusPLUS configuration is correctly set in the MOVI-C® CONTROLLER.

Subfault: 32.6 Description: Copy parameter set		
	Response: Output stage inhibit	
	Cause	Measure
	Fault while downloading the parameter set into the device.	– Check the wiring of the system bus and module bus. – Restart download.

9.5.12 Fault 33 System initialization

Subfault: 33.2 Description: Firmware CRC check		
	Response: Remote – critical fault System state: Fault acknowledgment with CPU reset	
	Cause	Measure
	Fault detected while checking the firmware.	Contact SEW-EURODRIVE Service.

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Subfault: 33.6 Description: FPGA configuration		
	Response: Output stage inhibit	
	Cause	Measure
	Fault detected while checking FPGA configuration.	Contact SEW-EURODRIVE Service.

Subfault: 33.10 Description: Boot timeout		
	Response: Remote – critical fault System state: Fault acknowledgment with CPU reset	
	Cause	Measure
	Timeout during system boot.	Contact SEW-EURODRIVE Service.

9.5.13 Fault 34 Process data configuration

Subfault: 34.1 Description: Process data configuration change		
	Response: Application stop + output stage inhibit	
	Cause	Measure
	The configuration of process data was changed during active process data operation.	– Stop the process data and make your changes. Then start the process data again. – Perform a reset. Doing so will stop the process data, apply the changes, and restart the process data.

9.5.14 Fault 36 Regenerative power supply module

Subfault: 36.1 Description: Precharging DC link timed out		
	Response: Output stage inhibit	
	Cause	Measure
	Precharging of the DC link to the voltage setpoint timed out.	– Project planning: Check the set nominal line voltage. – Project planning: Check DC link capacity. – Check the wiring.

Subfault: 36.2 Description: Charging the DC link to the voltage setpoint timed out		
	Response: Output stage inhibit	
	Cause	Measure
	Timeout during charging of the DC link to the voltage setpoint with power supply system connected.	– Project planning: Check the set nominal line voltage. – Project planning: Check DC link capacity. – Check the wiring.

Subfault: 36.10 Description: Implausible DC link voltage		
	Response: Output stage inhibit	
	Cause	Measure
	There is a wiring error. Initial course of the DC link voltage is not plausible.	Check the wiring.
	Line contactor jumpered or not present.	– The supply system is possibly connected directly. This is not permitted! – Check coupling relays and contactors. – Check feedback contacts.
	Line contactor jumpered or not present.	– The supply system is possibly connected directly. This is not permitted! – Check coupling relays and contactors. – Check feedback contacts.

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Subfault: 36.11 Description: Implausible line voltage		
	Response: Output stage inhibit	
	Cause	Measure
	There is a wiring error. Measurement of the line voltage is not plausible.	Check the wiring.
	"Line contactor feedback" connection erroneously switched with "Precharging contactor feedback" or "Line contactor activation" connection erroneously switched with "Precharging contactor activation" or "Precharging activation" connection erroneously switched with "Line contactor activation" and "Precharging feedback" erroneously switched with "Line contactor feedback"	– Check the connections of the feedback line(s). – Check the control line(s) of the coupling relays. – Check the control line(s) of the contactors.
	Line contactor jumpered or not present.	– The supply system is possibly connected directly. This is not permitted! – Check coupling relays and contactors. – Check feedback contacts.

Subfault: 36.15 Description: Precharging contactor feedback contact	
Response: Output stage inhibit	
Cause	Measure
Precharging contactor feedback contact provides an incorrect signal.	Check the wiring.

Subfault: 36.16 Description: Line contactor feedback contact	
Response: Output stage inhibit	
Cause	Measure
Line contactor feedback contact provides an incorrect signal.	Check the wiring.

Subfault: 36.20 Description: Precharging contactor opened externally	
Response: Output stage inhibit	
Cause	Measure
Precharging is active and the precharging contactor is actuated. Precharging contactor feedback contact provides an incorrect signal.	– Check the wiring. – Check the sequence control.

Subfault: 36.21 Description: Line contactor opened externally	
Response: Output stage inhibit	
Cause	Measure
The device is ready for operation and the line contactor is actuated. Line contactor feedback contact provides an incorrect signal.	– Check the wiring. – Check the sequence control.

Subfault: 36.30 Description: Closing of the precharging contactor timed out	
Response: Output stage inhibit	
Cause	Measure
Precharging contactor does not close within permitted timeout.	– Check the wiring. – Check the precharging contactor.

Subfault: 36.31 Description: Opening of the precharging contactor timed out	
Response: Output stage inhibit	
Cause	Measure
Precharging contactor does not open within permitted timeout.	– Check the wiring. – Check the precharging contactor.

Subfault: 36.35 Description: Closing of the line contactor timed out		
	Response: Output stage inhibit	
	Cause	Measure
	Line contactor does not close within permitted timeout.	– Check the wiring. – Check the line contactor.

Subfault: 36.36 Description: Opening of the line contactor timed out		
	Response: Output stage inhibit	
	Cause	Measure
	Line contactor does not open within permitted timeout.	– Check the wiring. – Check the line contactor. – Change the timeout.

9.5.15 Fault 45 Fieldbus interface

Subfault: 45.7 Description: Invalid process output data		
	Response: No response	
	Cause	Measure
	– The producer of the process output data reports that the data is invalid. – Process data is exchanged via the fieldbus but the data is invalid.	– Check whether the PLC is in "Stop" state. – Restart the PLC.

Subfault: 45.52 Description: Fieldbus interface – critical fault		
	Response: No response	
	Cause	Measure
	Fieldbus interface signals subcomponent fault of the "critical fault" type.	Refer to the subcomponent fault of the fieldbus interface and take the measures required for eliminating the fault.

9.5.16 Fault 49 Power supply module

Subfault: 49.5 Description: Fault in hardware component of analog to digital conversion		
	Response: Remote – critical fault	
	Cause	Measure
	Measured DC link values outside valid range or voltage supply of the transducers is defective.	Contact SEW-EURODRIVE Service.

Subfault: 49.11 Description: Collector emitter voltage monitoring		
	Response: Remote – critical fault	
	Cause	Measure
	– The voltage supply for the brake chopper is defective.	Check the connection of the braking resistor.
	UCE monitoring of brake chopper trips.	Switch the power off and on again. Contact the SEW-EURODRIVE Service if the error is still present.
	Short circuit in braking resistor.	Check the braking resistor and supply cable.
	Too much regenerative power.	Check the project planning for the axis system.

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9.6 Responses to error acknowledgement

9.6.1 Error acknowledgement at the power supply module

faults that are detected and displayed at the power supply module are acknowledged by switching off the fault source. The fault messages of the power supply module are transferred to the axis modules.

9.7 Operating braking resistor and emergency braking resistor

- The connection lead to the braking resistor/emergency braking resistor carries a **high DC voltage of up to 970 V** during rated operation.

⚠ WARNING

The surfaces of the braking resistors/emergency braking resistors reach high temperatures of up to 250 °C when the braking resistors are subject to a load of P_N.

Risk of burns and fire.

- Choose a suitable installation location. Braking resistors / emergency braking resistors are usually mounted on top of the control cabinet.
- Do not touch any braking resistor.

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10 Service

10.1 Inspection/maintenance

The device is maintenance-free. SEW-EURODRIVE does not stipulate any regular inspection work. However, it is recommended that you check the following components regularly:

- Connection cable:

  If cables become damaged or fatigued, replace them immediately.
- Cooling fins:

  In order to ensure sufficient cooling, remove any deposits which occur.

INFORMATION

Only SEW-EURODRIVE may repair the inverters

10.2 Extended storage

The following table shows the time intervals and maintenance tasks that are relevant for extended storage of the application inverter modules.

Modules	Time interval	Maintenance
MDR91A.... for extended storage above 40 °C	Every 2 years	Line connections: Connect the device to the line voltage for 5 minutes.

⚠ DANGER

Uncovered power connections.

Severe or fatal injuries from electric shock.

- Install the touch guards at the modules, see chapter "Touch guards" (→ 🗎 60).
- Install the closing covers according to the regulations, see chapter "Touch guards" (→ 🗎 60).
- Never start up the application inverter unless touch guards are installed and closing covers are inserted.

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10.3 Procedure in case maintenance has been neglected

If you have not performed maintenance regularly, SEW-EURODRIVE recommends that you increase the line voltage slowly up to the maximum voltage. This can be done, for example, by using a variable transformer for which the output voltage has been set according to the following overview. After you have completed the regeneration process, the device can be used immediately or stored again.

The following stages are recommended:

AC 400/500 V devices:

- Stage 1: 0 V to AC 350 V within a few seconds.
- Stage 2: AC 350 V for 15 minutes.
- Stage 3: AC 420 V for 15 minutes.
- Stage 4: AC 480 V for 1 hour.

10.4 Shutdown

To shut down the application inverter, de-energize the application inverter using appropriate measures.

⚠ WARNING

Electric shock from capacitors that have not been fully discharged.

Severe or fatal injuries.

- Observe a minimum switch-off time of 10 minutes after disconnecting the power supply.

10.5 Waste disposal

Observe the applicable national regulations.

Dispose of the following materials separately in accordance with the country-specific regulations in force, such as:

- Electronics scrap (circuit boards)
- Plastics
- Sheet metal
- Copper
- Aluminum

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Sales	Nairobi	SEW-EURODRIVE Pty Ltd Transnational Plaza, 5th Floor Mama Ngina Street P.O. Box 8998-00100 Nairobi	Tel. +254 791 398840 http://www.sew-eurodrive.co.tz info@sew.co.tz
Latvia			
Sales	Riga	SIA Alas-Kuul Katlakalna 11C 1073 Riga	Tel. +371 6 7139253 Fax +371 6 7139386 http://www.alas-kuul.lv info@alas-kuul.com

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Lebanon			
Sales (Lebanon)	Beirut	Gabriel Acar & Fils sarl B. P. 80484 Bourj Hammoud, Beirut	Tel. +961 1 510 532 Fax +961 1 494 971 ssacar@inco.com.lb
Sales (Jordan, Kuwait , Saudi Arabia, Syria)	Beirut	Middle East Drives S.A.L. (offshore) Sin El Fil. B. P. 55-378 Beirut	Tel. +961 1 494 786 Fax +961 1 494 971 http://www.medrives.com info@medrives.com
Lithuania			
Sales	Alytus	UAB Irseva Statybininku 106C 63431 Alytus	Tel. +370 315 79204 Fax +370 315 56175 http://www.irseva.lt irmantas@irseva.lt
Luxembourg			
representation: Belgium			
Macedonia			
Sales	Skopje	Boznos DOOEL Dime Anicin 2A/7A 1000 Skopje	Tel. +389 23256553 Fax +389 23256554 http://www.boznos.mk
Malaysia			
Assembly Sales Service	Johor	SEW-EURODRIVE SDN BHD No. 95, Jalan Seroja 39, Taman Johor Jaya 81000 Johor Bahru, Johor West Malaysia	Tel. +60 7 3549409 Fax +60 7 3541404 sales@sew-eurodrive.com.my
Mexiko			
Assembly Sales Service	Quéretaro	SEW-EURODRIVE MEXICO S.A. de C.V. SEM-981118-M93 Tequisquiapan No. 102 Parque Industrial Quéretaro C.P. 76220 Querétaro, México	Tel. +52 442 1030-300 Fax +52 442 1030-301 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx
Sales Service	Puebla	SEW-EURODRIVE MEXICO S.A. de C.V. Calzada Zavaleta No. 3922 Piso 2 Local 6 Col. Santa Cruz Buenavista C.P. 72154 Puebla, México	Tel. +52 (222) 221 248 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx
Mongolia			
Technical Office	Ulaanbaatar	IM Trading LLC Olympic street 28B/3 Sukhbaatar district, Ulaanbaatar 14230	Tel. +976-77109997 Tel. +976-99070395 Fax +976-77109997 http://imt.mn/ imt@imt.mn
Morocco			
Sales Service	Bouskoura	SEW-EURODRIVE Morocco Parc Industriel CFCIM, Lot 55 and 59 Bouskoura	Tel. +212 522 88 85 00 Fax +212 522 88 84 50 http://www.sew-eurodrive.ma sew@sew-eurodrive.ma
Namibia			
Sales	Swakopmund	DB Mining & Industrial Services Einstein Street Strauss Industrial Park Unit1 Swakopmund	Tel. +264 64 462 738 Fax +264 64 462 734 anton@dbminingnam.com
Netherlands			
Assembly Sales Service	Rotterdam	SEW-EURODRIVE B.V. Industrieweg 175 3044 AS Rotterdam Postbus 10085 3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 Service: 0800-SEWHELP http://www.sew-eurodrive.nl info@sew-eurodrive.nl

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New Zealand			
Assembly Sales Service	Auckland	SEW-EURODRIVE NEW ZEALAND LTD. P.O. Box 58-428 82 Greenmount drive East Tamaki Auckland	Tel. +64 9 2745627 Fax +64 9 2740165 http://www.sew-eurodrive.co.nz sales@sew-eurodrive.co.nz
	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 30 Lodestar Avenue, Wigram Christchurch	Tel. +64 3 384-6251 Fax +64 3 384-6455 sales@sew-eurodrive.co.nz
Nigeria			
Sales	Lagos	Greenpeg Nig. Ltd Plot 296A, Adeyemo Akapo Str. Omole GRA Ikeja Lagos-Nigeria	Tel. +234-701-821-9200-1 http://www.greenpegltd.com bolaji.adekunle@greenpegltd.com
Norway			
Assembly Sales Service	Moss	SEW-EURODRIVE A/S Solgaard skog 71 1599 Moss	Tel. +47 69 24 10 20 Fax +47 69 24 10 40 http://www.sew-eurodrive.no sew@sew-eurodrive.no
Pakistan			
Sales	Karachi	Industrial Power Drives Al-Fatah Chamber A/3, 1st Floor Central Commercial Area, Sultan Ahmed Shah Road, Block 7/8, Karachi	Tel. +92 21 452 9369 Fax +92-21-454 7365 seweurodrive@cyber.net.pk
Paraguay			
Sales	Fernando de la Mora	SEW-EURODRIVE PARAGUAY S.R.L De la Victoria 112, Esquina nueva Asunción Departamento Central Fernando de la Mora, Barrio Bernardino	Tel. +595 991 519695 Fax +595 21 3285539 sewpy@sew-eurodrive.com.py
Peru			
Assembly Sales Service	Lima	SEW EURODRIVE DEL PERU S.A.C. Los Calderos, 120-124 Urbanizacion Industrial Vulcano, ATE, Lima	Tel. +51 1 3495280 Fax +51 1 3493002 http://www.sew-eurodrive.com.pe sewperu@sew-eurodrive.com.pe
Philippines			
Sales	Makati	P.T. Cerna Corporation 4137 Ponte St., Brgy. Sta. Cruz Makati City 1205	Tel. +63 2 519 6214 Fax +63 2 890 2802 mech_drive_sys@ptcerna.com http://www.ptcerna.com
Poland			
Assembly Sales Service	Łódź	SEW-EURODRIVE Polska Sp.z.o.o. ul. Techniczna 5 92-518 Łódź	Tel. +48 42 293 00 00 Fax +48 42 293 00 49 http://www.sew-eurodrive.pl sew@sew-eurodrive.pl
	Service	Tel. +48 42 293 0030 Fax +48 42 293 0043	24 Hour Service Tel. +48 602 739 739 (+48 602 SEW SEW) serwis@sew-eurodrive.pl
Portugal			
Assembly Sales Service	Coimbra	SEW-EURODRIVE, LDA. Av. da Fonte Nova, n.º 86 3050-379 Mealhada	Tel. +351 231 20 9670 Fax +351 231 20 3685 http://www.sew-eurodrive.pt infosew@sew-eurodrive.pt
Romania			
Sales Service	Bucharest	Sialco Trading SRL str. Brazilia nr. 36 011783 Bucuresti	Tel. +40 21 230-1328 Fax +40 21 230-7170 sialco@sialco.ro
Russia			
Assembly Sales Service	St. Petersburg	ЗАО «СЕВ-ЕВРОДРАЙФ» а. я. 36 195220 Санкт-Петербург	Tel. +7 812 3332522 / +7 812 5357142 Fax +7 812 3332523 http://www.sew-eurodrive.ru sew@sew-eurodrive.ru

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Sambia			
representation: South Africa			
Senegal			
Sales	Dakar	SENEMECA Mécanique Générale Km 8, Route de Rufisque B.P. 3251, Dakar	Tel. +221 338 494 770 Fax +221 338 494 771 http://www.senemeca.com senemeca@senemeca.sn
Serbia			
Sales	Belgrade	DIPAR d.o.o. Ustanicka 128a PC Košum, IV floor 11000 Beograd	Tel. +381 11 347 3244 / +381 11 288 0393 Fax +381 11 347 1337 office@dipar.rs
Singapore			
Assembly Sales Service	Singapore	SEW-EURODRIVE PTE. LTD. No 9, Tuas Drive 2 Jurong Industrial Estate Singapore 638644	Tel. +65 68621701 Fax +65 68612827 http://www.sew-eurodrive.com.sg sewsingapore@sew-eurodrive.com
Slovakia			
Sales	Bratislava	SEW-Eurodrive SK s.r.o. Rybničná 40 831 06 Bratislava	Tel.+421 2 33595 202, 217, 201 Fax +421 2 33595 200 http://www.sew-eurodrive.sk sew@sew-eurodrive.sk
	Košice	SEW-Eurodrive SK s.r.o. Slovenská ulica 26 040 01 Košice	Tel. +421 55 671 2245 Fax +421 55 671 2254 Mobile +421 907 671 976 sew@sew-eurodrive.sk
Slovenia			
Sales Service	Celje	Pakman - Pogonska Tehnika d.o.o. UI. XIV. divizije 14 3000 Celje	Tel. +386 3 490 83-20 Fax +386 3 490 83-21 pakman@siol.net
South Africa			
Assembly Sales Service	Johannesburg	SEW-EURODRIVE (PROPRIETARY) LIMITED Eurodrive House Cnr. Adcock Ingram and Aerodrome Roads Aeroton Ext. 2 Johannesburg 2013 P.O.Box 90004 Bertsham 2013	Tel. +27 11 248-7000 Fax +27 11 248-7289 http://www.sew.co.za info@sew.co.za
	Cape Town	SEW-EURODRIVE (PROPRIETARY) LIMITED Rainbow Park Cnr. Racecourse & Omuramba Road Montague Gardens Cape Town P.O.Box 36556 Chempet 7442	Tel. +27 21 552-9820 Fax +27 21 552-9830 Telex 576 062 bgriffiths@sew.co.za
	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 48 Prospecton Road Isipingo Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 902 3815 Fax +27 31 902 3826 cdejager@sew.co.za
	Nelspruit	SEW-EURODRIVE (PROPRIETARY) LIMITED 7 Christie Crescent Vintonia P.O.Box 1942 Nelspruit 1200	Tel. +27 13 752-8007 Fax +27 13 752-8008 robermeyer@sew.co.za
South Korea			
Assembly Sales Service	Ansan	SEW-EURODRIVE KOREA CO., LTD. 7, Dangjaengi-ro, Danwon-gu, Ansan-si, Gyeonggi-do, Zip 425-839	Tel. +82 31 492-8051 Fax +82 31 492-8056 http://www.sew-eurodrive.kr master.korea@sew-eurodrive.com

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South Korea			
	Busan	SEW-EURODRIVE KOREA CO., LTD. 28, Noksansandan 262-ro 50beon-gil, Gangseo-gu, Busan, Zip 618-820	Tel. +82 51 832-0204 Fax +82 51 832-0230
Spain			
Assembly Sales Service	Bilbao	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 48170 Zamudio (Vizcaya)	Tel. +34 94 43184-70 http://www.sew-eurodrive.es sew.spain@sew-eurodrive.es
Sri Lanka			
Sales	Colombo	SM International (Pte) Ltd 254, Galle Raod Colombo 4, Sri Lanka	Tel. +94 1 2584887 Fax +94 1 2582981
Swaziland			
Sales	Manzini	C G Trading Co. (Pty) Ltd PO Box 2960 Manzini M200	Tel. +268 2 518 6343 Fax +268 2 518 5033 engineering@cgtrading.co.sz
Sweden			
Assembly Sales Service	Jönköping	SEW-EURODRIVE AB Gnejsvägen 6-8 553 03 Jönköping Box 3100 S-550 03 Jönköping	Tel. +46 36 34 42 00 Fax +46 36 34 42 80 http://www.sew-eurodrive.se jonkoping@sew.se
Switzerland			
Assembly Sales Service	Basel	Alfred Imhof A.G. Jurastrasse 10 4142 Münchenstein bei Basel	Tel. +41 61 417 1717 Fax +41 61 417 1700 http://www.imhof-sew.ch info@imhof-sew.ch
Taiwan			
Sales	Taipei	Ting Shou Trading Co., Ltd. 6F-3, No. 267, Sec. 2 Tung Huw S. Road Taipei	Tel. +886 2 27383535 Fax +886 2 27368268 Telex 27 245 sewtwn@ms63.hinet.net http://www.tingshou.com.tw
	Nan Tou	Ting Shou Trading Co., Ltd. No. 55 Kung Yeh N. Road Industrial District Nan Tou 540	Tel. +886 49 255353 Fax +886 49 257878 sewtwn@ms63.hinet.net http://www.tingshou.com.tw
Tanzania			
Sales	Daressalam	SEW-EURODRIVE PTY LIMITED TANZANIA Plot 52, Regent Estate PO Box 106274 Dar Es Salaam	Tel. +255 0 22 277 5780 Fax +255 0 22 277 5788 http://www.sew-eurodrive.co.tz info@sew.co.tz
Thailand			
Assembly Sales Service	Chonburi	SEW-EURODRIVE (Thailand) Ltd. 700/456, Moo.7, Donhuaroh Muang Chonburi 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.com
Tunisia			
Sales	Tunis	T. M.S. Technic Marketing Service Zone Industrielle Mghira 2 Lot No. 39 2082 Fouchana	Tel. +216 79 40 88 77 Fax +216 79 40 88 66 http://www.tms.com.tn tms@tms.com.tn
Turkey			
Assembly Sales Service	Kocaeli-Gebze	SEW-EURODRİVE Hareket Sistemleri San. Ve TIC. Ltd. Sti Gebze Organize Sanayi Böl. 400 Sok No. 401 41480 Gebze Kocaeli	Tel. +90 262 9991000 04 Fax +90 262 9991009 http://www.sew-eurodrive.com.tr sew@sew-eurodrive.com.tr

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United Arab Emirates			
Sales Service	Dubai	SEW-EURODRIVE FZE PO Box 263835 Office No. S3A1SR03 Jebel Ali Free Zone – South, Dubai, United Arab Emirates	Tel. +971 (0)4 8806461 Fax +971 (0)4 8806464 http://www.sew-eurodrive.ae info@sew-eurodrive.ae
Ukraine			
Assembly Sales Service	Dnipropetrovsk	ООО «СЕВ-Евродрайв» ул. Рабочая, 23-В, офис 409 49008 Днепр	Tel. +380 56 370 3211 Fax +380 56 372 2078 http://www.sew-eurodrive.ua sew@sew-eurodrive.ua
Uruguay			
Assembly Sales	Montevideo	SEW-EURODRIVE Uruguay, S. A. Jose Serrato 3569 Esqina Corumbe CP 12000 Montevideo	Tel. +598 2 21181-89 Fax +598 2 21181-90 sewuy@sew-eurodrive.com.uy
USA			
Production Assembly Sales Service	Southeast Region	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Production +1 864 439-9948 Fax Assembly +1 864 439-0566 Fax Confidential/HR +1 864 949-5557 http://www.seweurodrive.com cslyman@seweurodrive.com
Assembly Sales Service	Northeast Region	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Midwest Region	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 332-0038 cstroy@seweurodrive.com
	Southwest Region	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Western Region	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, CA 94544	Tel. +1 510 487-3560 Fax +1 510 487-6433 cshayward@seweurodrive.com
	Wellford	SEW-EURODRIVE INC. 148/150 Finch Rd. Wellford, S.C. 29385	Tel. +1 864 439-7537 Fax +1 864 661 1167 IGOrders@seweurodrive.com
	Additional addresses for service provided on request!		
Vietnam			
Sales	Ho Chi Minh City	Nam Trung Co., Ltd Huế - South Vietnam / Construction Materials 250 Binh Duong Avenue, Thu Dau Mot Town, Binh Duong Province HCM office: 91 Tran Minh Quyen Street District 10, Ho Chi Minh City	Tel. +84 8 8301026 Fax +84 8 8392223 khanh-nguyen@namtrung.com.vn http://www.namtrung.com.vn
	Hanoi	MICO LTD Quảng Trị - North Vietnam / All sectors except Construction Materials 8th Floor, Ocean Park Building, 01 Dao Duy Anh St, Ha Noi, Viet Nam	Tel. +84 4 39386666 Fax +84 4 3938 6888 nam_ph@micogroup.com.vn http://www.micogroup.com.vn

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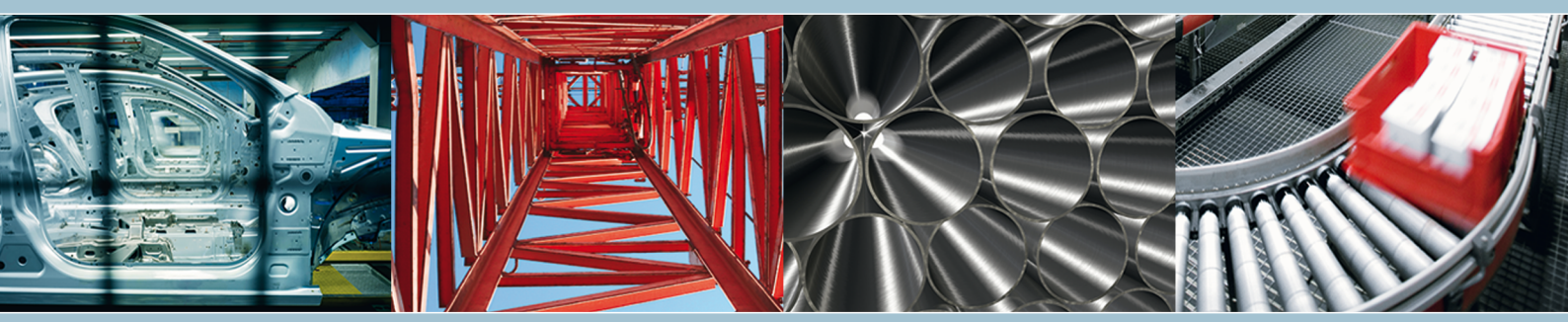

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