Product Manual

Application Inverter
MOVIDRIVE® system

Edition 03/2017

23061715/EN

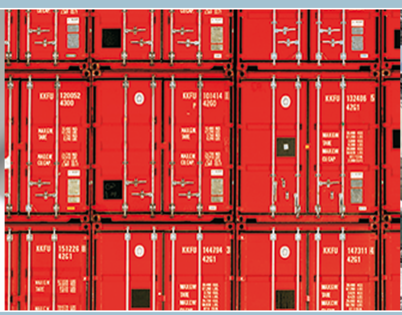


Table of contents

23061715/EN – 03/2017

23061715/EN – 03/2017

23061715/EN – 03/2017

1 Product description

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

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

MOVIDRIVE® system is the application inverter for direct line connection, suited for various types of applications, ranging from open-loop speed control to servo drives with kinematic model.

MOVIDRIVE® system consists of:

- Basic device application inverter.
- Accessories for EMC-compliant installation.
- Option cards for functional safety in functionally different versions.
- Accessories for connecting and controlling of motors and brakes, as well as prefabricated motor and encoder cables.

Besides MOVIDRIVE® system, the multi-axis system MOVIDRIVE® modular is available. The drive functions of both product series are based on one standardized software platform. The main difference between MOVIDRIVE® modular and MOVIDRIVE® system is the DC link connection of the individual modules with MOVIDRIVE® modular.

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

- 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 basic unit.
- Speed control, torque control, position control.
- Expansion slots for I/O, distance encoder, functional safety.
- Very compact device size, reduced space requirements in the control cabinet.

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

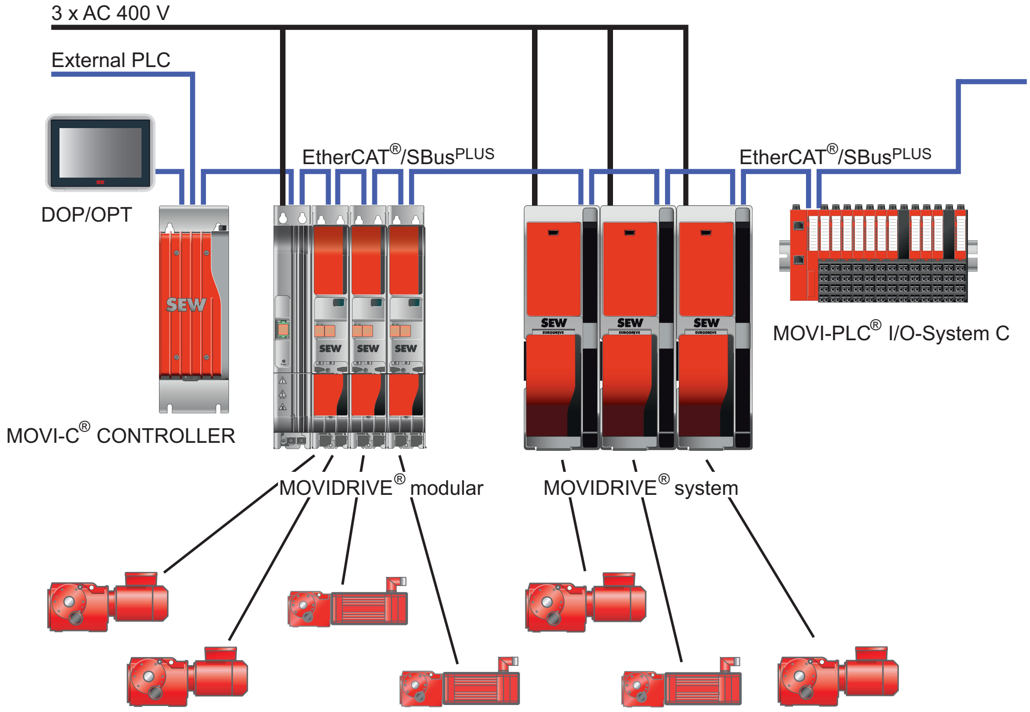
They offer a powerful clock-synchronous connection via the integrated EtherCAT®/SBus^{PLUS} communication interface. Other EtherCAT® stations from SEW-EURODRIVE or other manufacturers can be controlled and diagnosed by the MOVI-C® CONTROLLER.

The functions of the MOVI-C® CONTROLLER are:

- Freely programmable sequence control in accordance with IEC 6-1131 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 unit replacement through automatic data recovery.
- Central setpoint input for clock-synchronous drives and for auxiliary drives.
- Motion functions: Velocity control, torque specification, position specification, phase-synchronous operation, cams, application modules, kinematics.

23061715/EN – 03/2017

- EtherCAT®/SBus^{PLUS} master for SEW-EURODRIVE components and for peripheral devices with EtherCAT® interface.
- 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.
- Unit startup and parameterization.
- Data storage and data management.
- Scope and diagnostics.
- Programming environment for MOVI-C® CONTROLLER
- Programming environment for functional safety.
- Parameterization and diagnostics environment for application modules.

23061715/EN – 03/2017

1.1 Device availability

This documentation lists modules of the application inverter and accessories that are not yet available at the time of the publication of this document.

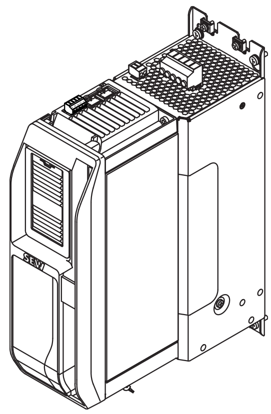
The following table lists the available application inverters. Accessories required for the inverter operation such as braking resistors, chokes, and filters are available.

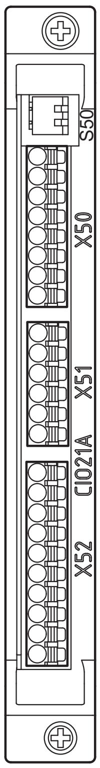
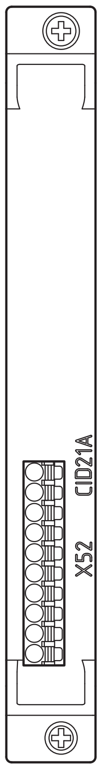
Type designation
MDX90A-0020-5E3-4-S00
MDX90A-0025-5E3-4-S00
MDX90A-0032-5E3-4-S00
MDX90A-0040-5E3-4-S00
MDX90A-0055-5E3-4-S00
MDX90A-0070-5E3-4-S00
MDX90A-0950-5E3-4-S00
MDX90A-0125-5E3-4-S00
MDX90A-0160-5E3-4-S00
MDX90A-0240-503-4-S00
MDX90A-0320-503-4-S00
MDX90A-0070-2E3-4-S00
MDX90A-0093-2E3-4-S00
MDX90A-0140-2E3-4-S00
MDX90A-0213-2E3-4-S00
MDX90A-0290-2E3-4-S00

23061715/EN – 03/2017

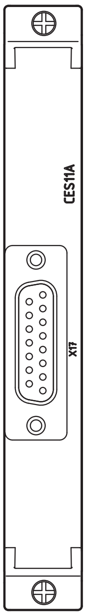
1

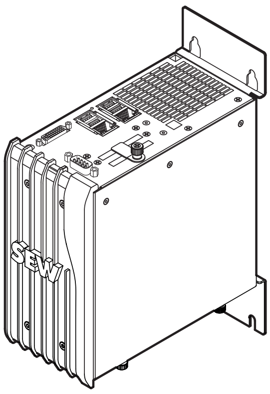
1.2 MOVIDRIVE® system at a glance

MOVIDRIVE® system	
	Description: (→ 🗎 12) Technical data: (→ 🗎 34) Dimension drawings: (→ 🗎 41) • Nominal output current: 2 – 588 A • Voltage ranges: 3 × 380 – 500 V, 3 × 200 – 240 V, 50 – 60 Hz • Nominal DC link voltage: DC 560 V (400 V), DC 325 V (230 V) • Overload capacity: 200% of the nominal output current for 3 s • System bus: EtherCAT®/SBus^PLUS

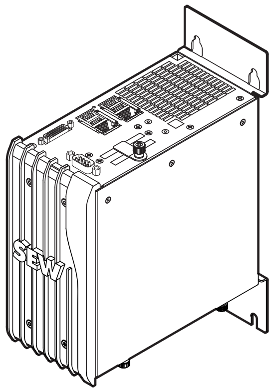
Option cards		
Input/output card		
CIO21A  	CID21A  	Description: (→ 🗎 14), (→ 🗎 187) Technical data: (→ 🗎 46) CIO21A • 4 digital inputs • 4 digital outputs • 2 analog inputs • 2 analog outputs CID21A • 4 digital inputs • 4 digital outputs

23061715/EN – 03/2017

Option cards	
CES11A multi-encoder card 	Description: (→ 🗎 14), (→ 🗎 190) Technical data: (→ 🗎 48) The multi-encoder card enables evaluating additional encoders. For detailed information on the CES11A multi-encoder card, refer to the manual "CES11A Multi-Encoder Card".

MOVI-C® CONTROLLER	
MOVI-C® CONTROLLER power 	MOVI-C® CONTROLLER power is characterized by: • Intel Core2Duo 2.2 GHz processor. • Windows® Embedded Standard 7. • Ethernet interface for engineering tasks or TCP/IP and UDP via IEC 61131-3. • 16 MB program memory and 64 MB data memory. • A maximum of 32 interpolating axes that can be connected. • Another 32 auxiliary axes that can be connected. • System bus master EtherCAT®/SBus^{PLUS}. • Optional slave connection via PROFIBUS DPV1. • Optional device connection via PROFINET IO. For further information on the control, refer to the manual "MOVI-C® CONTROLLER power UHX85A and power eco UHX84A".

23061715/EN – 03/2017

MOVI-C® CONTROLLER	
MOVI-C® CONTROLLER power eco 	The MOVI-C® CONTROLLER power eco is characterized by: • Intel Core2Duo 2.2 GHz processor. • Windows® Embedded Standard 7. • Ethernet interface for engineering tasks or TCP/IP and UDP via IEC 61131-3. • 16 MB program memory and 64 MB data memory. • A maximum of 16 interpolating axes that can be connected. • Another 16 auxiliary axes that can be connected. • System bus master EtherCAT®/SBus^{PLUS}. • Optional slave connection via PROFIBUS DPV1. • Optional device connection via PROFINET IO. For further information on the control, refer to the manual "MOVI-C® CONTROLLER power UHX85A and power eco UHX84A".

Accessories	
Prefabricated motor and encoder cables	Description and technical data: (→ 🗎 118)
Braking resistors	Description and technical data:" " (→ 🗎 50)
TCB thermal circuit breaker	Description and technical data: (→ 🗎 60)
Line filter	Description and technical data: (→ 🗎 62)
Output filter	Description and technical data: (→ 🗎 66)
Line choke	Description and technical data: (→ 🗎 64)
Output choke	Description and technical data: (→ 🗎 68)
Valid motor encoders	Description and technical data: (→ 🗎 74)

23061715/EN – 03/2017

1.3 Product overview MOVIDRIVE® system

Features

- Cover a wide range of power ratings with finely graded performance classes.
- Universal use due to a wide voltage range for line connection.
- Suited for TN/TT and IT voltage supply systems.
- EtherCAT®/SBus^{PLUS} system bus is available for communication.
- 4-quadrant capable due to integrated brake chopper.
- High overload capacity of 200% I_N.

Device data 3 × AC 400 V

Nominal line voltage according to EN 50160	3 × 380 – 500 V
Line frequency	50 – 60 Hz ± 10%
Nominal DC link voltage	DC 560 V
Overload capacity	200%: 3 s with PWM 4 kHz

Type designation	Nominal output current at PWM = 4 kHz	Recommended motor power ASM	Nominal line current	Size	Technical data
	A	kW	A		
MDX90A-0020-5E3-4-S00	2	0.55	1.9	1	(→ 🗎 34)
MDX90A-0025-5E3-4-S00	2.5	0.75	2.3		
MDX90A-0032-5E3-4-S00	3.2	1.1	2.9		
MDX90A-0040-5E3-4-S00	4	1.5	3.6		
MDX90A-0055-5E3-4-S00	5.5	2.2	5	2	
MDX90A-0070-5E3-4-S00	7	3	6.3		
MDX90A-0950-5E3-4-S00	9.5	4	8.6		
MDX90A-0125-5E3-4-S00	12.5	5.5	11.3	3	
MDX90A-0160-5E3-4-S00	16	7.5	14.4		
MDX90A-0240-503-4-S00	24	11	22	4	
MDX90A-0320-503-4-S00	32	15	29		
MDX90A-0460-503-4-S00	45	22	42	5	
MDX90A-0620-503-4-S00	62	30	56		
MDX90A-0750-503-4-S00	75	37	68		

23061715/EN – 03/2017

1

Type designation	Nominal output current at PWM = 4 kHz	Recommended motor power ASM	Nominal line current	Size	Technical data
	A	kW	A		
MDX90A-0910-503-4-S00	91	45	82	6	(→ 🗎 34)
MDX90A-1130-503-4-S00	113	55	102		
MDX90A-1490-503-4-S00	149	75	135		
MDX90A-1770-503-4-S00	177	90	160	7	
MDX90A-2200-503-4-S00	220	110	198		
MDX90A-2500-503-4-S00	250	132	225	8	
MDX90A-3000-503-4-S00	300	160	280		
MDX90A-3800-503-4-S00	380	200	340	9	
MDX90A-4700-503-4-S00	470	250	435		
MDX90A-5880-503-4-S00	588	315	545		

Device data 3 × AC 230 V

Nominal line voltage according to EN 50160	3 × 200 – 240 V
Line frequency	50 – 60 Hz ± 10%
Nominal DC link voltage	DC 325 V
Overload capacity	200%: 3 s with PWM 4 kHz

Type designation	Nominal output current at PWM = 4 kHz	Recommended motor power ASM	Nominal line current	Size	Technical data
	A	kW	A		
MDX90A-0070-2E3-4-S00	7	1.5	6.4	2	(→ 🗎 37)
MDX90A-0093-2E3-4-S00	9.3	2.2	8.4		
MDX90A-0140-2E3-4-S00	14	3.7	12.4	3	
MDX90A-0213-2E3-4-S00	21.3	5.5	18.9	4	
MDX90A-0290-2E3-4-S00	29	7.5	27.4		
MDX90A-0420-2E3-4-S00	42	11	40.8	5	
MDX90A-0570-2E3-4-S00	57	15	52		
MDX90A-0840-2E3-4-S00	84	22	76	6	
MDX90A-1080-2E3-4-S00	108	30	86		

23061715/EN – 03/2017

1.4 Product overview accessories

The functionality and flexibility of MOVI-C® application inverters can be supplemented by many different option cards.

1.4.1 CID21A input/output card

This option card is used to increase the number of digital inputs and outputs of the basic device.

- 4 digital inputs.
- 4 digital outputs.

1.4.2 CIO21A input/output card

This option card is used to increase the number of digital and analog inputs and outputs of the basic device.

- 4 digital inputs.
- 4 digital outputs.
- 2 analog inputs (current/voltage).
- 2 analog outputs (current/voltage).

1.4.3 CES11A multi-encoder card

The CES11A multi-encoder card enables evaluation of additional encoders. The additional encoder can be used as distance encoder or as motor encoder.

The following encoders are supported:

HTL 12/24 V (differential)
TTL/RS422 (differential)
SIN/COS 1 V_{SS} (differential)
HIPERFACE® with SIN/COS signals 1 V_{SS}
SEW encoder (RS485) with SIN/COS signals 1 V_{SS}, e.g. AS7W, AG7W
EnDat 2.1 with SIN/COS signals 1 V_{SS}
SSI encoder with/without SIN/COS signals 1 V_{SS}
CANopen encoder

Besides the encoders listed above, further encoders that can be used are described in chapter "Valid motor encoders from SEW-EURODRIVE".

1.5 FCB concept

FCB = Function Control Block

The term "FCB concept" describes the modular firmware design of MOVI-C® inverters. This feature ensures that a wide range of drive functions can be selected or deselected quickly and easily using control words.

All primary functions, i.e. functions that move or control the motors, are designed as individual FCBs that only have to be selected to perform a specific task, for example positioning.

You can switch between different FCBs any time. Switching to another FCB is performed with a maximum delay of 0.5 ms.

The FCBs are assigned to different priorities. If a FCB with a higher priority than the currently active FCB is selected, the FCB with the higher priority is activated.

The FCBs are sorted in descending order of their priority in the following list:

- FCB 01 Output stage inhibit
- FCB 14 Emergency stop
- FCB 13 Stop at application limits
- FCB 18 Rotor position identification
- FCB 25 Motor parameter measurement
- FCB 12 Reference travel
- FCB 04 Manual mode
- FCB 20 Jog mode
- FCB 19 Position hold control
- FCB 21 Brake test
- FCB 10 Interpolated position control
- FCB 09 Position control
- FCB 06 Interpolated speed control
- FCB 05 Speed control
- FCB 08 Interpolated torque control
- FCB 07 Torque control
- FCB 26 Stop at user limits
- FCB 02 Default stop

23061715/EN – 03/2017

1.5.1 Description of the FCBs

FCB 01 Output stage inhibit

Activating FCB 01 stops the connected motor via the motor brake. If no brake is installed, the motor coasts to a stop.

FCB 02 Default stop

FCB 02 stops the drive with the preset profile value "Maximum deceleration". This value is limited by the "Application limit – deceleration".

FCB 02 is active (default), when no other FCB is selected.

FCB 04 Manual mode

FCB 04 cannot be selected and activated directly using control words.

During startup using the MOVISUITE® engineering software the function block can be selected and activated via the function "manual mode". The manual mode is used for startup or setup mode without higher-level controller.

FCB 05 Speed control

The application inverter can be operated as speed-controlled axis.

The user can specify profile values for acceleration, deceleration, and jerk as the basic conditions for speed control. The actual speed setpoint for the drive controller is generated in the controller cycle by a profile generator integrated in the inverter using the specified limit values.

FCB 06 Interpolated speed control

FCB 06 is used for cyclic preselected speed setpoints of higher-level controllers.

In multi-axis applications, a controller often calculates a track profile for several drive axes. The axis is only assigned setpoints (position/speed/torque and torque limits/precontrol values/inertia) that it has to follow. The axis limits the setpoints using the application limits. The course of the profile of the path curve is controlled by the controller.

The setpoint cycle of the controller does usually not correspond to the setpoint cycle of the axis (500 µs). If the axis were to "see" the same setpoint for several cycles, a step-shaped actual value would result. To prevent this from happening, the axis can interpolate intermediate values. To do so, the setpoint cycle of the controller has to be known.

FCB 07 Torque control

The application inverter can be run as a torque-controlled axis.

The user can specify profile values for speed, deceleration and jerk as the basic conditions for torque control. The actual torque setpoint for the drive controller is generated in the controller cycle by a profile generator integrated in the inverter using the specified limit values.

During torque control the maximum speed is restricted by the speed limits so that the drive cannot permanently accelerate with the preset setpoint torque while the counter-torque is too low.

FCB 08 Interpolated torque control

FCB 08 is used for cyclic preselected torque setpoints of higher-level controllers.

This higher-level controller usually calculates a track profile for several drive axes. The axis is then assigned to one setpoint (position, speed, torque, torque limits, precontrol values, inertia) that it has to follow.

The inverter limits the setpoints using the application limits. The course of the path curve profile is controlled by the controller.

The cycle in which the controller sends the setpoints to the axis does not usually correspond with the setpoint processing cycle of the inverter. If the inverter were to "see" the same controller setpoint for several cycles, a step-shaped actual torque value would result.

To prevent this from happening, the axis can calculate intermediate values (interpolate) if it knows the controller cycle. The application inverter can be set to different cycle times of higher-level controllers.

FCB 09 Position control

FCB 09 is used to allow travel to the target position by using a position profile parameterized by the profile generator during positioning.

In addition, the application inverter has several positioning modes that are described in the following section:

Absolute positioning:

The position setpoint in user units is interpreted as an absolute target and is converted and executed in system units.

The travel range in system units is -2^{31} – 2^{31} -1 (2147483647). If the travel range is exceeded after calculation, the FCB issues a fault

Relative positioning:

The position setpoint in user units is interpreted as the offset for the last setpoint that was transferred. After it has been converted into system units, it is added to the last setpoint.

If the time calculated in system units is outside the travel range of -2^{31} – 2^{31} -1 (2147483647), the FCB issues a fault.

Modulo in positive direction with absolute position specification:

The position setpoint in user units is interpreted as the absolute position. It must be within the modulo range of the active drive:

Lower limit = "Modulo min."

Upper limit = "Modulo max."

If the position setpoint is outside this range, a fault is issued. The drive always turns in a positive direction to reach the position.

Modulo in negative direction with absolute position specification:

The position setpoint in user units is interpreted as the absolute position. It must be within the modulo range of the active drive:

Lower limit = "Modulo min."

Upper limit = "Modulo max."

If the position setpoint is outside this range, a fault is issued. The drive always turns in a negative direction to reach the position.

Modulo with shortest distance with absolute position specification:

The position setpoint in user units is interpreted as the absolute position. It must be within the modulo range of the active drive:

Lower limit = "Modulo min."

Upper limit = "Modulo max."

If the position setpoint is outside this range, a fault is issued.

The direction of the drive is determined using the last setpoint position (= current actual position after activation without an "In position" message) and the current setpoint position. This value is used to determine the shortest possible route and, therefore, the direction of rotation for positioning.

FCB 10 Interpolated position control

FCB 10 is used for cyclic preselected position setpoints of higher-level controllers.

In multi-axis applications, a higher-level controller usually calculates a track profile for several drive axes. The axis is only assigned setpoints (position, speed, torque, torque limits, precontrol values, inertia) that it has to follow. The axis limits the setpoints using the application limits. The course of the profile of the path curve is controlled by the controller.

The setpoint cycle of the controller does usually not correspond to the setpoint cycle of the axis. If the axis were to "see" the same setpoint for several cycles, a step-shaped actual value would result. To prevent this from happening, the axis can interpolate intermediate values. To do so, the setpoint cycle of the controller has to be known.

FCB 12 Reference travel

To perform positioning operations, a drive has to be referenced to a defined start or reference position within the permitted travel distance.

From this reference position, positions such as the machine zero can be specified and approached. With each restart of the inverter, referencing the position encoders is always necessary if position encoders do not have an absolute position detection. When using absolute encoders, the absolute position is immediately known upon the start of the system. An absolute encoder still has to be referenced to match the displayed position with the plant's reference system. Several reference travel types are available for referencing and for finding the reference point.

FCB 13 Stop at application limits

When FCB 13 is activated, the drive stops with speed control using the preset application limit deceleration.

23061715/EN – 03/2017

FCB 14 Emergency stop

When FCB 14 is activated, the drive stops with the preset emergency stop deceleration.

FCB 18 Rotor position identification

For an optimum operation of synchronous AC motors, the exact position information of the rotor is required for the control. The inverter can then create the maximum motor torque with this position information.

FCB 18 is required for the commutation detection of rotary and linear synchronous motors with encoder.

The drive must be disconnected from the load, which means also from the gear unit. If this is not possible, or only with considerable effort, FCB 25 "Motor parameter measurement" has to be used. But FCB 25 does not determine a relative position. Only in control mode ELSM® can be travelled according to FCB 25 alone.

In case of third-party synchronous motors , SEW-EURODRIVE recommends to activate FCB 25 before running FCB 18.

FCB 19 Position hold control

When FCB 19 is activated, the drive stops with speed control. After the standstill of the drive, the position is kept with position control as long as FCB 19 is active.

FCB 20 Jog mode

FCB 20 is used for setup mode when a higher-level controller is used.

FCB 20 allows the user to move an axis in positive and negative direction.

The control takes place via control signals that are specified with control words, via digital inputs of a higher-level controller or via input terminals.

For startup or for setup mode without higher-level controller use the manual operation of the MOVISUITE® engineering software, see "FCB 04" (→ 🗎 16).

FCB 21 Brake test

FCB 21 is used to check the braking capability of a brake connected to the motor. A test torque is applied electrically via the motor when the brake is applied.

Even when the brake has passed the brake test, it does not take on any safety functions as far as machine safety is concerned in combination with the application inverter.

The brake is only tested in accordance with the set brake test torque. The actual breakaway torque of the brake is not measured.

There are 4 test modes:

- A higher-level controller provides the setpoints and monitoring function for the test.
- The application inverter performs a check in both directions compared to the set limit torques.
- The application inverter performs a check in positive direction compared to the set limit torques.
- The application inverter performs a check in negative direction compared to the set limit torques.

The test torque, test time and the direction of rotation of the test can be set. If a test is not passed, the breakaway torque is documented.

23061715/EN – 03/2017

The braking torque is limited by the set "Torque" application limit.

Please note: The application torque must be considered for calculating the test torque, e.g. hoist test "downward".

FCB 25 Motor parameter measurement

FCB 25 is used for determining the necessary motor values from the electric equivalent wiring diagram during startup.

The nameplate data of the connected motor is required for the motor parameter measurement.

After the motor parameter measurement has been completed, the motor is completely started up electrically. Values that are not yet final at this stage, such as maximum speed and maximum torque, are estimated. The values have to be corrected at a later time to reach the full performance of the motor.

In case of synchronous motors, SEW-EURODRIVE recommends to activate FCB 25 before running FCB 18.

FCB 26 Stop at user limits

FCB 26 is used for stops at user limits. The user limits are either available as local setpoints or initiate the deceleration ramp set via the fieldbus.

You can choose between a speed-controlled ramp and a position-controlled ramp. In contrast to other stop FCBs (FCB 13/FCB 14), the FCB 26 has a very low priority.

This allows you to select FCB 26 as standard (e.g. bit in the control word that selects this FCB is always TRUE). If all other FCBs are deactivated, FCB 26 always becomes active. This makes it possible to always stop with position control.

FCB 26 has lag fault monitoring in position-controlled mode.

1.6 Control mode

The following control modes are available for MOVIDRIVE® application inverters:

- V/f
- VFC^{PLUS}
- CFC
- ELSM®

1.6.1 Description of the control modes

The characteristics of the motor connected to the application inverter are influenced by the control modes used.

V/f

V/f control is intended for easy controlled operation of asynchronous motors without encoder feedback. The procedure operates an asynchronous machine on a parameterizable voltage/frequency characteristic. To keep the magnetizing current on a constant level, the voltage (U) is adjusted in proportion to the frequency (f).

The actual slip is estimated and can be compensated. The voltage drop at the stator resistance can be compensated by the I×R compensation and improves the control behavior in case of load. The Boost parameter allows to increase the voltage over the V/f characteristic for improving the torque at low speeds.

V/f control is suited for applications with a limited speed setting range, where no dynamic step changes in load occur and where there are small requirements regarding the control characteristics.

V/f control is suited for group drives. A group drive is an electrical parallel connection of several identical or different motors at one inverter. The motors do not have a rigid mechanical connection.

Speed control

The V/f mode is an encoder-less mode and calculates the actual speed value. The calculation is always based on the electrical values of the motors. Therefore, information from a potentially existing encoder system is not used.

If an encoder is parameterized in the encoder assignment as "Actual speed source", the speed measured by this encoder is issued as the actual speed by the inverter. Otherwise, the model speed calculated by the V/f method based on stator frequency and slip, is issued as the actual speed.

The V/f mode does not have a higher-level speed controller, speed controller parameterization is therefore not possible. An acceleration and torque precontrol is also not possible.

VFC^{PLUS}

VFC^{PLUS} is a high-performance control mode that is able to operate asynchronous motors with very high torque dynamics with or without rotary encoder.

The control mode can be operated as speed or torque control.

This control mode calculates all important state variables for controlling the motor by using a motor model. As a result, optimal magnetic conditions are always achieved for the motor.

For applications with a large speed setting range (especially for low speeds up to standstill) and high requirements regarding the control characteristics or for drives with high dynamic step changes in load, a rotary encoder is absolutely necessary.

For applications with low requirements regarding the control characteristics and the torque dynamics, an encoder is not necessary. Without a rotary encoder, the electric rotor frequency is calculated in a model. In this case, stable stationary operation of the mode at < 0.5 Hz is not possible.

To also achieve enough torque with low currents, it is possible to raise the stator flux in the stator frequency < slip frequency range with the "Boost" parameter.

Due to the good torque dynamics, the VFC^{PLUS} control mode remains stable in case of load changes and has a high torque accuracy. Typical applications for the VFC^{PLUS} control mode are speed-controlled asynchronous machines with high demands on the speed and torque stability.

Speed control

A higher-level speed control loop that has to be parameterized accordingly is always used for speed control.

If the control mode is operated without an encoder, the actual speed of the motor is calculated by the control mode.

If an encoder is used, the angle information of this encoder is used for the control mode. The actual speed of the motor is calculated from this encoder. The maximum dynamics of the control loop are reached with a high-resolution encoder.

Torque control

The torque control operating mode can be selected independently of an encoder and does not need an encoder. With an encoder, however, stable stationary operation at stator frequency 0 Hz is also possible.

Position control

Position-controlled operation is only possible with an encoder as the actual position is calculated from the parameterized encoder. This encoder can either be mounted on the track or on the motor.

The accuracy of the position control can be increased with a motor encoder.

23061715/EN – 03/2017

CFC

The CFC control mode is a current-controlled control mode. The CFC control mode allows to operate asynchronous and synchronous servomotors with maximum torque dynamics. For this purpose, the current components for the magnetic flux and for the torque generation are controlled separately.

The control mode requires information about the rotor angle and the motor speed. For this reason, an encoder feedback (motor encoder) is always necessary.

For asynchronous motors, only the relative rotor angle is necessary. Thus, an incremental encoder is sufficient.

The control mode requires the absolute position for synchronous motors. In case of encoder types that do not provide an absolute value, a commutation must be performed before the release (FCB 18).

The advantage of the CFC control mode is the very high dynamic that can be achieved, as a control reserve for reaching the dynamic maximum torque is always available. For this reason, the CFC control mode is suited for drives with highly dynamic motion control.

ELSM®

The ELSM® control mode allows for operation of permanent-field synchronous servomotors without encoder.

The main characteristics are:

- Use of servomotors without encoder in horizontal materials handling technology.
- Maximum motor torque 150% M_0 in the entire speed range.
- Flying start function for synchronization to the running motor.
- Output current of the inverter ≥ 150% I_0 of the motor.
- No permanent operation below 2% of the nominal motor speed.
- Use in hoists and inclining tracks is not permitted.
- Multi-motor operation and group operation are not permitted.

Rotor adjustment/rotor position measurement

When the inverter is enabled in ELSM® control mode, the rotor position of the permanent-field synchronous motors is unknown. For this reason, the rotor position has to be determined first or the rotor has to be adjusted by turning so that its angular position is defined.

Measuring the rotor position:

The rotor position of the synchronous motor is measured with test pulses for each enable. This occurs at standstill. If a brake is used, this brake remains applied. The measurement is finished after a maximum of 50 ms. After the measurement is completed, the synchronous motor accelerates to the setpoint speed. A prerequisite for the measurement is the one-time determination of the complete motor parameters with the FCB 25 motor parameter measurement.

SEW-EURODRIVE recommends measuring the rotor position.

Adjusting the rotor:

If the complete motor data is not known, the rotor is moved to a defined position at each enable. A small motor movement depending on the motor pole number takes place during the adjustment. If a brake is used, this brake is released. The adjustment is completed after 1 s.

23061715/EN – 03/2017

Speed control

The speed control operating mode can be activated in the ELSM® control mode. The control mode has to be distinguished speed-dependent in two different operating ranges:

- Open-loop control

  and

- speed-controlled operation.

Open-loop control takes place when starting from standstill and below a transition speed. This transition speed is calculated and set depending on the inverter and motor parameters during motor startup. It is about 2% of the nominal speed.

Above this minimum speed, the speed control without encoder works.

Torque control

The ELSM® control mode enables the "Torque control" operating mode; however, only above the transition speed.

Practical meaning: The FCB 07 "Torque control" can only be activated when the flying start function is active and above the transition speed (example: winding drive). If the speed is too low, the system shuts down with a fault message.

Flying start function

If it cannot be ensured that the motor is at standstill during the start, the flying start function has to be activated. This way, the ELSM® control mode can also be enabled for a turning motor.

If the speed can be calculated plausibly, the control mode proceeds to speed-controlled operation. If this is not the case, the drive proceeds to the "rotor adjustment" or "rotor measurement" function and then to controlled operation.

23061715/EN – 03/2017

1.6.2 Characteristics of the control modes

Overview of the control modes

	V/f	VFC^PLUS		CFC		ELSM®
Principle	Voltage controlled according to characteristic curve	Field-oriented, voltage-controlled, stator flux controller, torque controller		Field-oriented, current controller		Field-oriented, current controller
Motor	ASM/LSPM	ASM	ASM	ASM	SM	SM
Encoder	None	None	Yes	Yes	Yes	None
Dynamics	+	+++	++++	+++++	+++++	++
Energy efficiency	+	+++	+++	++	+++++	++++
Speed control	Yes[1)]	Yes		Yes		Yes
Torque control	No	Yes		Yes		Yes
Positioning	No	No	Yes	Yes		No
Flying start	No[2)]	Yes		Yes		Yes
Typical applications	Group drive, multi-motor drives	General materials handling technology, horizontal drives, vertical drives, pumps/fans, winding drives		Packaging technology, handling technology, highly-dynamic positioning		Horizontal materials handling technology
Mark	Maximum robustness	Maximum precision		Maximum dynamics		Maximum energy efficiency

1) Open-loop speed control
2) DC braking

ASM	Asynchronous motors
LSPM	Motors with LSPM technology (Line Start Permanent Magnet)
SM	Synchronous motors

Characteristic values for dynamics

	V/f	VFC^PLUS	CFC	ELSM®
Torque control time	–	Approx. 2 ms[1)]	Approx. 150 µs	Approx. 150 µs
Time constant speed controller	–	Approx. 3 – 6 ms	Approx. 0.5 ms	Approx. 6 ms
Speed ripple	Is mainly determined by the total mass moment of inertia, the torque ripple and the mechanical structure. It is therefore not possible to specify a general value.			

1) Valid in voltage control range, in field weakening range < 5 ms.

Characteristic values for setpoint resolution

	V/f	VFC^PLUS	CFC	ELSM®
Torque	-	32 bit 0.001% M_{NMot}	32 bit 0.001% M_{NMot}	32 bit 0.001% M_{NMot}

	V/f	VFC^{PLUS}	CFC	ELSM®
Speed	32 bit 0.0001 1/min	32 bit 0.0001 1/min	32 bit 0.0001 1/min	32 bit 0.0001 1/min
Position (increment/revolution)	-	16 bit	16 bit	-
Position (absolute increment)	-	16 bit	16 bit	-

Characteristic values for accuracy of torque and speed

	VFC^{PLUS} without encoder	VFC^{PLUS} with encoder	CFC	ELSM®
Speed accuracy	Depending on motor parameters, typically: 0.2 × $f_{Nominal\ slip}$	Is mainly determined by the encoder resolution, approx. 1% of n	Is mainly determined by the total mass moment of inertia, the torque ripple and the mechanical structure. It is therefore not possible to specify a general value.	
Torque accuracy	< 10% M_N for n > 0.2 × n_N	< 5 % M_N	-	

Maximum output frequency

PWM	V/f	VFC^{PLUS}	CFC	ELSM®
	Optimum operation is possible up to an output frequency of:			
2.5 kHz	250 Hz	250 Hz	250 Hz	250 Hz
4 kHz	400 Hz	250 Hz	400 Hz	400 Hz
≥ 8 kHz	599 Hz	250 Hz	500 Hz	500 Hz

23061715/EN – 03/2017

1

FCBs that can be activated for selected control mode

FCB no.	Designation	V/f	VFC^{PLUS}	CFC	ELSM®
01	Output stage inhibit	+	+	+	+
02	Default stop	+	+	+	+
04	Manual mode	+	+	+	+
05	Speed control	+	+	+	+
06	Interpolated speed control	+	+	+	+
07	Torque control	-	+	+	+
08	Interpolated torque control	-	+	+	+
12	Reference travel	+	+	+	+
13	Stop at application limits	+	+	+	+
14	Emergency stop	+	+	+	+
26	Stop at user limits	+	+	+	+
FCBs requiring a position encoder					
09	Position control	-	+	+	-
10	Interpolated position control	-	+	+	-
19	Position hold control	-	+	+	-
20	Jog	-	+	+	-
21	Brake test	-	+	+	-
18	Rotor position identification	-	-	+	+
22	Output stage test	+	+	+	+
25	Motor parameter measurement	+	+	+	+

1.7 Energy saving functions

1.7.1 Energy-saving function partial magnetization

The energy-saving function partial magnetization reduces the rotor magnetization of asynchronous motors depending of the required torque in the VFC^{PLUS} control mode.

This allows to reduce the magnetization losses in the rotor in partial torque operation. The energy-saving function partial magnetization is especially suitable for applications with little dynamics, such as fans, pumps, escalators, and conveyor systems with constant speed.

The energy-saving function partial magnetization can reduce magnetization losses in the motor by up to 70%.

1.7.2 Energy-saving function standby operation

The energy-saving function standby operation is designed for pause times in which the operation is paused. The bus communication is maintained over the entire time.

The significant difference between disconnection of the DC 24 V supply voltage and standby operation is that switching from standby operation to operation only takes approx. 500 ms. This allows for reducing the energy consumption even in short pauses.

The following functions are deactivated in standby operation:

- 7-segment display.
- STO function.
- Digital output at the basic device and the option cards.
- Analog outputs at the option card.
- Power section controller.
- Fan of the power heat sink.
- Optional: Switch-off of the encoder supply and the encoder evaluation in the basic device and the option card.

Standby operation can be activated via a digital input or via a control word bit.

The bus communication is active without restrictions in standby operation.

Energy consumption in standby operation

MOVIDRIVE® system	DC 24 V power consumption in standby operation
MDX90A-0020 – 0320-5_3..	3.6 W
MDX90A-0070 – 0290-2_3..	

The energy-saving function "standby operation" can reduce the DC 24 V power consumption by 89%.

23061715/EN – 03/2017

1.8 MOVISUITE® engineering software

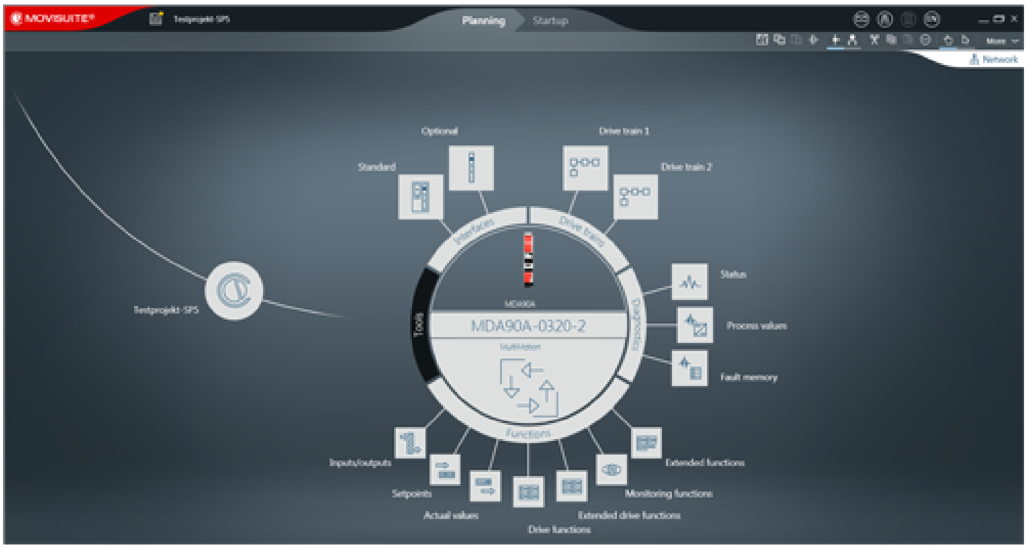
MOVISUITE® is the new engineering software from SEW-EURODRIVE and comprises the following modules in the full stage of construction:

- MOVISUITE® standard
- MOVISUITE® professional
- MOVISUITE® enterprise

The engineering software excels by a new design of user interface and user guidance. This new interface concept allows for the users to configure, parameterize and startup their applications intuitively.

Using the various views, the users can switch to the suitable display mode depending on their requirements. In the circle view for example, single components can be edited in a clear structure.

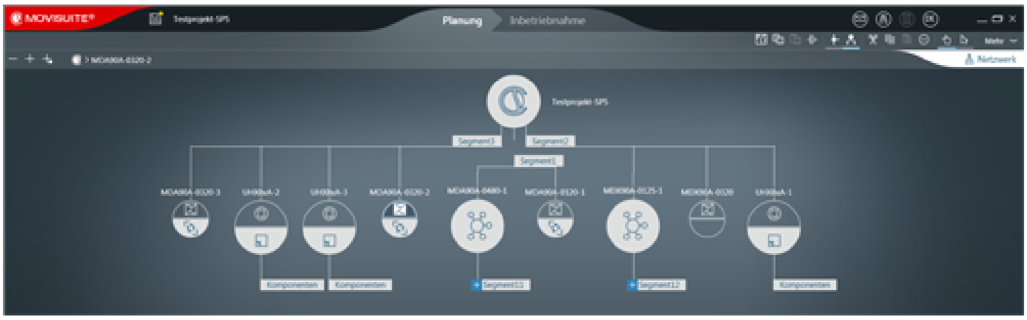
Circle view



19272006795

The tree view provides an overview of the entire network.

Tree view



19272004875

The view can be selected depending on application and personal preferences, the functionality is identical in both views.

The interface concept of MOVISUITE® enables visualizing the system structure via structure nodes that can be freely named. These structure nodes are displayed with a varying level of detail in the views mentioned above.

The data management has clearly marked transfer directions, and thus is clearly structured during data transmission.

The scan function allows for reading connected devices, and for creating these devices as projects in MOVISUITE®.

The drive train can be built from motor to gear unit using the product catalog. Furthermore, encoders, brakes, control modes, and user units can be selected and parameterized.

A scope function is available for diagnostic purposes. This enables a diagnostics overview of connected devices and functions. Long-term data acquisition on the engineering PC hard disk is also possible.

In case of motors by SEW-EURODRIVE, an electronic nameplate can be read-in for simplified startup. MOVISUITE® suggests standard drive trains. Various drive functions are summarized in function control blocks, the so-called FCBs.

Manual operation can also be intuitively used for each application via the new interface.

Startup procedure

The following steps illustrate an example of the startup procedure for an application inverter.

Drive trains

Drive train		Configuring drive trains.

Interfaces

Built-in interfaces		Basic settings of the installed interfaces • EtherCAT® • Standard I/O • Encoder 1
Options		Basic settings of the options • Fieldbus • I/O card • Encoder 2 • DriveSafety®

Functions

I/O configuration		• Standard I/O • I/O card DI/DO • I/O card AI/AO
PO configuration	10010	• Basic settings • PO data • Setpoint buffer • Fixed setpoints • Control word 1 – 3
PI configuration	11100	• PI data • Status word 1 – 3
Drive functions		• FCB 05 Speed control • FCB 06 Interpolated speed control • FCB 08 Interpolated torque control • FCB 09 Positioning • FCB 10 Interpolated position control • FCB 12 Reference travel

Advanced drive functions		• FCB 01 Output stage inhibit • FCB 20 Jog mode • FCB 21 Brake test • FCB 26 Stop at user limit
Event-driven functions		• Touchprobe 1 • Touchprobe 2 • Cam switch
Monitoring		• Reference signals • Limit values 1 • Limit values 2 • Monitoring functions 1 • Monitoring functions 2 • Energy-saving function
User units		Converting system units into user units.

Information on the application inverter

Device data is available via the project nodes.

Device data		• Device identification • Main component • Subcomponent • Production label
Overview of fault responses		• Axis module • Power supply monitoring • Functions
Setup		• Parameter set selection • Access rights • Resetting device parameters.

23061715/EN – 03/2017

2 Technical data

2.1 Markings

The MOVIDRIVE® system application inverter complies with the following directives and guidelines:

Mark	Meaning
CE	CE mark to state compliance with the following European guidelines: • Low Voltage Directive 2014/35/EU • EMC Directive 2014/30/EU • Machinery Directive 2006/42/EC
EAC	The MOVIDRIVE® system device series fulfills the requirements of the technical regulations of the Customs Union of Russia, Kazakhstan, and Belarus. The EAC marking on the nameplate certifies the conformity with the safety requirements of the Custom Union.
c UL us LISTED	UL mark to confirm UL (Underwriters Laboratories) is in preparation. Also valid for CSA together with the registration number.
	RCM logo (Regulatory Compliance Mark). Confirmation of compliance with technical regulations of the Australian Communications and Media Authority ACMA is in preparation.

2.2 General technical data

The following tables lists the technical data for all MOVIDRIVE® system application inverters independent of

- Type
- Design
- Size
- Power

MOVIDRIVE® system	
Interference immunity	Meets EN 61800-3; 2. Environment
Interference emission	Limit value category C2 to EN 61800-3
Ambient temperature ϑ_A	0 °C to +40 °C without derating 40 °C to +60 °C with derating
Type of cooling	Increased air cooling due to installed, speed-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 +60 °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 60721-3-3 class 1S1 • Transportation: EN 60721-3-3 class 2S1 • Operation (fixed installation, weatherproof): EN 60721-3-3 class 3S1
Vibration testing	• 3M5 according to EN 60721-3-3 • 5M1 according to EN 60721-3-5

Degree of protection according to EN 60529	
MDX90A-0020-... – MDX90A-0320-...	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 creepage distances according to EN 61800-5-1, you have to connect an overvoltage protection device in order to reduce the overvoltages from category III to category II.

23061715/EN – 03/2017

2.3 Technical data of basic device

2.3.1 Performance data 3 × AC 400 V

MOVIDRIVE® system	Unit	MDX90A-...-5_3-4-S00								
Type		**0020**	**0025**	**0032**	**0040**	**0055**	**0070**	**0095**	**0125**	**0160**
Size		1				2			3	
Nominal output current I_N PWM = 4 kHz	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16
Input										
Nominal line voltage (to EN 50160) AC V_{line}	V	3 × 380 – 500 V								
Nominal line current AC I_{line}	A	1.9	2.3	2.9	3.6	5.0	6.3	8.6	11.3	14.4
Line frequency f_{line}	Hz	50 – 60 Hz ± 10%								
Controlled rectifier		No								
X1 connection contacts		Plug connector - 1 core: 0.25 – 4 mm^2 - 2 cores: 0.25 – 2.5 mm^2 (Twin-AEH)[1]								
Output										
Output voltage V_O	V	0 – max. V_{line}								
Motor power ASM P_{Mot}	kW	0.55	0.75	1.1	1.5	2.2	3	4	5.5	7.5
Nominal output current I_N PWM = 4 kHz	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16
Overload capacity		200%: 3 s with PWM 4 kHz								
Maximum output current at f = 0 Hz	A	100% × I_N at PWM 4 kHz								
Apparent output power S_N	kVA	1.9	2.3	2.9	3.7	5	6.5	8.8	11.6	14.9
Nominal DC link voltage V_{NDCL}	V	DC 560								
PWM frequency f_{PWM}	kHz	4, 8, 16 (adjustable)								
Max. output frequency f_{max}	kHz	V/f: 599 Hz VFC^{PLUS}: 250 Hz CFC: 500 Hz ELSM®: 500 Hz								
X2 connection contacts		Plug connector - 1 core: 0.25 – 4 mm^2 - 2 cores: 0.25 – 2.5 mm^2 (Twin-AEH)[1]								
General										
Nominal power loss 24 V	W	20								
Nominal power loss power section	W	16	20	27	34	45	58	83	112	147
Permitted number of times power may be switched on/off	1/min	< 1								
Minimum switch-off time for power off	s	10								
Weight	kg	4.1				4.4			5.7	
Brake chopper and braking resistor										
Minimum braking resistance R_{BRmin}	Ω	100				47			27	
Continuous power brake chopper	kW	1.9	2.3	2.9	3.7	5	6.5	8.8	11.6	14.9
Peak power brake chopper	kW	200% × apparent output power S_N × 0.9								
Connection contacts		Plug connector - 1 core: 0.25 – 4 mm^2 - 2 cores: 0.25 – 2.5 mm^2 (Twin-AEH)[1]								
Dimensions										
Width	mm	95				105			105	
Height	mm	295				295			295	
Depth	mm	216				216			260	

1) AEH: Conductor end sleeve

MOVIDRIVE® system	Unit	MDX90A-...-5_3-4-S00									
Type		**0240**	**0320**	**0460**	**0620**	**0750**	**0910**	**1130**	**1490**	**1770**	**2200**
Size		4		5			6			7	
Nominal output current I_N PWM = 4 kHz	A	24	32	46	62	75	91	113	149	177	220

MOVIDRIVE® system	Unit	MDX90A-...-5_3-4-S00									
Type		**0240**	**0320**	**0460**	**0620**	**0750**	**0910**	**1130**	**1490**	**1770**	**2200**
Input											
Nominal line voltage (to EN 50160) AC V_{line}	V	3 × 380 – 500 V									
Nominal line current AC I_{line}	A	22	29	42	56	68	82	102	135	160	198
Line frequency f_{line}	Hz	50 – 60 Hz ± 5%									
Controlled rectifier		Yes									
X1 connection contacts		Plug connector - 1 core: 0.5 – 16 mm² - 2 cores: 0.25 – 6 mm² (Twin-AEH)[1]		M8			M10			M12	
Output											
Output voltage V_O	V	0 – max. V_{line}									
Motor power ASM P_{Mot}	kW	11	15	22	30	37	45	55	75	90	110
Nominal output current I_N PWM = 4 kHz	A	24	32	46	62	75	91	113	149	177	220
Overload capacity		200%: 3 s with PWM 4 kHz									
Maximum output current at f = 0 Hz	A	100% × I_N at PWM 4 kHz									
Apparent output power S_N	kVA	15.3	19.8	28.8	38.7	46.8	56.7	70.2	92.7	110.7	136.8
Nominal DC link voltage V_{NDCL}	V	DC 560									
PWM frequency f_{PWM}	kHz	4, 8, 16 (adjustable)									
Max. output frequency f_{max}	kHz	V/f: 599 Hz VFC^{PLUS}: 250 Hz CFC: 500 Hz ELSM®: 500 Hz									
X2 connection contacts		Plug connector - 1 core: 0.5 – 16 mm² - 2 cores: 0.25 – 6 mm² (Twin-AEH)[1]		M8			M10				
General											
Nominal power loss 24 V	W	30									
Nominal power loss power section	W	202	282	419	600						
Permitted number of times power may be switched on/off	1/min	< 1									
Minimum switch-off time for power off	s	10									
Weight	kg	6.6		12.1			24.1				
Brake chopper and braking resistor											
Minimum braking resistance R_{BRmin}	Ω	15		10	6		4.7			2.3	
Continuous power brake chopper	kW	15.3	19.8	28.8	38.7	46.8	56.7	70.2	92.7	110.7	136.8
Peak power brake chopper	kW	200% × apparent output power S_N × 0.9									
Connection contacts		Plug connector - 1 core: 0.5 – 16 mm² - 2 cores: 0.25 – 6 mm² (Twin-AEH)[1]		M8			M10				
Dimensions											
Width	mm	135		195			240			280	
Height	mm	295		325			505			620	
Depth	mm	260		296			346			346	

1) AEH: Conductor end sleeve

23061715/EN – 03/2017

MOVIDRIVE® system	Unit	MDX90A-...-5_3-4-S00				
Type		**2500**	**3000**	**3800**	**4700**	**5880**
Size		8		9		
Nominal output current I_N PWM = 4 kHz	A	250	300	380	470	588
Input						
Nominal line voltage (to EN 50160) AC V_{line}	V	3 × 380 – 500 V				
Nominal line current AC I_{line}	A	225	280	340	435	545
Line frequency f_{line}	Hz	50 – 60 Hz ± 5%				
Controlled rectifier		Yes				
X1 connection contacts						
Output						
Output voltage V_O	V	0 – max. V_{line}				
Motor power ASM P_{Mot}	kW	132	160	200	250	315
Nominal output current I_N PWM = 4 kHz	A	250	300	380	470	588
Overload capacity		200% with PWM 2.5 kHz		150% with PWM 2.5 kHz		
Maximum output current at f = 0 Hz	A	100% × I_N at PWM 4 kHz				
Apparent output power S_N	kVA	230	277	350	434	541
Nominal DC link voltage V_{NDCL}	V	DC 560				
PWM frequency f_{PWM}	kHz	4, 8, 16 (adjustable)				
Max. output frequency f_{max}	kHz	V/f: 599 Hz VFC^{PLUS}: 250 Hz CFC: 500 Hz ELSM®: 500 Hz				
X2 connection contacts	mm^2					
General						
Nominal power loss 24 V						
Nominal power loss power section						
Permitted number of times power may be switched on/off						
Minimum switch-off time for power off						
Weight						
Brake chopper and braking resistor						
Minimum braking resistance R_{BRmin}	Ω	2.3		1		
Continuous power brake chopper	kW	230	277	350	434	541
Peak power brake chopper	kW	200% × apparent output power S_N × 0.9				
Connection contacts						
Dimensions						
Width	mm	285		700		
Height	mm	950		1490		
Depth	mm	346		473		

2.3.2 Performance data 3 × AC 230 V

MOVIDRIVE® system	Unit	MDX90A-...-2_3-4-S00		
Type		**0070**	**0093**	**0140**
Size		2		3
Nominal output current I_N PWM = 4 kHz	A	7	9.3	14
Input				
Nominal line voltage (to EN 50160) AC V_{line}	V	3 × 200 – 240 V		
Nominal line current AC I_{line}	A	6.4	8.4	12.4
Line frequency f_{line}	Hz	50 – 60 Hz ± 10%		
Controlled rectifier		No		
X1 connection contacts		Plug connector - 1 core: 0.25 – 4 mm² - 2 cores: 0.25 – 2.5 mm² (Twin-AEH)[1]		
Output				
Output voltage V_O	V	0 – max. V_{line}		
Motor power ASM P_{Mot}	kW	1.5	2.2	3.7
Nominal output current I_N PWM = 4 kHz	A	7	9.3	14
Overload capacity		200%: 3 s with PWM 4 kHz		
Maximum output current at f = 0 Hz	A	100% × I_N at PWM 4 kHz		
Apparent output power S_N	kVA	3.7	4.9	7.5
Nominal DC link voltage V_{NDCL}	V	DC 325		
PWM frequency f_{PWM}	kHz	4, 8, 16 (adjustable)		
Max. output frequency f_{max}	kHz	V/f: 599 Hz VFC^PLUS^: 250 Hz CFC: 500 Hz ELSM®: 500 Hz		
X2 connection contacts		Plug connector - 1 core: 0.25 – 4 mm² - 2 cores: 0.25 – 2.5 mm² (Twin-AEH)[1]		
General				
Nominal power loss 24 V	W	20		
Nominal power loss power section	W	51	72	105
Permitted number of times power may be switched on/off	1/min	< 1		
Minimum switch-off time for power off	s	10		
Weight		4.4		5.7
Brake chopper and braking resistor				
Minimum braking resistance R_{BRmin}	Ω	27		15
Continuous power brake chopper	kW	3.7	4.9	7.5
Peak power brake chopper	kW	200% × apparent output power S_N × 0.9		
Connection contacts		Plug connector - 1 core: 0.25 – 4 mm² - 2 cores: 0.25 – 2.5 mm² (Twin-AEH)[1]		
Dimensions				
Width	mm	105		105
Height	mm	295		295
Depth	mm	216		260

1) AEH: Conductor end sleeve

MOVIDRIVE® system	Unit	MDX90A-...-2_3-4-S00					
Type		**0213**	**0290**	**0420**	**0570**	**0840**	**1080**
Size		4		5		6	
Nominal output current I_N PWM = 4 kHz	A	21.3	29	42	57	84	108
Input							
Nominal line voltage (to EN 50160) AC V_{line}	V	3 × 200 – 240 V					
Nominal line current AC I_{line}	A	18.9	27.4	40.8	52	76	86

MOVIDRIVE® system	Unit	MDX90A-...-2_3-4-S00					
Type		**0213**	**0290**	**0420**	**0570**	**0840**	**1080**
Line frequency f_{line}	Hz	50 – 60 Hz ± 10%					
Controlled rectifier		Yes					
X1 connection contacts		Plug connector - 1 core: 0.5 – 16 mm² - 2 cores: 0.25 – 6 mm² (Twin-AEH)[1]		M8		M10	
Output							
Output voltage V_O	V	0 – max. V_{line}					
Motor power ASM P_{Mot}	kW	5.5	7.5	11	15	22	30
Nominal output current I_N PWM = 4 kHz	A	21.3	29	42	57	84	108
Overload capacity		200%: 3 s with PWM 4 kHz					
Maximum output current at f = 0 Hz	A	100% × I_N at PWM 4 kHz					
Apparent output power S_N	kVA	11.3	15.4	22.2	30.2	44.6	50.4
Nominal DC link voltage V_{NDCL}	V	DC 325					
PWM frequency f_{PWM}	kHz	4, 8, 16 (adjustable)					
Max. output frequency f_{max}	kHz	V/f: 599 Hz VFC^{PLUS}: 250 Hz CFC: 500 Hz ELSM®: 500 Hz					
X2 connection contacts	mm²	Plug connector - 1 core: 0.5 – 16 mm² - 2 cores: 0.25 – 6 mm² (Twin-AEH)[1]		M8		M10	
General							
Nominal power loss 24 V	W	30					
Nominal power loss power section	W	152	218	315	459		
Permitted number of times power may be switched on/off	1/min	< 1					
Minimum switch-off time for power off	s	10					
Weight		6.6		12.1		24.1	
Brake chopper and braking resistor							
Minimum braking resistance R_{BRmin}	Ω	7.5		4.7		2.3	
Continuous power brake chopper	kW	11.3	15.4	22.2	30.2	44.6	50.4
Peak power brake chopper	kW	200% × apparent output power S_N × 0.9					
Connection contacts		Plug connector - 1 core: 0.5 – 16 mm² - 2 cores: 0.25 – 6 mm² (Twin-AEH)[1]		M8		M10	
Dimensions							
Width	mm	135		195		240	
Height	mm	295		325		505	
Depth	mm	260		296		346	

1) AEH: Conductor end sleeve

23061715/EN – 03/2017

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2.4 Electronics data – signal terminals

	Terminal designation	Specification
General		
Design		according to EN 61131-2
Supply voltage		
Connection	X5	External power supply 24 V -20% +25% according to EN 61131
Connection contacts		Plug connector - 1 core: 0.25 – 2.5 mm^2 - 2 cores: 0.5 – 1.5 mm^2 (Twin-AEH)[1)] Shield terminals for control cables available.

1) AEH: Conductor end sleeve

Digital inputs		
Cycle time input		1 ms / 500 µs
Number		• 6 for MOVIDRIVE® system • 8 for MOVIDRIVE® technology
Response time		100 µs plus cycle time
Assignment	X20: 1 – 6	DI00: "Output stage enable" fixedly assigned. DI01 – DI07: Selection option, see parameter menu. All inputs are suitable for touch probe function. Latency period < 100 µs, max. 2 simultaneously. DI04, DI05: HTL low-resolution encoder connection. DI05: Primary frequency input.
	X20: 7 – 8	Reserved
	X20: 9	GND
Connection contacts		Plug connector - 1 core: 0.25 – 2.5 mm^2 - 2 cores: 0.5 – 1.5 mm^2 (Twin-AEH)[1)] Shield terminals for control cables available.

1) AEH: Conductor end sleeve

Digital outputs		
Cycle time output		1 ms / 500 µs
Number		4
Response time		175 µs plus cycle time
Output current		I_{max} = 50 mA
Short-circuit protection		Yes
Assignment	X21: 1	24 V supply voltage Maximum output current = 50 mA
	X21: 2 – 5	DO00 – DO03: Selection option, see parameter menu.
	X21: 6	GND
Connection contacts		Plug connector - 1 core: 0.25 – 2.5 mm^2 - 2 cores: 0.5 – 1.5 mm^2 (Twin-AEH)[1)] Shield terminals for control cables available.

1) AEH: Conductor end sleeve

Brake control		
Assignment	X10:DB0	DB00: - Control SEW brake switchgear - Control braking contactor DC 24 V, max. 150 mA
	X10:GND	GND
Connection contacts		Plug connector MDX90A-0020 – 0320-5_3-.. and MDX90A-0070 – 0290-2_3-..: - One core: 0.25 – 2.5 mm^2 MDX90A-0460-5_3-.. and higher and MDX90A-0420-.. and higher: - One core: 0.25 – 2.5 mm^2 - Two cores: 0.5 – 1 mm^2 (Twin-AEH)[1)] Shield terminals for control cables available.

1) AEH: Conductor end sleeve

23061715/EN – 03/2017

Encoder input		
	X15:13	X15:13 DC 24 V, I_{max} = 500 mA
	X15:15	X15:15 DC 12 V, I_{max} = 500 mA

2.5 Electronics data – safety functions

The table below shows the technical data of the application inverter relating to the integrated safety technology.

The safety-related digital inputs comply with type 3 according to IEC 61131-2.

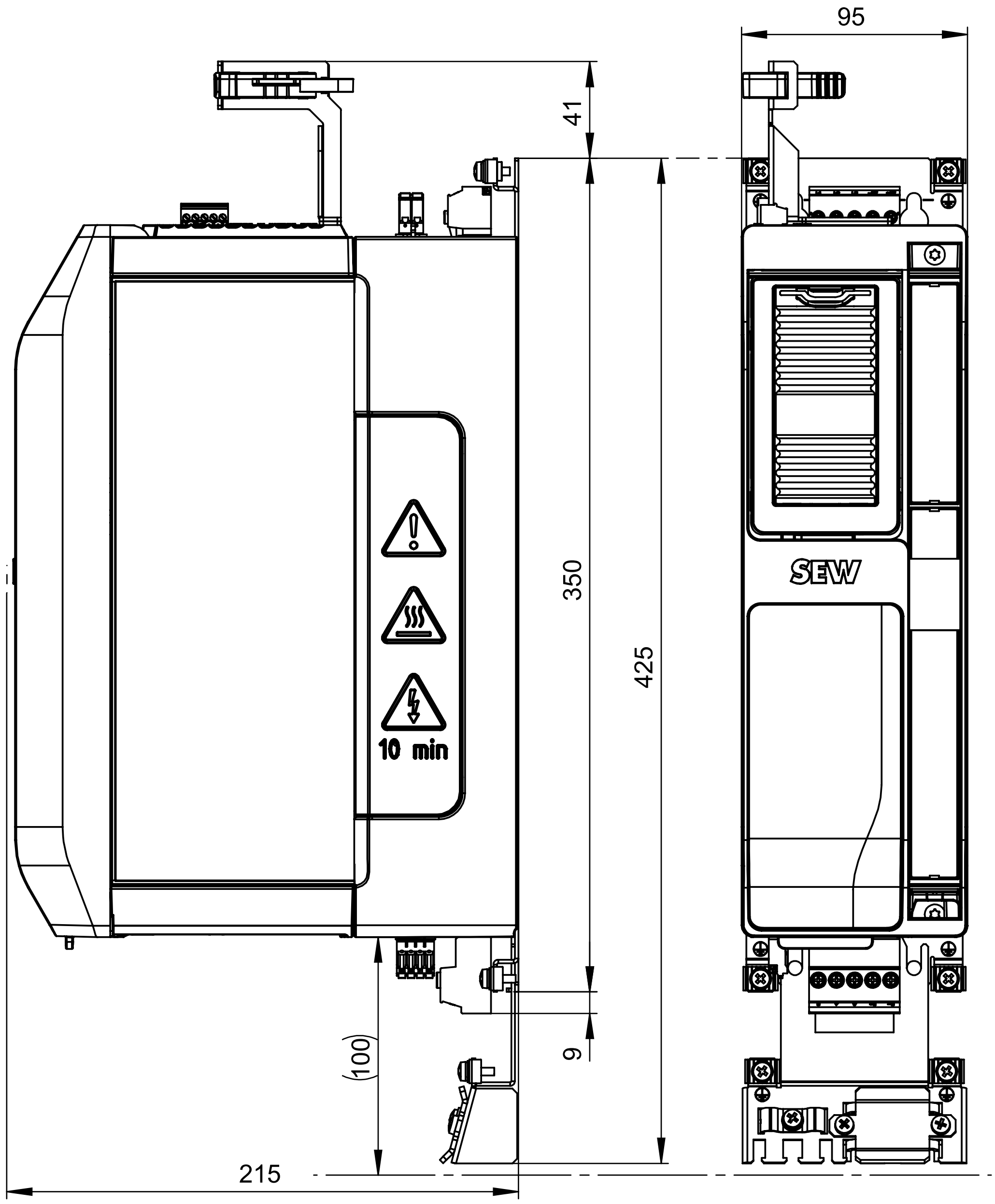
Reference potential for the STO_P1 and STO_P2 is STO_M (contact at terminal X6:2).

	Terminal designation	General electronics data		
Safety contact STO	X6			
Electrical data inputs STO_P1, STO_P2		**Minimum**	**Typical**	**Maximum**
Input voltage range	X6:1 and X6:3	DC -3 V	DC 24 V	DC 30 V
Input capacitance			1 nF	10 nF
Power consumption at DC 24 V			200 mW	300 mW
Input voltage for ON status (STO)		DC 11 V		DC 30 V
Input voltage for OFF status (STO)		DC -3 V		DC 5 V
Permitted leakage current of the external safety controller				1 mA
Technical data				
Time from disconnecting the safety voltage until the deactivation of the rotating field			1.5 ms	2 ms
Time from connecting the safety voltage until the activation of the rotating field				110 ms
Connection contacts		Plug connector - 1 core: 0.25 – 1.5 mm² - 2 cores: 0.25 – 0.5 mm² (Twin-AEH)[1]		

1) AEH: Conductor end sleeve

2.6 Dimension drawings

2.6.1 MDX90A-0020 – 0040-5_3-..



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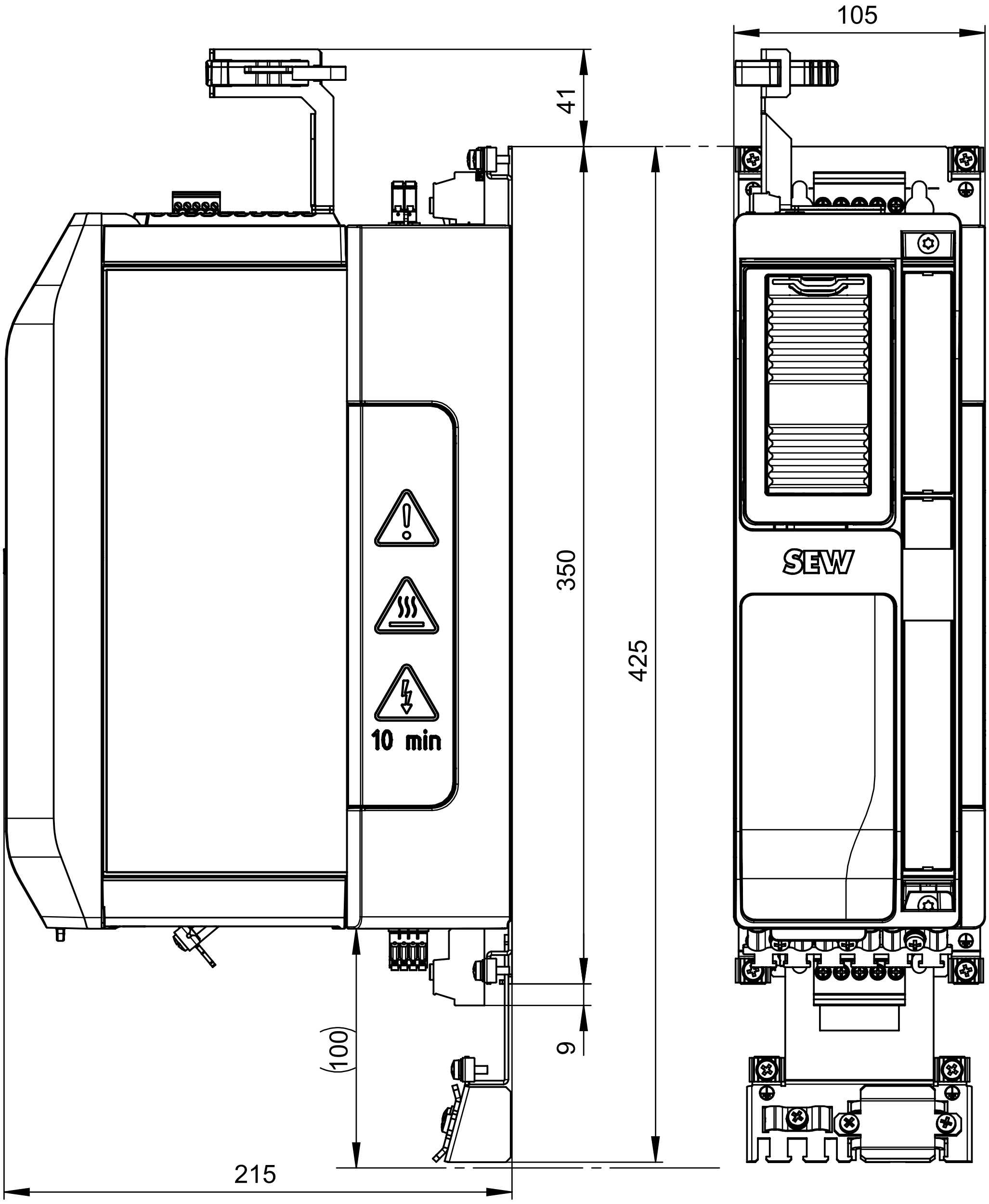
2.6.2 MDX90A-0055 – 0095-5_3-.. , MDX90A-0070 – 0093-2_3-..



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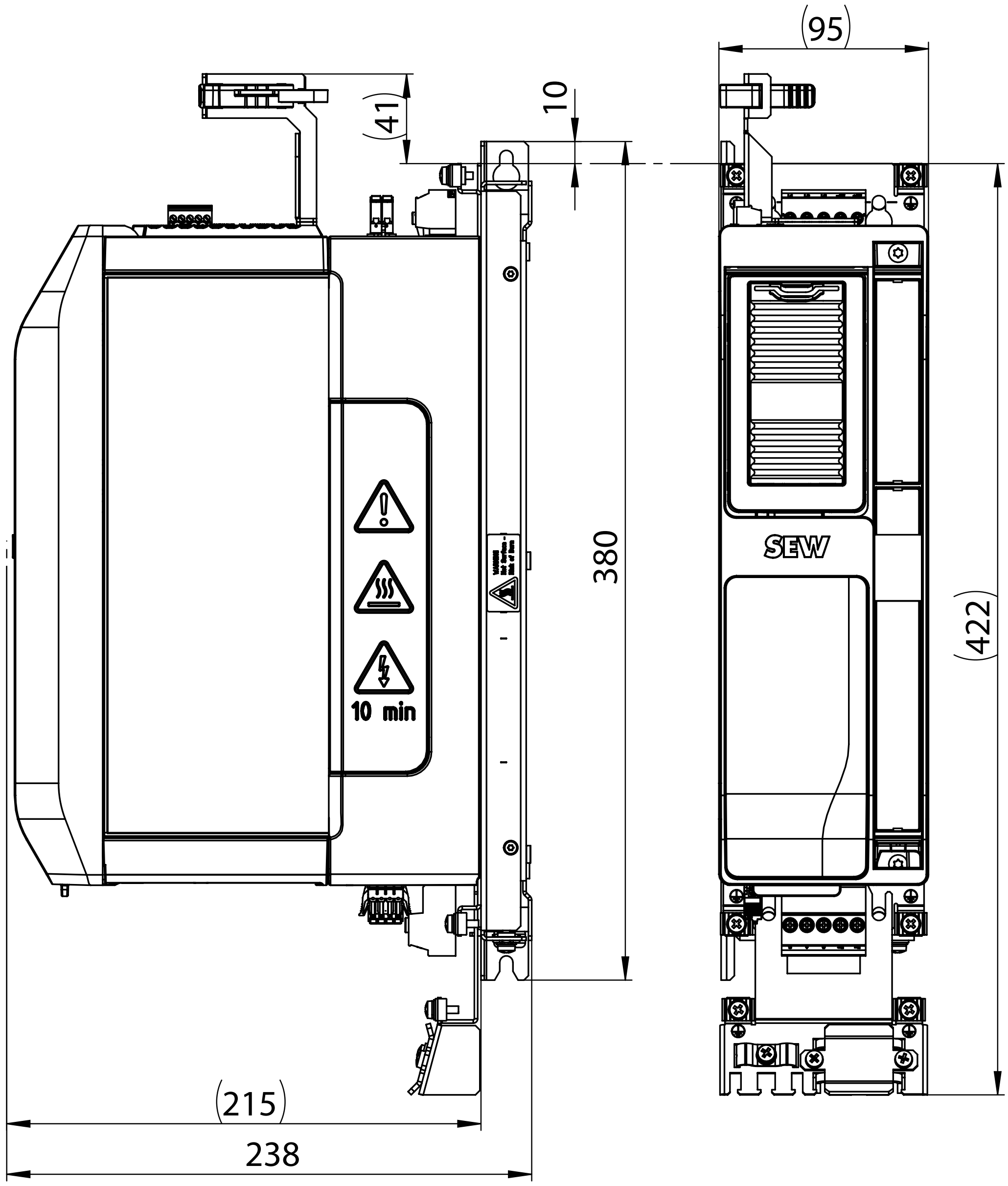
23061715/EN – 03/2017

2.6.3 MDX90A-0020 – 0040-5_3-.. , MDX90A-0070 – 0093-2_3-.. with braking resistor



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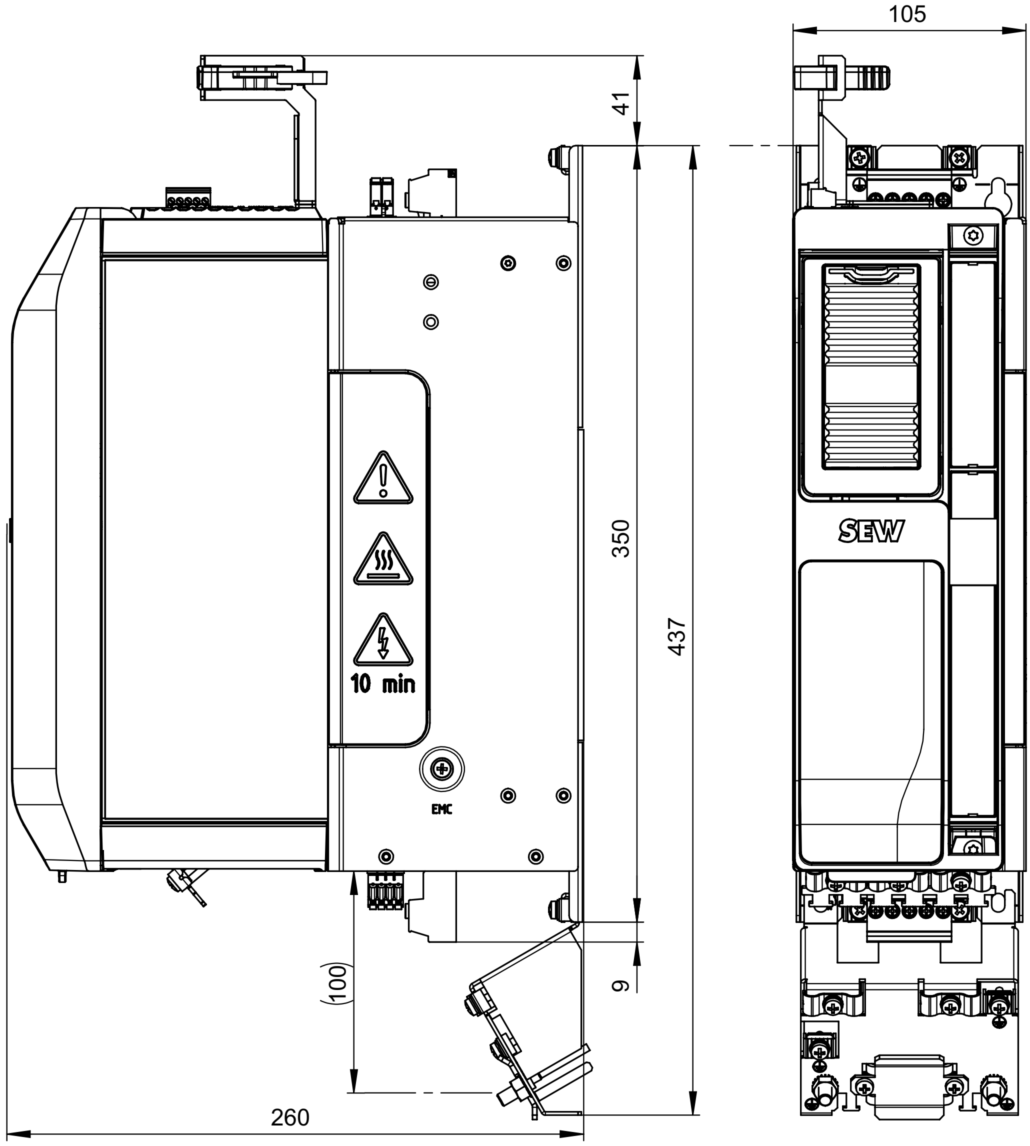
23061715/EN – 03/2017

2.6.4 MDX90A-0125 – 0160-5_3-.. , MDX90A-0140-2_3-..



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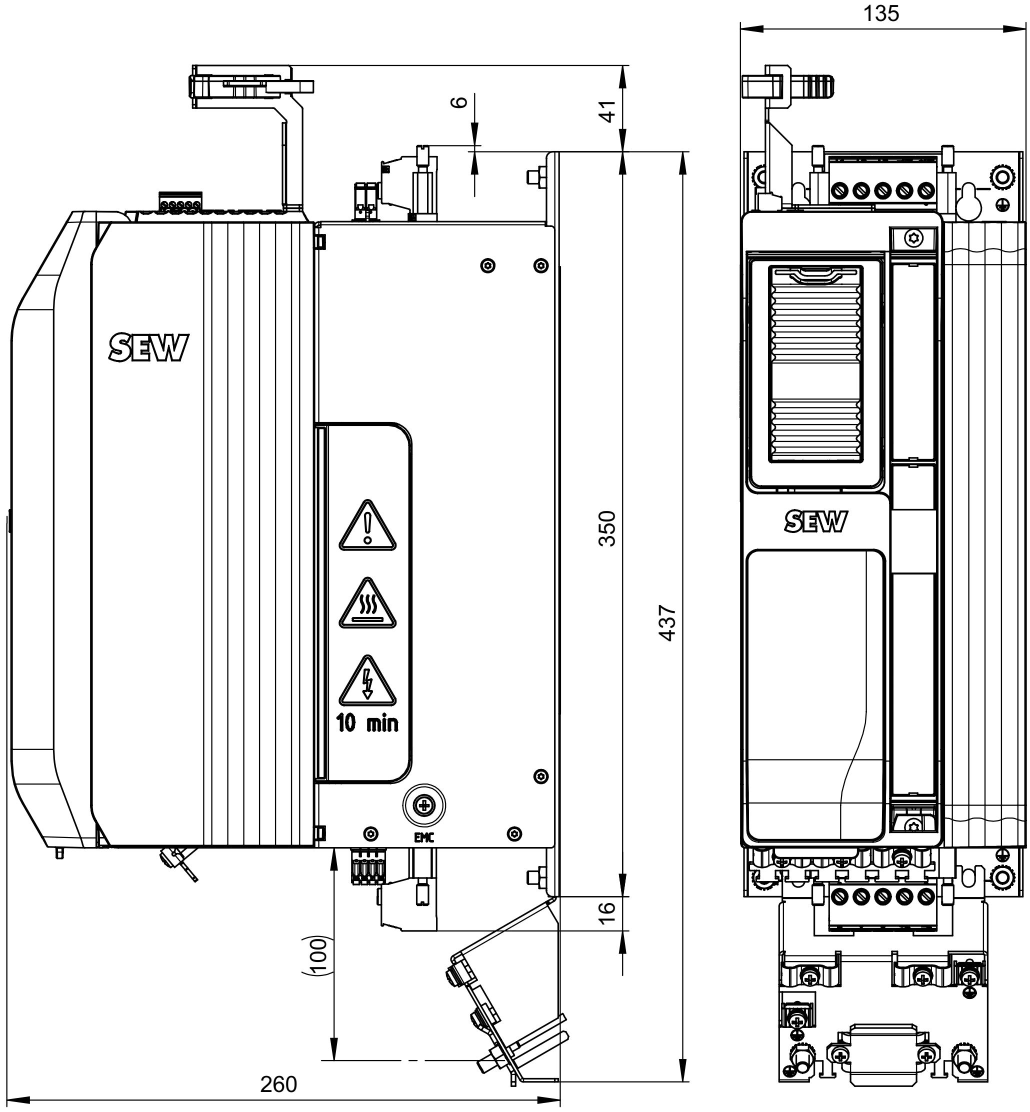
23061715/EN – 03/2017

2.6.5 MDX90A-0240 – 0320-5_3-.. , MDX90A-0213 – 0290-2_3-..



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2.7 Technical data of the option cards

2.7.1 CIO21A and CID21A input/output cards

The CIO21A input/output card provides digital/analog inputs and outputs; the CID21A cards provide digital inputs and outputs.

	Terminal designation/ specification		Specification
	CIO21A	CID21A	
Part number	28229495	28229487	
General			
Design			According to IEC 61131-2 (type 3 for digital inputs)
Cycle time			1 ms
Power consumption	1.2 W	0.4 W	Base load plus total load at outputs.
Connection contacts			Plug connector - 1 core: 0.25 – 0.5 mm^2 Shield terminals for control cables available.
Digital inputs			
Quantity			4
Response time			160 µs plus cycle time
Assignment	X52: 1 – 4		DI10 – DI13: Selection option, see parameter menu.
	X52: 5		GND
Digital outputs			
Quantity			4
Response time			175 µs plus cycle time
Output current			I ≤ 50 mA
Capacitive load			≤ 300 nF
Inductive load			Not permitted
Protection device			Short-circuit-proof, protected against external voltage DC 0 – 30 V
Assignment	X52: 6 – 9		DO10 – DO13: Selection option, see parameter menu.
	X52: 10		GND
Analog inputs			
Quantity			2
Type			Differential Switchable to current input
Output value			0 to +10 V, -10 V to +10 V 0(4) – 20 mA
Assignment	X50:2 X50:3		Analog input AI21/AI22
	X50:4 X50:7		GND
	X50:5 X50:6		Analog input AI31/AI32
Voltage input			
Resolution			0 to +10 V (11 Bits), -10 V to +10 V (12 Bits)
Tolerance			± 0.5%
Overvoltage immunity			DC -20 V to DC +20 V
Input resistance			≥ 10 kΩ
Current input			
Resolution			0(4) – 20 mA (11 Bit)
Tolerance			±2%
Load impedance			(internal) 250 Ω
Overvoltage immunity			DC -10 V to DC +10 V
Analog outputs			
Quantity			2
Short-circuit protection			Yes

23061715/EN – 03/2017

	Terminal designation/ specification		Specification
	CIO21A	CID21A	
Assignment	X51:1 X51:4		Analog voltage output AOV2/AOV3
	X51:2 X51:5		Analog current output AOC2/AOC3
	X51: 3, 6		GND
Voltage output			
Tolerance			±5%
Capacitive load			≤ 300 nF
Inductive load			< 500 µH
Load resistance			≥ 1 kΩ
Resolution			12 bit
Reset state			0 V
Output value			-10 V to +10 V, ≤ 10 mA
Current output			
Tolerance			±3%
Capacitive load			≤ 300 nF
Inductive load			None
Load resistance			≤ 500 Ω
Resolution			11 bit
Reset state			0 mA
Measuring range			0(4) – 20 mA
Reference voltage output			
Short-circuit protection			Yes
Output voltage			DC -10 V, DC +10 V
Tolerance			±0.5%
Noise			≤ 10 mA
Output current			≤ 3 mA
Capacitive load			≤ 300 nF
Inductive load			< 500 µH
Assignment	X50: 1		REF1 (DC +10 V)
	X50: 8		REF2 (DC -10 V)

INFORMATION

Freewheeling diode application

If inductive loads are connected to the digital outputs, you must install an external protective element (freewheeling diode).

23061715/EN – 03/2017

2.7.2 CES11A multi-encoder card

Voltage supply

The multi-encoder card is supplied by the basic device.

Technical data of encoder supply

	Terminal designation	Specification
Part number		28229479
Power consumption		
Nominal power loss 24 V (option card)		0.8 W
Maximum power consumption 24 V (option card including encoder supply)		12.8 W
Encoder supply		
12 V	X17:15	DC 12 V ± 10%
24 V	X17:13	DC 24 V -10%, +20% according to EN 61131
Nominal output current 12 V or 24 V		500 mA
Peak output current I_{max} for 150 µs		1000 mA
Capacitive load		< 220 µF
Inductive load		< 500 µH
Short-circuit protection of 12 V supply		Yes, but a permanent short circuit is not permitted.
Short-circuit protection of 24 V supply		Yes, but a permanent short circuit is not permitted.
Evaluable temperature sensor		TF / TH / KTY84-130 / PT1000

Encoder connection

Encoder connection	Specification
Connection on encoder card end	15-pin socket
Maximum encoder cable length	- HTL encoder ES7C and EG7C: 300 m - Standard HTL encoder: 200 m - Other encoders: 100 m

23061715/EN – 03/2017

2.8 Technical data of encoder interfaces

2.8.1 Basic device

	Terminal designation	Specification
Encoder interface	X15:1 – 15	Supported encoders
		Resolver
		SIN/COS
		TTL/HTL
		HIPERFACE®
Connection contacts		15-pin socket
Encoder supply		
Nominal output voltage V_{S24VG}		DC 24 V -10%, +20% according to EN 61131
Nominal output voltage V_{S12VG}		DC 12 V ± 10%
I_{max}		500 mA
I_{peak} for 150 µs		1000 mA
Short-circuit protection of 12 V supply		Yes, but a permanent short circuit is not permitted.
Short-circuit protection of 24 V supply		Yes, but a permanent short circuit is not permitted.

2.8.2 CES11A multi-encoder card

	Terminal designation	Specification
Encoder interface	X17:1 – 15	Supported encoders
		SIN/COS
		TTL/HTL
		HIPERFACE®
		EnDat2.1
		SSI
		CANopen
Connection contacts		15-pin socket
Encoder supply		
Nominal output voltage V_{S24VG}		DC 24 V -10%, +20% according to EN 61131
Nominal output voltage V_{S12VG}		DC 12 V ± 10%
I_{max}		500 mA
I_{peak} for 150 µs		1000 mA

2.9 Technical data of braking resistors, filters and chokes

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

General

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

There are braking resistors with different continuous and peak braking power available.

The braking resistors can be protected against overload and overtemperature by the customer by using a thermal overload relay. The tripping current is set to the value I_F, see the following tables.

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.

Another possibility to protect the braking resistor is the TCB thermal circuit breaker. The TCB thermal circuit breaker protects the braking resistor against continuous overload and against power peaks over short periods.

A PTC resistor protects itself (reversible) against regenerative overload by changing abruptly to high resistance and no longer consuming any more energy. The inverter then switches off and signals a "brake chopper" fault.

In the documented assignments of drive inverters and flat-design resistors, flat-design resistors have an internal thermal protection (non-replaceable fuse) that interrupts the current circuit in the event of overload. The project planning guidelines and the documented assignments of drive inverter and braking resistor must be adhered to.

INFORMATION

Use of protection devices

Only use the protection devices listed in the following section:

- TCB thermal circuit breaker
- 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.

Parallel connection of braking resistors

Identical braking resistors must be connected in parallel for some inverter/resistor combinations.

In this case, protect each braking resistor against overload and overtemperature using a thermal overload relay.

The temperature switches must be connected in series for braking resistors of the BW...-T series.

23061715/EN – 03/2017

Technical data and assignment to an inverter

Technical data

Braking resistor	Unit	BW120-001	BW100-001	BW100-002	BW100-006-T
Part number		18176011	08281718	08281653	18204198
Current-carrying capacity at 100% cdf	kW	0.1	0.1	0.2	0.6
Resistance value R_{BW}	Ω	117	100 ± 10%		
Tripping current I_F	A		1	1	2.4
Design		Submounting resistor	Flat-type resistor		Wire resistor
Power connections		Single conductors			Ceramic terminal 2.5 mm²
Tightening torque	Nm	-			0.5
PE connection					M4
Tightening torque PE	Nm				1.8
Degree of protection		IP20	IP65		IP20
Ambient temperature ϑ_A			-20 °C – +40 °C (Reduction 4% P_N/10 K up to +60 °C)		
Weight	kg	0.95	0.3	0.6	3

Assignment to an inverter

Braking resistor	BW120-001	BW100-003	BW100-005	BW100-006-T
MDX90A-...-5_3-..	0020 0025 0032 0040	0020 0025 0032 0040		

Technical data

Braking resistor	Unit	BW47-010-T	BW147-T	BW247-T
Part number		17983207	18201342	18200842
Current-carrying capacity at 100% cdf	kW	0.8	1.2	2
Resistance value R_{BW}	Ω	47 ± 10%		
Tripping current I_F	A	4.1	5.1	6.5
Design		Wire resistor		
Power connections		Ceramic terminal 2.5 mm²		
Tightening torque	Nm	0.5		
PE connection		M4		
Tightening torque PE	Nm	1.8		
Degree of protection		IP20		
Ambient temperature ϑ_A		-20 °C – +40 °C		
Weight	kg	4	4.9	6.7

Assignment to an inverter

Braking resistor	BW47-010-T	BW147-T	BW247-T
MDX90A-...-5_3-..	0055 0070 0095		

Technical data

Braking resistor	Unit	BW027-016-T	BW027-024-T	BW027-042-T
Part number		17983215	17983231	19155301
Current-carrying capacity at 100% cdf	kW	1.6	2.4	4.2
Resistance value R_{BW}	Ω	27 ± 10%		
Tripping current I_F	A	7.7	9.4	12.5
Design		Wire resistor		Frame resistor

23061715/EN – 03/2017

Braking resistor	Unit	BW027-016-T	BW027-024-T	BW027-042-T
Power connections		Ceramic terminal 2.5 mm^2		
Tightening torque	Nm	0.5		
PE connection		M4		M5
Tightening torque PE	Nm	1.8		2.5
Degree of protection		IP20		
Ambient temperature ϑ_A		-20 °C – +40 °C		
Weight	kg	5.8	8	10

Assignment to an inverter

Braking resistor	BW027-016-T	BW027-024-T	BW027-042-T
MDX90A-...-5_3-..	0125 0160		
MDX90A-...-2_3-..	0070 0093		

Technical data

Braking resistor	Unit	BW015-016	BW015-042-T	BW015-075-T	BW915-T
Part number		17983258	19155328	19155271	18204139
Current-carrying capacity at 100% cdf	kW	1.6	4.2	7.5	16
Resistance value R_{BW}	Ω	15 ± 10%			
Tripping current I_F	A	10.3	16.7	22.4	32.7
Design		Wire resistor	Frame resistor	Grid resistor	
Power connections		Ceramic terminal 2.5 / 4 mm^2		M8 stud	
Tightening torque	Nm	0.5	0.9	6	
PE connection		M4	M5	M6 stud	
Tightening torque PE	Nm	1.8	2.5	3	
Degree of protection		IP20			
Ambient temperature ϑ_A		-20 °C – +40 °C			
Weight	kg	5.8	10	12	32

Assignment to an inverter

Braking resistor	BW015-016	BW015-042-T	BW015-075-T	BW915-T
MDX90A-...-5_3-..	0240 0320 0620 (Parallel connection of 2 braking resistors) 0750 (Parallel connection of 2 braking resistors)			
MDX90A-...-2_3-..	0140 0213 (Parallel connection of 2 braking resistors) 0290 (Parallel connection of 2 braking resistors)			

Technical data

Braking resistor	Unit	BW010-024	BW010-050-T	BW010-108-T
Part number		17983266	17983274	19155298
Current-carrying capacity at 100% cdf	kW	2.4	5	10.8
Resistance value R_{BW}	Ω	10 ± 10%		
Tripping current I_F	A	15.5	22.4	32.9
Design		Wire resistor	Grid resistor	
Power connections		Ceramic terminal 2.5 mm^2	M8 stud	
Tightening torque	Nm	0.5	6	
PE connection		M4 stud	M6 stud	
Tightening torque PE	Nm	1.8	3	
Degree of protection		IP20		
Ambient temperature ϑ_A		-20 °C – +40 °C		

Braking resistor	Unit	BW010-024	BW010-050-T	BW010-108-T
Weight	kg	8	11	17.5

Assignment to an inverter

Braking resistor	BW010-024	BW010-050-T	BW010-108-T
MDX90A-...-5_3-..	0460 0910 (Parallel connection of 2 braking resistors) 1130 (Parallel connection of 2 braking resistors)		
MDX90A-...-2_3-..	0213 0290 0420 (Parallel connection of 2 braking resistors)		

Technical data

Braking resistor	Unit	BW006-025-01	BW006-050-01	BW106-T	BW206-T
Part number		18200117	18200125	18200834	18204120
Current-carrying capacity at 100% cdf	kW	2.5	5	13.5	18
Resistance value R_{BW}	Ω	6 ± 10%			
Tripping current I_F	A	20.4	28.9	47.4	54.8
Design		Grid resistor			
Power connections		M8 stud			
Tightening torque	Nm	6			
PE connection					
Tightening torque PE	Nm				
Degree of protection		IP20			
Ambient temperature ϑ_A		-25 °C – +40 °C			
Weight	kg	7.5	12	30	40

Assignment to an inverter

Braking resistor	BW006-025-01	BW006-050-01	BW106-T	BW206-T
MDX90A-...-5_3-..	0620 0750 1490 (Parallel connection of 2 braking resistors)			
MDX90A-...-2_3-..	570 (Parallel connection of 2 braking resistors)			

Technical data

Braking resistor	Unit	BW004-050-01	BW004-070-01	BW005-070	BW005-170-T
Part number		18200133	17967678	17983282	17983290
Current-carrying capacity at 100% cdf	kW	5	7	7	17
Resistance value R_{BW}	Ω	3.6 ± 10%		4.7 ± 10%	
Tripping current I_F	A	32.6	38.6	38.6	60.1
Design		Grid resistor			
Power connections		M8 stud			
Tightening torque	Nm	6			
PE connection				M6 stud	
Tightening torque PE	Nm			3	
Degree of protection		IP20			
Ambient temperature ϑ_A		-20 °C – +40 °C			
Weight	kg			13	33

Assignment to an inverter

Braking resistor	BW004-050-01	BW004-070-01	BW005-070	BW005-170-T
MDX90A-...-5_3-..	1490		0910 1130 1770 (Parallel connection of 2 braking resistors) 2200 (Parallel connection of 2 braking resistors) 2500 (Parallel connection of 2 braking resistors)	

23061715/EN – 03/2017

Braking resistor	BW004-050-01	BW004-070-01	BW005-070	BW005-170-T
MDX90A-...-2_3-..	570		-	

Technical data

Braking resistor	Unit	BW002-070	BW003-420-T
Part number		17983304	13302345
Current-carrying capacity at 100% cdf	kW	7	42
Resistance value R_{BW}	Ω	2.3 ± 10%	2.5
Tripping current I_F	A	355.2	135.1
Design		Grid resistor	
Power connections		M8 stud	M12 stud
Tightening torque	Nm	6	15.5
PE connection		M6 stud	M10 stud
Tightening torque PE	Nm	3	10
Degree of protection		IP20	
Ambient temperature ϑ_A		-20 °C – +40 °C	
Weight	kg	33	93

Assignment to an inverter

Braking resistor	BW002-070	BW003-420-T
MDX90A-...-5_3-..	1770 2200 2500 3000 (Parallel connection of 2 braking resistors) 3800 (Parallel connection of 2 braking resistors) 4700 (Parallel connection of 2 braking resistors) 5880 (Parallel connection of 2 braking resistors)	

Technical data

Braking resistor	Unit	BW1.0-170
Part number		17985455
Current-carrying capacity at 100% cdf	kW	17
Resistance value R_{BW}	Ω	1 ± 10%
Tripping current I_F	A	130.4
Design		Grid resistor
Power connections		M12 stud
Tightening torque	Nm	15.5
PE connection		M10 stud
Tightening torque PE	Nm	10
Degree of protection		IP20
Ambient temperature ϑ_A		-25 °C – +40 °C
Weight	kg	45

Assignment to an inverter

Braking resistor	BW1.0-170
MDX90A-...-5_3-..	3000 3800 4700 5880

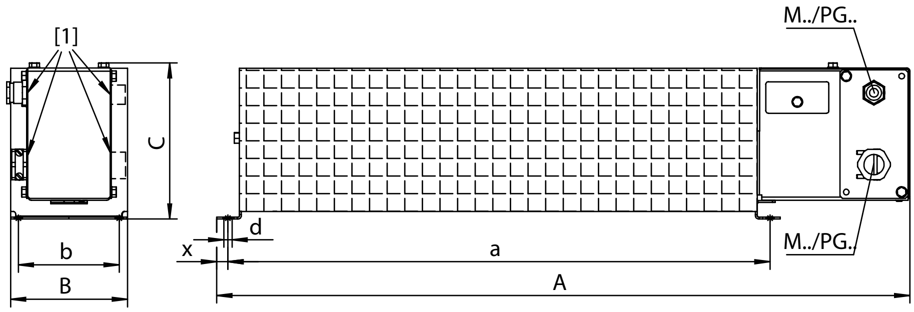
Technical data of BW..-T

Specifications for BW..-T	Design
Signal contact connection cross section	1 × 2.5 mm^2
Tightening torque signal contact	1 Nm

Specifications for BW..-T	Design
Switching capacity signal contact	DC 2 A / DC 24 V (DC11) AC 2 A / AC 230 V (AC11)
Switch contact (NC contact)	According to EN 60730

Dimension drawings and dimensions

Wire resistor



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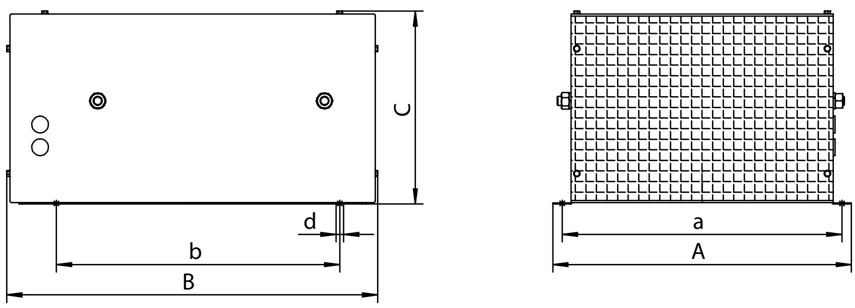
Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW100-006-T	549	92	125	430	80	6.5	8	M25 + M12
BW47-010-T	749	92	125	630	80	6.5	8	M25 + M12
BW147-T	549	185	125	430	150	6.5	8	PG16 + M12
BW247-T	749	185	125	630	150	6.5	8	PG16 + M12
BW027-016-T	649	185	125	530	150	6.5	8	M25 + M12
BW027-024-T	649	275	125	530	240	6.5	8	M25 + M12
BW015-016	649	185	125	530	150	6.5	8	M25
BW010-024	649	275	125	530	240	6.5	8	M25

Grid resistor



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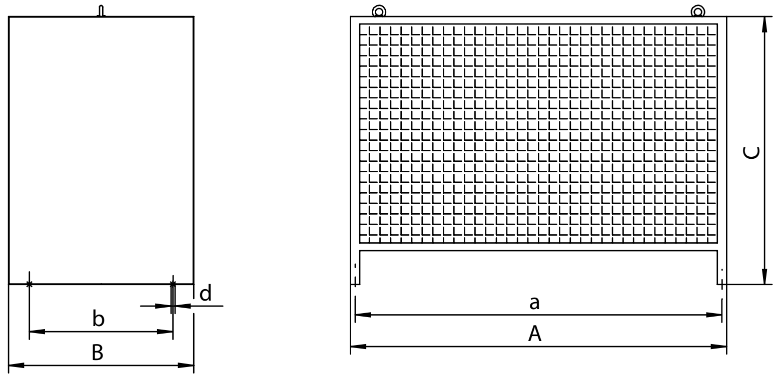
Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW015-075-T	415	500	270	395	380	9	-	-
BW106-T	795	490	270	770	380	10.5	-	-
BW206-T	995	490	270	970	380	10.5	-	-
BW915-T	795	490	270	770	380	10.5	-	-
BW010-050-T	395	490	260	370	380	10.5	-	-
BW010-108-T	525	500	270	505	380	9	-	-
BW004-050-01	395	490	260	370	380	10.5	-	-
BW005-070	395	490	260	370	380	10.5	-	-
BW002-070	395	490	260	370	380	10.5	-	-

23061715/EN – 03/2017

Grid resistor



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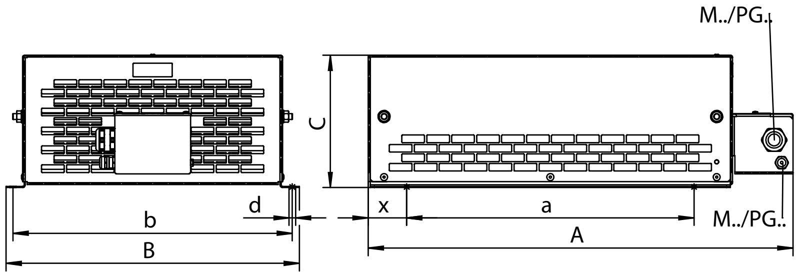
Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW003-420-T	995	490	710	970	380	10.5	-	-

Grid resistor

Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW005-170-T	490	795	270	380	770	10.5	-	-
BW1.0-170	490	795	490	380	770	10.5	-	-
BW006-025-01	295	490	260	270	380	10.5	-	-
BW006-050-01	395	490	260	370	380	10.5	-	-

23061715/EN – 03/2017

Frame resistor



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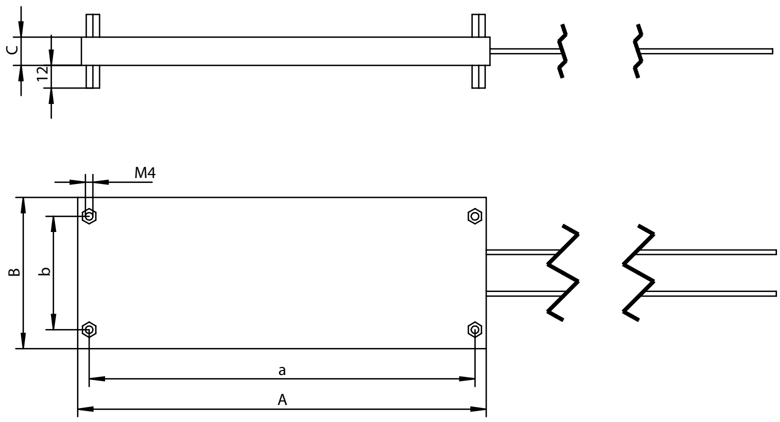
Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW027-042-T	570	390	180	380	370	6.5	55	M25 + M12
BW015-042-T	570	390	180	380	370	6.5	55	M25 + M12

Flat type resistor



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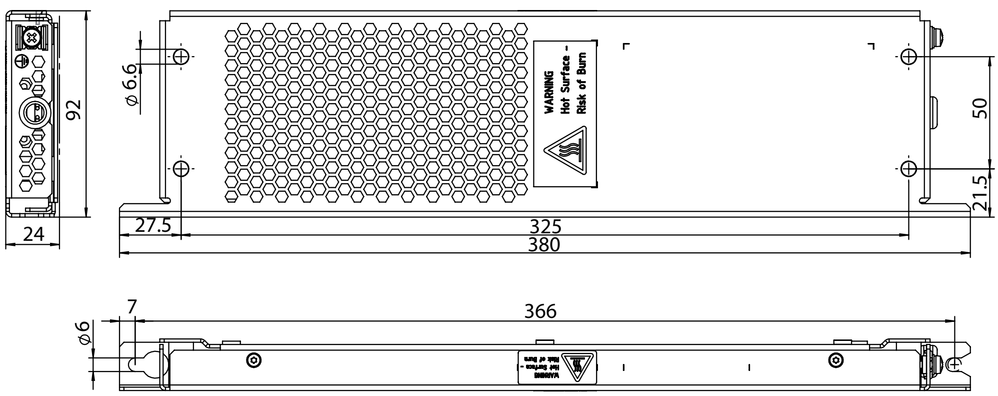
Braking resistor	Main dimensions in mm			Mounting dimensions in mm				Cable gland
	A	B	C	a	b	d	x	
BW100-003	110	80	15	98	60			
BW100-005	216	80	15	204	60			

Submounting resistor BW120-001



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2.9.2 TCB thermal circuit breaker option

General

The TCB thermal circuit breaker protects the braking resistor from constant overload and protects it in case of a short circuit in the cable or the braking resistor.

In the event of a fault, the thermal circuit breaker disconnects the braking resistor and signals this fault via isolated NO and NC contacts.

After fault elimination, the thermal circuit breaker can be reset manually. For this purpose, there is a lever at the front, similar to the design of a miniature circuit breaker.

The setting range of the thermal circuit breaker has to be selected in such a way that it corresponds to the tripping current I_F of the braking resistor.

The switch reacts to the following events:

- Thermal overload.
- Short circuit.
- Exceeded nominal current.

In the event of a fault, the thermal circuit breaker switches off the braking resistor. The present fault is signaled via isolated NO and NC contacts.

After fault elimination, the thermal circuit breaker can be reconnected like a normal miniature circuit breaker.

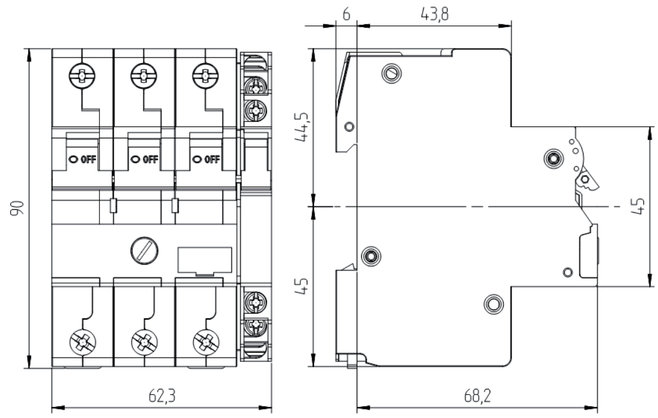
Technical data

Circuit breaker type	Unit	TCB0040	TCB0063	TCB0100
Part number		19170424	19170432	19170440
Setting range	A	2.5 – 4	4 – 6.3	6.3 – 10
Connection cross section main contact	mm²	1.5 – 16		
Tightening torque	Nm	2.5		
Signal contact connection cross section	mm²	0.5 – 1.5		
Tightening torque	Nm	0.8		
Mechanical service life		20000 switching cycles		

Circuit breaker type	Unit	TCB0160	TCB0200	TCB0250	TCB0320	TCB0400
Part number		19170459	19148658	19170467	19170475	19170483
Setting range	A	10 – 16	16 – 20	20 – 25	25 – 32	32 – 40
Connection cross section main contact	mm²	2.5 – 16	4 – 16		6 – 16	10 – 16
Tightening torque	Nm	2.5				
Signal contact connection cross section	mm²	0.5 – 1.5				
Tightening torque	Nm	0.8				
Mechanical service life		20000 switching cycles				

23061715/EN – 03/2017

Dimension drawing



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2.9.3 Line filter

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

INFORMATION:

- Do not switch between the NF... line filter and inverter.

UL and cUL approval

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

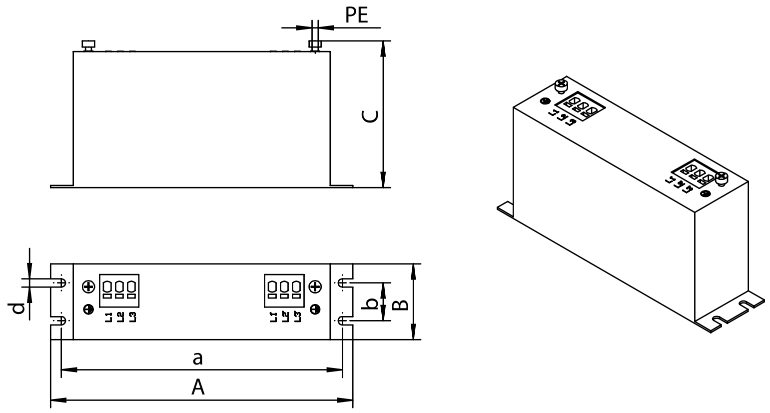
Technical data

Line filter	NF0055-503	NF0120-503	NF0220-503	NF0420-513
Part number	17984319	17984270	17984300	17983789
Nominal line voltage V_N	3 × AC 230 V - 500 V, 50/60 Hz			
Nominal current I_N	5.5 A	12 A	22 A	42 A
Nominal power loss			9 W	30 W
Ambient temperature ϑ_A	0 to 45 °C (reduction: x% I_N up to max. 60 °C)			
Connection contacts L1/L2/L3 - L1'/L2'/L3'	Cage clamp terminals max. 6 mm²			2.5 – 16 mm²
Tightening torque L1/L2/L3 - L1'/L2'/L3'	-			2 - 4 Nm
PE terminal contacts			M5	M6
Tightening torque PE			3 Nm	6 Nm
Degree of protection	IP20 according to EN 60529			
Weight			1.4 kg	3 kg

Assignment to an inverter

Line filter	NF0055-503	NF0120-503	NF0220-503	NF0420-513
MDX90A-...-5_3-..	0020 – 0040	0055 – 0095	0125 – 0160	0240 – 0320
MDX90A-...-2_3-..	-	0070 – 0093	0140	0213 – 0290

Dimension drawings and dimensions



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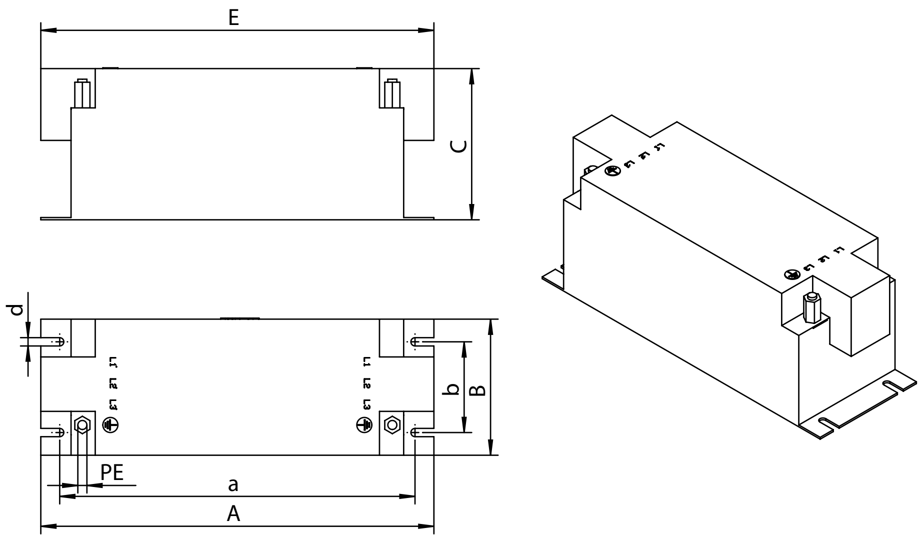
Line filter	Main dimensions in mm				Mounting dimensions in mm			
	A	B	C	E	a	b	d	PE
NF0055-503	200	50	97	-	186	25	5.5	M4
NF0120-503	200	50	97	-	186	25	5.5	M4
NF0220-503	230	55	102	-	216	30	5.5	M4



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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

23061715/EN – 03/2017

2.9.4 Line choke

Using line chokes is optional:

- To support overvoltage protection
- To smoothen the line current, to reduce harmonics
- Protection in the event of distorted line voltage
- To limit the charging current when several inverters are connected together in parallel on the input end with shared line contactors (nominal current of line choke = total of inverter currents).

UL and cUL approval

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

Technical data

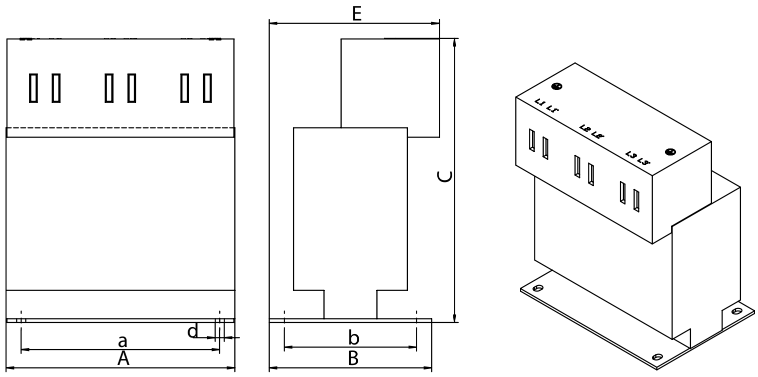
Line choke	**ND0070-503**	**ND0160-503**	**ND0300-503**	**ND0420-503**
Part number	17984173	17984181	17983800	17983819
Nominal line voltage V_N	3 × AC 230 V - 500 V, 50/60 Hz			
Nominal current I_N	7 A	16 A	30 A	42 A
Nominal inductance	0.36 mH	0.2 mH	0.1 mH	0,045 mH
Nominal power loss	4 W	9 W	11 W	13 W
Ambient temperature ϑ_A	-10 °C to 45 °C (reduction: 3% I_N up to max. 60 °C)			
Terminal contacts L1/L2/L3 - L1'/L2'/L3'	0.2 – 4 mm^2		0.2 – 10 mm^2	2.5 – 16 mm^2
Tightening torque L1/L2/L3 - L1'/L2'/L3'	0.5 – 1 Nm		1.2 – 2 Nm	2.5 Nm
PE terminal contact	M4		M5	
Tightening torque PE	1.5 Nm		3 Nm	
Degree of protection	IPXXB to EN 60529			
Weight	0.5 kg	1.3 kg	1.95 kg	1.82 kg

Assignment to an inverter

Line choke	**ND0070-503**	**ND0160-503**	**ND0300-503**	**ND0420-503**
MDX90A-...-5_3-..	0020 – 0055	0070 – 0125	0160 – 0240	0320
MDX90A-...-2_3-..	-	0070 – 0093	0140 – 0213	0290

23061715/EN – 03/2017

Dimension drawings and dimensions



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Line choke	Main dimensions in mm				Mounting dimensions in mm			
	A	B	C	E	a	b	d	PE
ND0070-503	78	57	105	56	65	40	4.8	M4
ND0160-503	96	70	120	65	71	54	4.8	M4
ND0300-503	121	86	145	86	105	70	4.8	M5
ND0420-503	121	86	150	90	105	70	4.8	M5

2.9.5 Output filter

Description of the output filter

HF.. type output filters are sine filters used to smooth the output voltages of inverters.

- Discharge currents in the motor cables are suppressed.
- Motor winding insulations of third-party motors that are not suitable for inverters are protected.
- For long motor cables (> 100 m), overvoltage peaks are prevented.

UL and cUL approval

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

Technical data

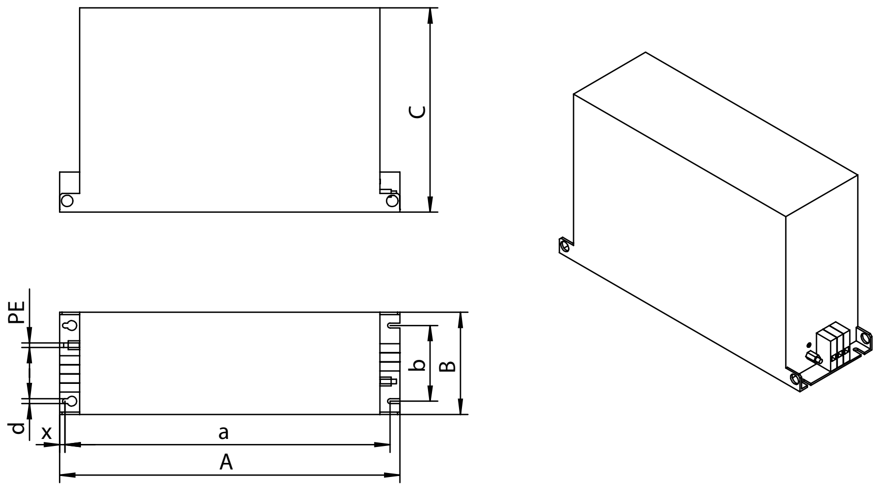
Output filter	HF0055-503	HF0125-503	HF0240-503	HF0460-503
Part number	17985110	17985129	17985137	17985145
Nominal voltage U_N	3 × AC 230 V - 500 V, 50/60 Hz			
Nominal current I_N	5.5 A	12.5 A	24 A	46 A
Nominal power loss	80 W	120 W	200 W	400 W
Ambient temperature ϑ_A	0 °C to 45 °C (reduction: 3% I_N/K up to max. 60 °C)			
Terminal contacts L1/L2/L3 - L1'/L2'/L3'	0.2 – 10 mm²		2.5 – 16 mm²	
Tightening torque L1/L2/L3 - L1'/L2'/L3'	1.2 – 2 Nm		2 – 4 Nm	
PE terminal contacts	M6 stud			
Tightening torque PE	6 Nm			
Degree of protection	IP20			
Weight	8 kg	18 kg	25 kg	40 kg

Assignment to an inverter

Output filter	HF0055-503	HF0125-503	HF0240-503	HF0460-503
MDX90A-...-5_3-..	0020 – 0040	0055 – 0095	0125 – 0160	0240 – 0320
MDX90A-...-2_3-..	-	0070 – 0093	0140	0213 – 0290

23061715/EN – 03/2017

Dimension drawings and dimensions



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Output filter	Main dimensions in mm			Mounting dimensions in mm				
	A	B	C	a	b	d	x	PE
HF0055-503	310	105	160	290	75	6.5	7	M6
HF0125-503	390	120	215	370	90	6.5	7	M6
HF0240-503	450	135	270	430	100	6.5	7	M6
HF0460-503	450	160	310	430	120	6.5	7	M6

2.9.6 Output choke

Description of output choke

HD.. type output chokes suppress interference emitted from unshielded motor cables.

UL and cUL approval

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

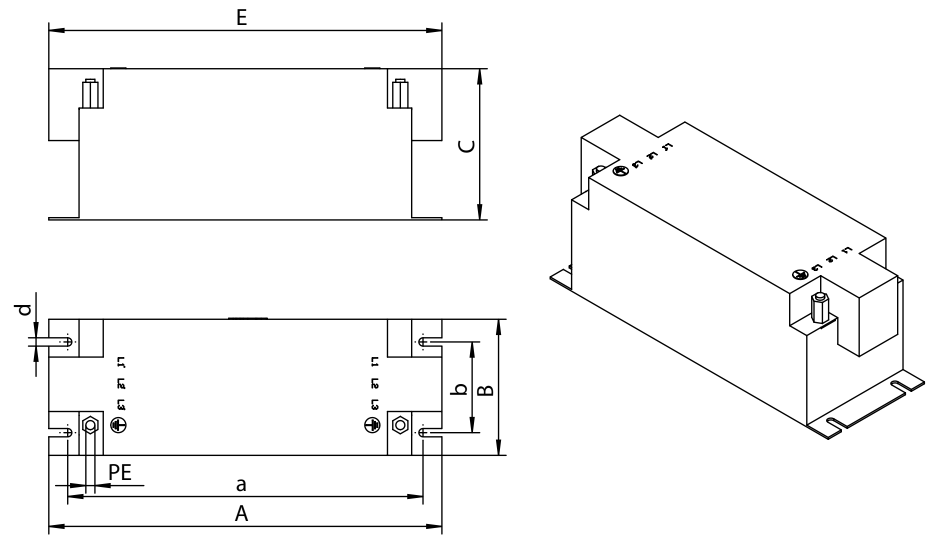
Technical data

Output choke	HD0125-503	HD0240-503	HD0460-503
Part number	17985153	17985188	17985161
Nominal voltage U_N	3 × AC 230 V - 500 V, 50/60 Hz		
Nominal current I_N	12.5 A	24 A	46 A
Nominal power loss	2.9 W	6 W	14 W
Ambient temperature ϑ_A	0 °C to 45 °C (reduction: 3% I_N/K up to max. 60 °C)		
Connection contacts U1/V1/W1 - U2/V2/W2	0.2 – 10 mm²	2.5 – 16 mm²	
Tightening torque L1/L2/L3 - L1'/L2'/L3'	1.2 – 2 Nm	2 – 4 Nm	
PE terminal contact	M6		
Tightening torque PE	6 Nm		
Degree of protection	IP20		
Weight	0.85 kg	1.46 kg	2.35 kg

Assignment to an inverter

Output choke	HD0125-503	HD0240-503	HD0460-503
MDX90A-...-5_3-..	0020 – 0095	0125 – 0160	0240 – 0320
MDX90A-...-2_3-..	0070 – 0093	0140	0213 – 0290

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
HD0125-503	153	62.5	72.5	151	138	40	5.5	M6
HD0240-503	178	92.5	82.5	178	158	65	5.5	M6
HD0460-503	190	122.5	112.5	189	170	90	5.5	M6

23061715/EN – 03/2017

3 Configuration

3.1 SEW Workbench

The SEW Workbench is the central configuration software for inverters by SEW-EURODRIVE.

All necessary configurations can be processed, from entering the application to gear unit, motor and inverter calculations. Other features are optimization of the various axis cycles including the selection of accessories and a fault check of the entire drive system configuration.

Of course, the workbench can also be used to select and dimension all other products from SEW-EURODRIVE (such as decentralized drives and gearmotors). This means the SEW Workbench allows for specifying drive solutions from the entire range of products from SEW-EURODRIVE. The straightforward operation saves a lot of time and minimizes complexity.

The key features of the SEW Workbench are:

- Application selection.
- Calculation of gear unit and motor.
- Price-optimized project planning.
- Comparison of different solutions.
- Inverter calculation.
- Multi-axis optimization.
- Parameterization of cable and accessories selection.
- Dimensioning faults check.
- Parts list generation.
- Electronic catalog with all products.

The SEW Workbench is made available to customers by the responsible SEW-EURODRIVE sales representative.

To use SEW Workbench, all you need to do is to register via the Online Support once you have received the data DVD. An Internet update service ensures that products and functions are always up-to-date.

3.2 Schematic workflow for project planning

The following flow diagram illustrates the drive selection procedure for a positioning drive. The drive consists of a gearmotor that is supplied by an application inverter.

Necessary information regarding the machine to be driven
- Technical data and ambient conditions.
- Positioning accuracy.
- Speed setting range.
- Travel cycle calculation.

↓

Calculation of the relevant application data
- Travel diagram.
- Speeds.
- Static, dynamic torques.
- Regenerative power.

↓

Gear unit selection
- Defining gear unit type, gear unit size, gear unit ratio, and gear unit design.
- Checking the positioning accuracy.
- Checking the gear unit load.
- Checking the input speed.

↓

Motor selection
- Maximum torque.
- With dynamic drives: effective torque at medium speed.
- Maximum speed.
- Observe dynamic and thermal torque curves.
- Motor equipment (brake, plug connector, thermal motor protection, etc.).

↓

Selection of application modules
- Determining the control mode.
- Motor/inverter assignment.
- Checking if the application inverters fulfill the duration and overload requirements.

↓

Braking resistor selection
- Checking if the braking resistor fulfills the duration and overload requirements.
- Observe braking resistor assignment.

↓

Selection of other system components
- Option cards.
- Motor and power supply cables.
- Signal and encoder cables.
- EMC measures.

↓

24 V voltage supply selection
- Determining the current demand of the 24 V voltage supply.
- Observing the requirements for the voltage tolerance.

↓

Make sure that all requirements have been met.

23061715/EN – 03/2017

3.3 Drive selection

For drive selection, in addition to the travel diagram that describes the exact travel cycle, a large number of additional specifications must be made about the operating and ambient conditions.

It is first necessary to have data for the machine to be driven such as mass, setting range, speed, information about the mechanical design and so on in order to select the drive correctly. The appropriate drive can be determined with the calculated torques and speeds of the drive while taking other mechanical requirements such as environmental and operating conditions into account.

For selecting the drive, a decision is to be taken if an asynchronous motor or a synchronous motor is to be used. The extensive product range of SEW-EURODRIVE is available for this purpose.

3.3.1 General requirements for motors

SEW-EURODRIVE's AC motors are suitable for use with an inverter due to the high-quality windings. For operation of third-party motors at SEW-EURODRIVE's application inverters, their suitability has to be checked.

Motors that can be connected

- Asynchronous motors with squirrel-cage rotor.
- Permanent-field synchronous motors.

When third-party motors are operated with MOVIDRIVE® modular/system, SEW-EURODRIVE cannot ensure that the specified performance data is reached.

Dielectric strength of the motor

The operation of an AC motor with a frequency inverter places a much greater load on the motor winding than in the case of operation on the supply system. All AC motors by SEW-EURODRIVE have the required voltage endurance.

At a line voltage of AC 3 x 400 V, the nominal DC link voltage is DC 560 V. In regenerative operation, the DC link voltage can rise to 970 V.

Requirements on third-party motors

The connected third-party motor has to be designed for these DC link voltages.

The inverters pulse the DC voltage of the DC link U_{DC} to the supply cables to the motor. At SEW-EURODRIVE, the pulsed voltage supply is available with 2.5 kHz, 4 kHz, 8 kHz or 16 kHz. As a result, the motor is loaded with voltage peaks, high amplitude and very short rise times.

23061715/EN – 03/2017

Thermal motor protection

Thermal motor protection prevents the motor from overheating and consequently from being damaged. For this purpose, temperature sensors detect the winding temperature. As standard, the MOVIDRIVE® modular/system frequency inverters can evaluate the following temperature sensors:

- PTC (SEW-EURODRIVE designation: TF)
- Bimetallic switch (SEW-EURODRIVE designation: TH)
- KTY84 - 130 (SEW-EURODRIVE designation: KY/KTY)
- PT1000 (SEW-EURODRIVE designation: PK)

3.3.2 Group drive and multi-motor drive

Group drive of asynchronous motors

A group drive is a group of asynchronous motors of any power rating. The motors do not have a rigid mechanical connection or only a connection that is subject to slip and are connected to an inverter electrically parallel.

After a suitable startup, operation in V/f control mode is possible.

If motors with different power ratings are operated at the inverter in parallel, the motor with the largest power rating has to be set up.

- The total of the motor currents must not exceed the nominal output current of the inverter.
- Note the permitted length of all motor leads connected in parallel:

  $l_{tot} = l_{max}/n$

  l_{tot} = Total length of the motor leads connected in parallel

  l_{max} = Permitted motor lead length

  n = Number of motors connected in parallel

Multi-motor drive of asynchronous motors

Multi-motor drive means the electrical parallel connection of several identical asynchronous motors at 1 inverter, that are rigidly and mechanically coupled and drive a load.

Parallel operation of several identical asynchronous motors is possible provided the strict compliance with the following conditions.

- Only use gearmotors of the same type and with the same winding data.
- The rotor position of the individual motors must not differ in more than the following mechanical angle:

  $Z_p \times \Delta\varphi_{mech\_max} < 20°$

  Z_p = Number of motor pole pairs

  $\Delta\varphi_{mech\_max}$ = maximum used angle of the shaft connection in regard of the motor shaft

  This must be ensured by the mechanics even for maximally different torque loads of the motor shafts. The motor has to be equipped with an encoder for the encoder feedback.

- Note the permitted length of all motor leads connected in parallel:

  $l_{tot} = l_{max}/n$

  l_{tot} = Total length of the motor leads connected in parallel

  l_{max} = Permitted motor lead length

  n = Number of motors connected in parallel
- Make sure the speed sensor is installed on the gearmotor which has the greatest clearance or elasticity with respect to the load inertia.

3.3.3 Connecting explosion-proof AC motors

Observe the following instructions when connecting explosion-proof AC motors to application inverter:

- The inverter must be installed outside of the potentially explosive atmosphere.
- Observe industry and country-specific regulations.
- Observe the regulations and information of the motor manufacturer with regard to operation on a frequency inverter, e.g. mandatory sine filter.
- All operating resources used in potentially explosive atmospheres must adhere to the relevant standards, such as Directive 94/9/EC (ATEX 100a) or IEC 60079.
- The sensor input of the motor's temperature monitoring must not be used in potentially-explosive areas. For thermal monitoring use a monitoring device approved for potentially explosive atmospheres.
- In case of motors with speed feedback the speed sensor must also be approved for potentially explosive atmospheres. The speed sensor can be directly connected to the inverter.

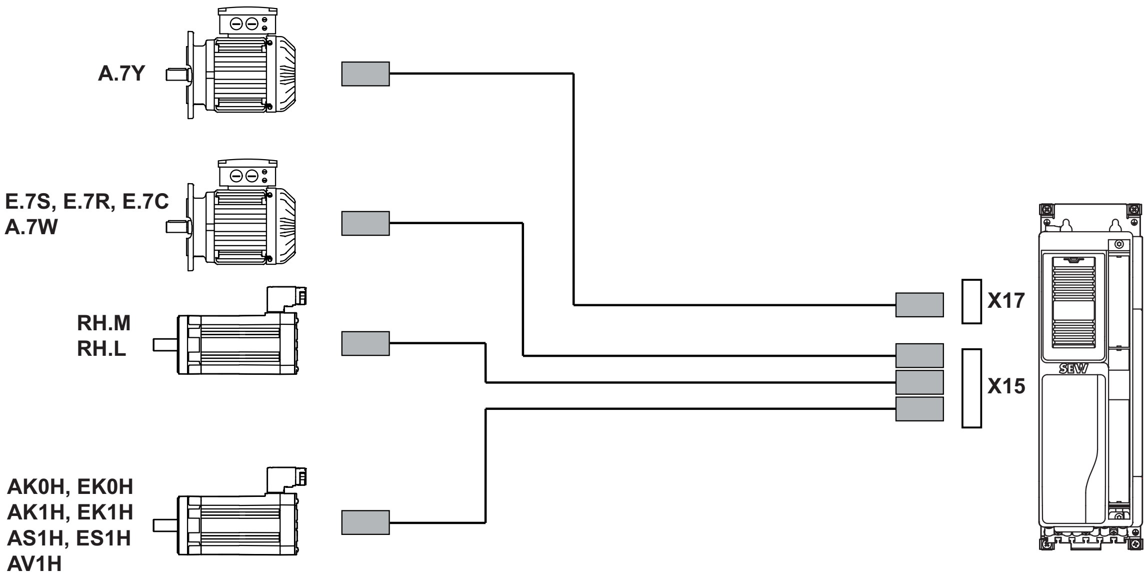
INFORMATION

For more information on the operation of explosion-proof AC motors, refer to the "Explosion-Proof AC Motors, Asynchronous Servomotors" operating instructions. You can order the operating instructions from SEW-EURODRIVE.

3.3.4 General requirements for encoders

Valid motor encoders from SEW-EURODRIVE

The following overview shows the motor encoders from SEW-EURODRIVE that are valid for use with MOVIDRIVE® system. For information on the respective encoder cables, refer to chapter "Prefabricated cables" (→ 🗎 118).



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3.3.5 General requirements for the brake control

Refer to the motor catalogs for extensive information and technical data regarding the brakes.

Brake control

Brakes may only be controlled via the digital output X10: DB0 at the application inverter. It is not permitted to control them via other electronic devices or via controllers.

The digital output DB00 is designed as output for operating a relay with protection circuit with a DC 24 V control voltage, a maximum current of 150 mA and a power rating of 3.6 W.

With this, a power contactor with DC 24 V coil voltage or a suitable brake rectifier from SEW-EURODRIVE can be controlled. This power contactor is used to switch the brake.

Direct switch of the brake via DB00 is not permitted.

Permitted load of brake control and brake

One complete switching sequence (opening and closing) must not be repeated more often than a maximum of every 2 seconds. SEW-EURODRIVE brakes must remain switched off for at least 100 ms before it can be switched on again.

3.4 Recommendations for motor and inverter selection

The basis for motor selection are the limit characteristic curves of the motors in inverter operation. The limit characteristic curve states the torque characteristic of the motor depending on the speed.

The dynamic and thermal limits must be observed when selecting the motor.

3.4.1 Thermal limit characteristic curve

The mean motor speed and the effective torque are calculated during drive selection to determine the thermal utilization of the motor. The operating point of the motor must lie below the thermal limit characteristic curve of the motor; otherwise the motor will be thermally overloaded.

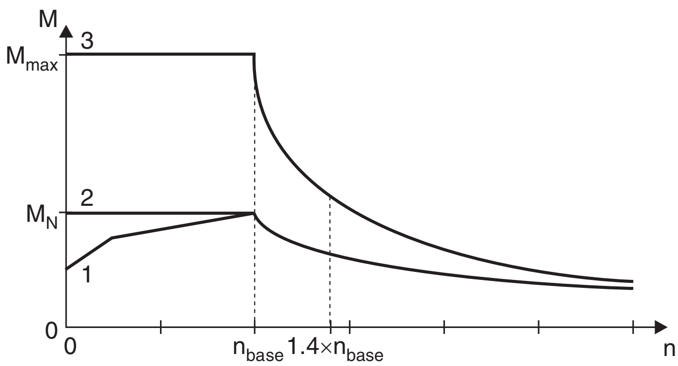
3.4.2 Dynamic limit characteristic curve

The dynamic limit characteristic curve depicts the maximum torque the motor can generate at a certain speed. Note that the inverter must supply sufficient current for the motor to reach its maximum torque.

The base speed is especially important for project planning. The base speed is the available speed up to the maximum motor torque. In inverter operation, field weakening begins at the rated speed. The motor torque is limited by the voltage limit characteristic curve in the field-weakening range, and decreases with increasing speed.

M_N is determined by the motor. M_{max} and n_{base} depend on the motor/inverter combination. For the values for M_{max} and n_{base} in control modes VFC^{PLUS}, CFC, ELSM®, refer to the motor selection tables in chapter "Motor/inverter assignment" (→ 🗎 79).

Typical characteristic curve of asynchronous motors



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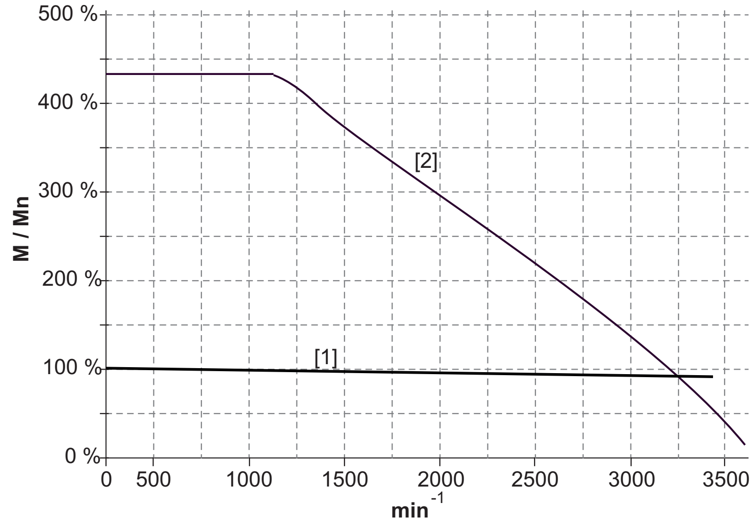
[1] S1 operation with self-cooling

[2] S1 operation with external cooling

[3] Mechanical limit for gearmotors

23061715/EN – 03/2017

Typical characteristic curve of synchronous motors



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[1] Thermal limit characteristic curve S1 operation

[2] Dynamic limit torque

3.4.3 Motor selection for asynchronous motors

The mechanical resistance of the motor against the overload, which might exceed the permitted limit values, must be strictly checked.

M_{pk} and n_{base} depend on the motor/inverter combination, as well as on the used control mode.

Asynchronous motors are mainly operated in control mode VFC^{PLUS}. The control mode efficiently adjusts the motor magnetization to the respective operating point. Simultaneously it allows for dynamic responses to load shocks at the drive train.

3.4.4 Asynchronous motors in control mode VFC^{PLUS}

The control mode VFC^{PLUS} without encoder allows dynamic use of the entire speed range of the drive. Reversing and moving through the speed 0 are also possible.

INFORMATION

Lifting application with encoder

The control must be designed in such a way that the direction of rotation of the drive can only be reversed when it is at a standstill (with the brake applied).

If the direction of rotation should be changed without standstill, a motor encoder must be used.

But continuous operation of asynchronous motors without encoder at low speeds is not possible. The minimum speeds that must not be permanently undercut during operation without encoder are:

- Motor mode: 1% of the asynchronous motor nominal speed.
- Regenerative: 10% of the asynchronous motor nominal speed.

The described restrictions do not apply in control mode VFC^{PLUS} with encoder. In comparison to operation without encoder, higher dynamic properties can be achieved with an encoder.

When determining the maximum speed, observe that the nominal torque M_N reciprocally decreases in the field weakening range, but the breakdown torque M_K is reduced in an quadratic relationship. Thus, the breakdown torque is smaller than the nominal torque from a certain speed on.

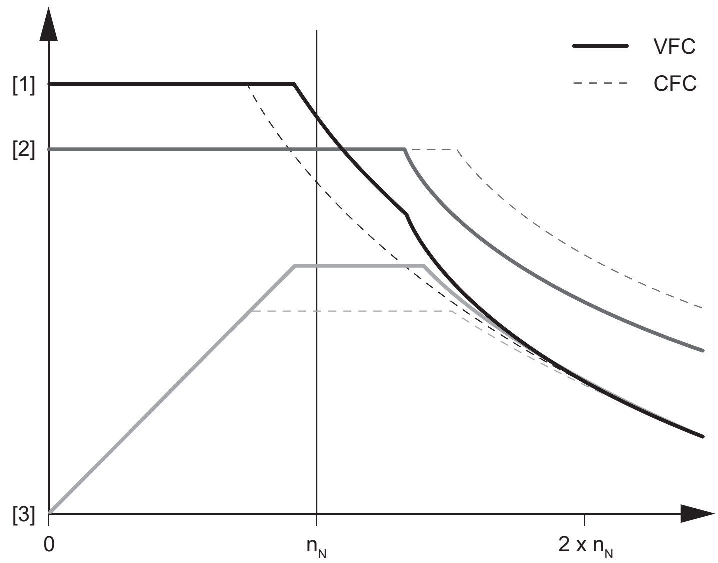
3.4.5 Asynchronous motors in control mode CFC

Either standard asynchronous motors (e.g. DRN.. motors) or asynchronous servomotors (e.g. DRL.. motors) can be used in control mode CFC. SEW-EURODRIVE recommends using asynchronous servomotors to achieve optimum benefit from the advantages of the control mode CFC.

Standard asynchronous motors in control mode CFC

In comparison to control mode VFC^{PLUS}, higher dynamic properties can be achieved using CFC. The full motor magnetization is maintained in each operating state, so that the highest requirements on dynamics are met. Due to the voltage reserves required for this, standard asynchronous motors are operated with a lower base speed in this operating mode than in operating mode VFC^{PLUS}. Power yield and energy efficiency are thus lower.

Sped/torque characteristic for VFC^{PLUS} and CFC in comparison.



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[1] Torque
[2] Current
[3] Power

Asynchronous servomotors in control mode CFC

The high-quality mechanic design of the DRL.. series asynchronous AC servomotors allows for dynamic overload values that exceed the values of the standard asynchronous motors in line or inverter operation. Due to these characteristics the values of a synchronous servomotor are almost reached.

23061715/EN – 03/2017

SEW-EURODRIVE offers DRL.. motors in 2 dynamics packages:

Package	Overload capacity in relation to the nominal torque
Dynamics 1 (D1)	190% – 220%
Dynamics 2 (D2)	300% – 350%

To obtain an optimal adjustment of the motor speed to the required controller output limit of the application, SEW-EURODRIVE offers DRL.. servomotors with the following 4 rated speeds:

- 1200 min^{-1}
- 1700 min^{-1}
- 2100 min^{-1}
- 3000 min^{-1}

In inverter operation, field weakening begins at the rated speed. Compared to standard asynchronous motors, the inverter has higher voltage reserves for dynamic processes at equal line voltage. In inverter operation, field weakening begins at the rated speed.

3.4.6 Synchronous servomotors in control mode CFC

In general, synchronous servomotors and the corresponding inverters are designed for a high short-time overload capacity. Values of up to 400% of the nominal torque are permitted in this case.

When using the following CMP.. motors in the higher speed ranges, it is recommended to only set the PWM frequencies 8 kHz or 16 kHz.

- CMP40 – 63 for speed class 6000 min^{-1},
- CMP 71 – 100 for speed classes 4500 min^{-1} and 6000 min^{-1}.

3.4.7 Synchronous servomotors in control mode ELSM®

The control mode ELSM® allows dynamic use of the entire speed range of the drive. Reversing and moving through the speed 0 are also possible. The speed must not permanently drop below the minimum speed of 2% of the nominal motor speed.

When the control mode ELSM® is operated without encoder, the maximum motor torque is 150% M_0 of the connected motor.

The nominal output current of the inverter must not be lower than 1.5 × I_0 of the connected motor.

The maximum speed must not be dimensioned higher than the rated speed of the motor.

The control mode ELSM® may only be used when the motors are equipped with the following temperature sensors.

- KTY84 - 130 (SEW-EURODRIVE designation: KY/KTY)
- PT1000 (SEW-EURODRIVE designation: PK)

Using the ELSM® control mode for hoists and inclining tracks is not permitted.

23061715/EN – 03/2017

3.5 Motor-inverter assignments

3.5.1 Technical data DRN.. motors

Key

P_N	Rated power
M_N	Rated torque
n_N	Rated speed
I_N	Rated current
cosφ	Power factor
IE	Short for "International Efficiency" (international efficiency classes IE1 – IE4)
$\eta_{50\%}$	Efficiency at 50% of the rated power
$\eta_{75\%}$	Efficiency at 75% of the rated power
$\eta_{100\%}$	Efficiency at 100% of the rated power
I_A/I_N	Starting current ratio
M_A/M_N	Starting torque ratio
M_H/M_N	Ramp-up torque ratio
M_K/M_N	Breakdown torque ratio
m	Mass of the motor
J_{Mot}	Mass moment of inertia of the motor
BE..	Brake used
Z_0 BG	Starting frequency for operation with BG brake control
Z_0 BGE	Starting frequency for operation with BGE brake control
M_B	Braking torque
m_B	Mass of the brakemotor
J_{MOT_BE}	Mass moment of inertia of the brakemotor

23061715/EN – 03/2017

IE3 DRN.. motors, 400 V, 50 Hz, 4-pole

Information on motors

Motor	P_N kW	M_N Nm	n_N min^{-1}	I_N 400 V A	cosφ	$η_{50\%}$ %	$η_{75\%}$ %	$η_{100\%}$ %	I_A/I_N	M_A/M_N M_H/M_N	M_K/M_N
DRN 80M 4	0.75	4.95	1440	1.75	0.74	80.7	82.9	82.9	6.7	3.1 2.7	3.4
DRN 90S 4	1.1	7.2	1455	2.55	0.73	83.5	85.0	84.5	6.9	2.7 2.1	3.3
DRN 90L 4	1.5	9.8	1461	3.4	0.74	84.6	86.1	85.6	7.5	2.7 2.0	3.3
DRN 100LS 4	2.2	14.5	1450	4.75	0.76	86.4	87.5	86.9	7.1	2.9 2.2	3.3
DRN 100L 4	3	19.7	1456	6.4	0.76	87.3	88.3	87.8	8.2	3.4 2.3	3.7
DRN 112M 4	4	26	1464	7.9	0.81	88.6	89.4	88.7	8.2	2.4 1.6	3.6
DRN 132S 4	5.5	36	1461	10.5	0.84	90.6	90.6	89.6	8.3	2.8 2.2	3.5
DRN 132M 4	7.5	49	1468	15.2	0.78	90.8	91.1	90.4	7.8	3.1 2.4	3.3
DRN 132L 4	9.2	60	1470	18.7	0.77	90.8	91.6	91.0	8.4	3.7 1.8	3.7
DRN 160M 4	11	71	1473	21	0.81	91.1	91.7	91.4	7.3	2.6 2.2	3.0
DRN 160L 4	15	97	1474	29	0.80	91.9	92.5	92.1	8.0	3.0 2.0	3.4
DRN 180M 4	18.5	120	1478	33.5	0.85	92.8	93.1	92.6	9.5	3.6 2.9	3.6
DRN 180L 4	22	142	1477	38.5	0.87	93.4	93.6	93.0	9.6	3.5 2.1	3.4
DRN 200L 4	30	194	1480	56	0.82	93.3	93.9	93.6	8.2	2.9 2.5	3.3
DRN 225S 4	37	240	1482	64	0.88	94.3	94.4	93.9	8.4	3.0 2.3	2.7
DRN 225M 4	45	290	1482	81	0.85	94.1	94.5	94.2	8.8	3.0 2.2	2.7
DRN 250M 4	55	355	1482	104	0.80	94.4	94.8	94.6	8.2	4.0 2.5	2.9
DRN 280S 4	75	485	1482	143	0.79	94.9	95.3	95.0	7.6	3.7 2.6	2.9
DRN 280M 4	90	580	1481	161	0.84	95.4	95.6	95.2	7.7	3.6 2.0	2.7
DRN 315S 4	110	710	1488	189	0.87	95.4	95.7	95.5	6.7	2.9 2.1	3.1
DRN 315M 4	132	850	1487	230	0.87	95.6	95.9	95.6	6.5	2.7 2.0	2.9
DRN 315L 4	160	1030	1486	275	0.87	95.9	96.1	95.9	6.5	2.7 2.0	2.8
DRN 315H 4	200	1280	1489	355	0.84	95.4	96.0	96.0	8.1	3.7 2.8	3.8

23061715/EN – 03/2017

Further information on motors and brakemotors

Motor	P_N kW	M_N Nm	n_N min⁻¹	m_{Mot} kg	J_{Mot} 10^{-4} kgm²	BE..	Z_0 BG BGE h⁻¹	M_B Nm	m_{BMot} kg	J_{BMot} 10^{-4} kgm²
DRN 80M 4	0.75	4.95	1440	14	24.7	BE1	3200 8200	10	18	26.2
DRN 90S 4	1.1	7.2	1455	20	54	BE2	2300 6000	14	24	58.7
DRN 90L 4	1.5	9.8	1461	23	67.2	BE2	2200 5800	20	27	71.9
DRN 100LS 4	2.2	14.5	1450	27	81.4	BE5	- 6100	28	33	87.4
DRN 100L 4	3	19.7	1456	34	112	BE5	- 3700	40	40	118
DRN 112M 4	4	26	1464	45	178	BE5	- 2900	55	52	183
DRN 132S 4	5.5	36	1461	56	241	BE11	- 420	80	71	251
DRN 132M 4	7.5	49	1468	73	381	BE11	- 1100	110	91	403
DRN 132L 4	9.2	60	1470	81	439	BE20	- 980	150	110	490
DRN 160M 4	11	71	1473	115	817	BE20	- 900	150	145	877
DRN 160L 4	15	97	1474	130	1040	BE20	- 800	200	165	1100
DRN 180M 4	18.5	120	1478	155	1630	BE30	- 510	300	195	1770
DRN 180L 4	22	142	1477	170	1950	BE30	- 470	300	210	2090
DRN 200L 4	30	194	1480	280	2660	BE32	- 500	400	335	2890
DRN 225S 4	37	240	1482	310	4350	BE32	- 230	500	365	4580
DRN 225M 4	45	290	1482	310	4350	BE32	- 200	600	365	4580
DRN 250M 4	55	355	1482	460	7360	BE62	- 180	800	550	7960
DRN 280S 4	75	485	1482	520	8940	BE62	- 150	1000	600	9530
DRN 280M 4	90	580	1481	630	12000	BE62	- 79	1200	720	12600
DRN 315S 4	110	710	1488	870	23400	BE122	- 53	1600	1000	24400
DRN 315M 4	132	850	1487	890	24800	BE122	- 46	2000	1020	25800
DRN 315L 4	160	1030	1486	1020	28600	BE122	- 34	2000	1150	29600
DRN 315H 4	200	1280	1489	1140	35200	BE122	- 23	2000	1270	36200

3.5.2 Motor-inverter assignments DRN.. motors, PWM 4 kHz

Key

I_N	Nominal output current of the inverter
I_{max}	Maximum output current of inverter
M_{pk}	Peak torque of the motor
n_{base}	Base speed of the motor

MOVIDRIVE® system – 400 V, 50 Hz, VFC^PLUS^

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	**Value**	**Unit**											
DRN80M4 750 W	M_{pk}	Nm	14.1	16.9									
	n_{base}	min^{-1}	1095	1034									
	I_{max}	%	200	200									
DRN90S4 1.1 kW	M_{pk}	Nm	13.4	17.4	22.9	23.8							
	n_{base}	min^{-1}	1269	1210	1129	1132							
	I_{max}	%	200	200	200	169							
DRN90L4 1.5 kW	M_{pk}	Nm			22.3	28.7	32.4						
	n_{base}	min^{-1}			1239	1175	1179						
	I_{max}	%			200	200	169						
DRN100LS4 2.2 kW	M_{pk}	Nm				27.7	39.6	47.8					
	n_{base}	min^{-1}				1258	1174	1130					
	I_{max}	%				200	200	190					
DRN100L4 3 kW	M_{pk}	Nm					38.7	50.8	69.7				
	n_{base}	min^{-1}					1267	1212	1124				
	I_{max}	%					200	200	198				
DRN112M4 4 kW	M_{pk}	Nm						50.5	70.4	81.4			
	n_{base}	min^{-1}						1286	1223	1189			
	I_{max}	%						200	200	174			
DRN132M4 7.5 kW	M_{pk}	Nm								87.6	114	122	
	n_{base}	min^{-1}								1314	1278	1268	
	I_{max}	%								200	200	142	
DRN132L4 9.2 kW	M_{pk}	Nm									110	143	
	n_{base}	min^{-1}									1320	1284	
	I_{max}	%									200	171	
DRN160M4 11 kW	M_{pk}	Nm									115	177	197
	n_{base}	min^{-1}									1340	1294	1280
	I_{max}	%									200	200	166
DRN160L4 15 kW	M_{pk}	Nm										174	235
	n_{base}	min^{-1}										1337	1307
	I_{max}	%										200	200
DRN180M4 18.5 kW	M_{pk}	Nm										179	239
	n_{base}	min^{-1}										1351	1325
	I_{max}	%										200	200
DRN180L4 22 kW	M_{pk}	Nm											243
	n_{base}	min^{-1}											1337
	I_{max}	%											200

23061715/EN – 03/2017

3.5.3 Technical data of DRL.. motors

Key to the technical data for asynchronous DRL.. servomotors

The following table lists the short symbols used in the "Technical data" tables.

n_N	Rated speed
M_N	Rated torque
I_N	Rated current
J_{Mot}	Mass moment of inertia of the motor
M_{pk} D1	Maximum limit torque (dynamics package 1)
M_{pk} D2	Maximum limit torque (dynamics package 2)
m	Mass of the motor
BE..	Brake used
m_B	Mass of the brake motor
J_{MOT_BE}	Mass moment of inertia of the brake motor
M_B D1	Braking torque (dynamics package 1)
M_B D2	Braking torque (dynamics package 2)

Asynchronous DRL.. servomotors

4-pole DRL.. servomotors for 400 V, 50 Hz

n_N	Motor type	M_N	I_N	I_{q_n}	I_{d_n}	c_T	M_{pk} D1	M_{pk} D2	m	J_{mot}
		Nm	A	A	A	Nm/A	Nm	Nm	kg	10^{-4} kgm^2
1200	DRL71S4	2.7	1.18	1.02	0.62	2.66	5	8.5	8.6	4.9
	DRL71M4	4	1.6	1.36	0.80	2.93	7	14	10	7.1
	DRL80S4	6.5	2.15	1.95	0.88	3.33	10	25	11.5	14.9
	DRL80M4	9.5	2.9	2.64	1.10	3.60	14	30	15.2	21.5
	DRL90L4	15	4.8	4.14	2.21	3.63	25	46	22.5	43.5
	DRL100L4	26	8.5	8.05	2.68	3.23	40	85	30	68
	DRL132S4	42	12.6	11.9	4.07	3.52	80	150	45.5	190
	DRL132MC4	56	17.6	15.4	7.50	3.63	130	200	65	340
	DRL160M4	85	25.5	24.2	8.05	3.51	165	280	93	450
	DRL160MC4	90	28	25.1	10.9	3.58	185	320	95	590
	DRL180S4	120	34.5	33.2	10.8	3.62	210	380	122	900
	DRL180M4	135	38	36.1	11.3	3.74	250	430	143	1110
	DRL180L4	165	47	44.9	14.8	3.67	320	520	154	1300
	DRL180LC4	175	52	46.8	17.1	3.74	420	600	163	1680
	DRL200L4	200	58.5	56.0	17.8	3.57	475	680	260	2360
	DRL225S4	250	72	68.1	23.4	3.67	520	770	295	2930
	DRL225MC4	290	89	78.6	29.2	3.69	770	1100	330	4330
1700	DRL71S4	2.7	1.63	1.40	0.86	1.92	5	8.5	8.6	4.9
	DRL71M4	4	2.2	1.90	1.11	2.11	7	14	10	7.1
	DRL80S4	6.5	2.96	2.71	1.22	2.40	10	25	11.5	14.9
	DRL80M4	9.5	4	3.65	1.52	2.60	14	30	15.2	21.5
	DRL90L4	15	6.6	5.67	3.02	2.65	25	46	22.5	43.5
	DRL100L4	26	11.4	11.00	3.66	2.36	40	85	30	68
	DRL132S4	42	17.8	16.9	5.75	2.49	80	150	45.5	190
	DRL132MC4	56	24.9	21.9	10.6	2.56	130	200	65	340
	DRL160M4	85	35	33.5	11.1	2.54	165	280	93	450
	DRL160MC4	90	36	32.3	14.0	2.78	185	320	95	590
	DRL180S4	120	47.5	45.6	14.8	2.63	210	380	122	900
	DRL180M4	135	52	50.1	15.7	2.70	250	430	143	1110
	DRL180L4	165	63	61.3	20.2	2.69	320	520	154	1300
	DRL180LC4	175	72	65.7	24.1	2.66	420	600	163	1680
	DRL200L4	200	80.6	78.4	25.0	2.55	475	680	260	2360
	DRL225S4	245	97	92	32.2	2.66	520	770	295	2930
	DRL225MC4	280	130	114	43.9	2.45	770	1100	330	4330

23061715/EN – 03/2017

n_N	Motor type	M_N	I_N	I_{q_n}	I_{d_n}	c_T	M_{pk} D1	M_{pk} D2	m	J_{mot}
		Nm	A	A	A	Nm/A	Nm	Nm	kg	10^{-4} kgm²
2100	DRL71S4	2.6	2	1.70	1.08	1.53	5	8.5	8.6	4.9
	DRL71M4	3.8	2.7	2.25	1.39	1.69	7	14	10	7.1
	DRL80S4	6.2	3.59	3.22	1.52	1.92	10	25	11.5	14.9
	DRL80M4	9.5	5	4.60	1.91	2.07	14	30	15.2	21.5
	DRL90L4	15	8.4	7.21	3.84	2.08	25	46	22.5	43.5
	DRL100L4	25	14	13.4	4.63	1.87	40	85	30	68
	DRL132S4	41	21.4	20.3	7.07	2.02	80	150	45.5	190
	DRL132MC4	52	28.8	25.0	13.0	2.08	130	200	65	340
	DRL160M4	85	44	42.1	14.0	2.02	165	280	93	450
	DRL160MC4	88	48	42.8	18.9	2.06	185	320	95	590
	DRL180S4	110	55.3	52.7	18.7	2.09	210	380	122	900
	DRL180M4	130	64	60.4	19.6	2.15	250	430	143	1110
	DRL180L4	160	78	75.8	25.8	2.11	320	520	154	1300
	DRL180LC4	170	87	79.1	29.8	2.15	420	600	163	1680
	DRL200L4	195	99	94.6	30.9	2.06	475	680	260	2360
	DRL225S4	235	119	111	40.6	2.11	520	770	295	2930
	DRL225MC4	265	142	125	50.8	2.12	770	1100	330	4330
3000	DRL71S4	2.5	2.68	2.26	1.49	1.11	5	8.5	8.6	4.9
	DRL71M4	3.6	3.55	2.96	1.93	1.21	7	14	10	7.1
	DRL80S4	6	4.82	4.32	2.10	1.39	10	25	11.5	14.9
	DRL80M4	8.8	6.5	5.86	2.63	1.50	14	30	15.2	21.5
	DRL90L4	14	11	9.19	5.25	1.52	25	46	22.5	43.5
	DRL100L4	21	16.6	15.4	6.35	1.36	40	85	30	68
	DRL132S4	35	25.5	24.4	10.0	1.43	80	150	45.5	190
	DRL132MC4	42	34.8	28.4	18.4	1.48	130	200	65	340
	DRL160M4	79	57	53.9	19.3	1.47	165	280	93	450
	DRL160MC4	83	59	51.8	24.3	1.60	185	320	95	590
	DRL180S4	100	70.1	65.9	25.7	1.52	210	380	122	900
	DRL180M4	105	73	67.6	27.2	1.55	250	430	143	1110
	DRL180L4	130	90	83.8	35.0	1.55	320	520	154	1300
	DRL180LC4	140	105	91	41.8	1.53	420	600	163	1680
	DRL200L4	165	118	112	43.3	1.47	475	680	260	2360
	DRL225S4	195	139	127	56.0	1.53	520	770	295	2930
	DRL225MC4	220	188	156	76	1.41	770	1100	330	4330

23061715/EN – 03/2017

4-pole DRL.. servomotors/brakemotors for 400 V, 50 Hz

n_N	Motor type	M_N	I_N	BE..	M_B D1	M_B D2	m_B	J_{Mot_BE}
		Nm	A		Nm	Nm	kg[1]	10^{-4} kgm^2
1200	DRL71S4	2.7	1.18	BE05	5	5	11	6.2
	DRL71M4	4	1.6	BE1	7	10	12.6	8.4
	DRL80S4	6.5	2.15	BE2	10	20	15.2	19.4
	DRL80M4	9.5	2.9	BE2	14	20	18.9	26
	DRL90L4	15	4.8	BE5	20	40	28.5	49.5
	DRL100L4	26	8.5	BE5	40	55	36	74
	DRL132S4	42	12.6	BE11	80	110	60	200
	DRL132MC4	56	17.6	BE11	110	110	79	355
	DRL160M4	85	25.5	BE20	150	200	120	500
	DRL160MC4	90	28	BE20	150	200	122	640
	DRL180S4	120	34.5	BE30	200	300	162	1030
	DRL180M4	135	38	BE30	200	300	183	1250
	DRL180L4	165	47	BE30	300	300	194	1440
	DRL180LC4	175	52	BE32	400	400	210	1910
	DRL200L4	200	58.5	BE32	400	600	315	2590
	DRL225S4	250	72	BE32	500	500	350	3160
	DRL225MC4	290	89	BE32	600	600	385	4560
1700	DRL71S4	2.7	1.63	BE05	5	5	11	6.2
	DRL71M4	4	2.2	BE1	7	10	12.6	8.4
	DRL80S4	6.5	2.96	BE2	10	20	15.2	19.4
	DRL80M4	9.5	4	BE2	14	20	18.9	26
	DRL90L4	15	6.6	BE5	20	40	28.5	49.5
	DRL100L4	26	11.4	BE5	40	55	36	74
	DRL132S4	42	17.8	BE11	80	110	60	200
	DRL132MC4	56	24.9	BE11	110	110	79	355
	DRL160M4	85	35	BE20	150	200	120	500
	DRL160MC4	90	36	BE20	150	200	122	640
	DRL180S4	120	47.5	BE30	200	300	162	1030
	DRL180M4	135	52	BE30	200	300	183	1250
	DRL180L4	165	63	BE30	300	300	194	1440
	DRL180LC4	175	72	BE32	400	400	210	1910
	DRL200L4	200	80.6	BE32	400	600	315	2590
	DRL225S4	245	97	BE32	500	500	350	3160
	DRL225MC4	280	130	BE32	600	600	385	4560
2100	DRL71S4	2.6	2	BE05	5	5	11	6.2
	DRL71M4	3.8	2.7	BE1	7	10	12.6	8.4
	DRL80S4	6.2	3.59	BE2	10	20	15.2	19.4
	DRL80M4	9.5	5	BE2	14	20	18.9	26
	DRL90L4	15	8.4	BE5	20	40	28.5	49.5
	DRL100L4	25	14	BE5	40	55	36	74
	DRL132S4	41	21.4	BE11	80	110	60	200
	DRL132MC4	52	28.8	BE11	110	110	79	355
	DRL160M4	85	44	BE20	150	200	120	500
	DRL160MC4	88	48	BE20	150	200	122	640
	DRL180S4	110	55.3	BE30	200	300	162	1030
	DRL180M4	130	64	BE30	200	300	183	1250
	DRL180L4	160	78	BE30	300	300	194	1440
	DRL180LC4	170	87	BE32	400	400	210	1910
	DRL200L4	195	99	BE32	400	600	315	2590
	DRL225S4	235	119	BE32	500	500	350	3160
	DRL225MC4	265	142	BE32	600	600	385	4560

23061715/EN – 03/2017

n_N	Motor type	M_N	I_N	BE..	M_B	M_B	m_B	J_{Mot_BE}
					D1	D2		
		Nm	A		Nm	Nm	kg[1]	10^{-4} kgm²
3000	DRL71S4	2.5	2.68	BE05	5	5	11	6.2
	DRL71M4	3.6	3.55	BE1	7	10	12.6	8.4
	DRL80S4	6	4.82	BE2	10	20	15.2	19.4
	DRL80M4	8.8	6.5	BE2	14	20	18.9	26
	DRL90L4	14	11	BE5	20	40	28.5	49.5
	DRL100L4	21	16.6	BE5	40	55	36	74
	DRL132S4	35	25.5	BE11	80	110	60	200
	DRL132MC4	42	34.8	BE11	110	110	79	355
	DRL160M4	79	57	BE20	150	200	120	500
	DRL160MC4	83	59	BE20	150	200	122	640
	DRL180S4	100	70.1	BE30	200	300	162	1030
	DRL180M4	105	73	BE30	200	300	183	1250
	DRL180L4	130	90	BE30	300	300	194	1440
	DRL180LC4	140	105	BE32	400	400	210	1910
	DRL200L4	165	118	BE32	400	600	315	2590
	DRL225S4	195	139	BE32	500	500	350	3160
	DRL225MC4	220	188	BE32	600	600	385	4560

1) Applies for foot-mounted motor with brake (DRL...BE../FI..)

23061715/EN – 03/2017

3.5.4 Motor-inverter assignments DRL.. motors, PWM 4 kHz

Key

I_N	Nominal output current of the inverter
I_{max}	Maximum output current of inverter
M_{pk}	Peak torque of the motor
n_{base}	Base speed of the motor

MOVIDRIVE® system – rated motor speed 1200 1/min, dynamics package 1, CFC

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	**Value**	**Unit**											
DRL71S4	M_{pk}	Nm	5										
	n_{base}	1/min	774										
	I_{max}	%	104										
DRL71M4	M_{pk}	Nm	7										
	n_{base}	1/min	907										
	I_{max}	%	138										
DRL80S4	M_{pk}	Nm	10										
	n_{base}	1/min	867										
	I_{max}	%	171										
DRL80M4	M_{pk}	Nm	13.3	14									
	n_{base}	1/min	928	983									
	I_{max}	%	200	200									
DRL90L4	M_{pk}	Nm				25							
	n_{base}	1/min				1052							
	I_{max}	%				200							
DRL100L4	M_{pk}	Nm						40					
	n_{base}	1/min						1203					
	I_{max}	%						200					
DRL132S4	M_{pk}	Nm							65.8	80			
	n_{base}	1/min							1047	1068			
	I_{max}	%							200	200			
DRL132MC4	M_{pk}	Nm								79.2	105	130	
	n_{base}	1/min								1262	1164	1300	
	I_{max}	%								200	200	200	
DRL160M4	M_{pk}	Nm										165	
	n_{base}	1/min										1090	
	I_{max}	%										200	
DRL160MC4	M_{pk}	Nm										159	185
	n_{base}	1/min										1162	1271
	I_{max}	%										200	200
DRL180S4	M_{pk}	Nm										171	210
	n_{base}	1/min										1136	1170
	I_{max}	%										200	200
DRL180M4	M_{pk}	Nm											249
	n_{base}	1/min											1048
	I_{max}	%											200
DRL180L4	M_{pk}	Nm											235
	n_{base}	1/min											1162
	I_{max}	%											200

MOVIDRIVE® system - rated motor speed 1700 1/min, dynamics package 1, CFC

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
DRL71S4	M_{pk}	Nm	5										
	n_{base}	1/min	1389										
	I_{max}	%	159										
DRL71M4	M_{pk}	Nm	7										
	n_{base}	1/min	1529										
	I_{max}	%	200										
DRL80S4	M_{pk}	Nm		10									
	n_{base}	1/min		1484									
	I_{max}	%		200									
DRL80M4	M_{pk}	Nm			14								
	n_{base}	1/min			1551								
	I_{max}	%			200								
DRL90L4	M_{pk}	Nm					25						
	n_{base}	1/min					1582						
	I_{max}	%					200						
DRL100L4	M_{pk}	Nm							40				
	n_{base}	1/min							1790				
	I_{max}	%							200				
DRL132S4	M_{pk}	Nm								60.8	80		
	n_{base}	1/min								1595	1487		
	I_{max}	%								200	200		
DRL132MC4	M_{pk}	Nm										112	130
	n_{base}	1/min										1693	1895
	I_{max}	%										200	200
DRL160M4	M_{pk}	Nm										118	165
	n_{base}	1/min										1656	1511
	I_{max}	%										200	200
DRL160MC4	M_{pk}	Nm										119	166
	n_{base}	1/min										1647	1515
	I_{max}	%										200	200
DRL180S4	M_{pk}	Nm											165
	n_{base}	1/min											1638
	I_{max}	%											200

MOVIDRIVE® system - rated motor speed 2100 1/min, dynamics package 1, CFC

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
DRL71S4	M_{pk}	Nm	5										
	n_{base}	1/min	1971										
	I_{max}	%	200										
DRL71M4	M_{pk}	Nm	5.96	7									
	n_{base}	1/min	2078	2078									
	I_{max}	%	200	200									
DRL80S4	M_{pk}	Nm		8.81	10								
	n_{base}	1/min		2020	2052								
	I_{max}	%		200	200								

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
DRL80M4	M_{pk}	Nm				14							
	n_{base}	1/min				2088							
	I_{max}	%				200							
DRL90L4	M_{pk}	Nm						25					
	n_{base}	1/min						2112					
	I_{max}	%						200					
DRL100L4	M_{pk}	Nm							35.9	40			
	n_{base}	1/min							2102	2451			
	I_{max}	%							200	200			
DRL132S4	M_{pk}	Nm									63.8	80	
	n_{base}	1/min									1986	2220	
	I_{max}	%									200	200	
DRL132MC4	M_{pk}	Nm										89.3	124
	n_{base}	1/min										2231	2065
	I_{max}	%										200	200
DRL160M4	M_{pk}	Nm											127
	n_{base}	1/min											2061
	I_{max}	%											200
DRL160MC4	M_{pk}	Nm											118
	n_{base}	1/min											2263
	I_{max}	%											200

MOVIDRIVE® system - rated motor speed 3000 1/min, dynamics package 1, CFC

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
DRL71S4	M_{pk}	Nm	3.89	5									
	n_{base}	1/min	3053	2839									
	I_{max}	%	200	200									
DRL71M4	M_{pk}	Nm		5.2	7								
	n_{base}	1/min		3264	2963								
	I_{max}	%		200	200								
DRL80S4	M_{pk}	Nm				10							
	n_{base}	1/min				2952							
	I_{max}	%				200							
DRL80M4	M_{pk}	Nm					14						
	n_{base}	1/min					3082						
	I_{max}	%					200						
DRL90L4	M_{pk}	Nm							25				
	n_{base}	1/min							3003				
	I_{max}	%							200				
DRL100L4	M_{pk}	Nm								34	40		
	n_{base}	1/min								3065	3318		
	I_{max}	%								200	200		
DRL132S4	M_{pk}	Nm										68.2	80
	n_{base}	1/min										2847	3156
	I_{max}	%										200	200

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
DRL132MC4	M_{pk}	Nm										58.8	83.1
	n_{base}	1/min										3552	3278
	I_{max}	%										200	200

MOVIDRIVE® system - rated motor speed 1200 1/min, dynamics package 2, CFC

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
DRL71S4	M_{pk}	Nm	8.5										
	n_{base}	1/min	319										
	I_{max}	%	162										
DRL71M4	M_{pk}	Nm	11.6	14									
	n_{base}	1/min	528	367									
	I_{max}	%	200	189									
DRL80S4	M_{pk}	Nm	13.3	17.3	23	25							
	n_{base}	1/min	634	423	188	113							
	I_{max}	%	200	200	200	171							
DRL80M4	M_{pk}	Nm	13.3	17.7	23.9	30							
	n_{base}	1/min	928	775	587	434							
	I_{max}	%	200	200	200	194							
DRL90L4	M_{pk}	Nm				25.8	37.7	46					
	n_{base}	1/min				1010	810	705					
	I_{max}	%				200	200	197					
DRL100L4	M_{pk}	Nm						49.6	72.5	85			
	n_{base}	1/min						939	763	728			
	I_{max}	%						200	200	200			
DRL132S4	M_{pk}	Nm							65.8	88.9	116	150	
	n_{base}	1/min							1047	949	851	776	
	I_{max}	%							200	200	200	188	
DRL132MC4	M_{pk}	Nm								79.2	105	165	200
	n_{base}	1/min								1262	1164	1008	1036
	I_{max}	%								200	200	200	200
DRL160M4	M_{pk}	Nm										172	237
	n_{base}	1/min										1030	916
	I_{max}	%										200	200
DRL160MC4	M_{pk}	Nm										159	219
	n_{base}	1/min										1162	1057
	I_{max}	%										200	200
DRL180S4	M_{pk}	Nm										171	239
	n_{base}	1/min										1136	1013
	I_{max}	%										200	200
DRL180M4	M_{pk}	Nm											249
	n_{base}	1/min											1048
	I_{max}	%											200
DRL180L4	M_{pk}	Nm											235
	n_{base}	1/min											1162
	I_{max}	%											200

23061715/EN – 03/2017

MOVIDRIVE® system - rated motor speed 1700 1/min, dynamics package 2, CFC

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	**Value**	**Unit**											
DRL71S4	M_{pk}	Nm	7.48	8.5									
	n_{base}	1/min	963	836									
	I_{max}	%	200	182									
DRL71M4	M_{pk}	Nm	7.89	10.3	13.6	14							
	n_{base}	1/min	1350	1139	892	866							
	I_{max}	%	200	200	200	167							
DRL80S4	M_{pk}	Nm		11.7	15.8	20.4	25						
	n_{base}	1/min		1268	1010	751	559						
	I_{max}	%		200	200	200	172						
DRL80M4	M_{pk}	Nm			16.2	21.3	30						
	n_{base}	1/min			1327	1127	880						
	I_{max}	%			200	200	200						
DRL90L4	M_{pk}	Nm					25.9	34.7	46				
	n_{base}	1/min					1515	1327	1190				
	I_{max}	%					200	200	200				
DRL100L4	M_{pk}	Nm							49.1	69.2	85		
	n_{base}	1/min							1421	1221	1180		
	I_{max}	%							200	200	200		
DRL132S4	M_{pk}	Nm								60.8	80	123	150
	n_{base}	1/min								1595	1487	1311	1320
	I_{max}	%								200	200	200	200
DRL132MC4	M_{pk}	Nm										112	155
	n_{base}	1/min										1693	1556
	I_{max}	%										200	200
DRL160M4	M_{pk}	Nm										118	165
	n_{base}	1/min										1656	1506
	I_{max}	%										200	200
DRL160MC4	M_{pk}	Nm										119	166
	n_{base}	1/min										1647	1515
	I_{max}	%										200	200
DRL180S4	M_{pk}	Nm											165
	n_{base}	1/min											1638
	I_{max}	%											200

MOVIDRIVE® system – rated motor speed 2100 1/min, dynamics package 2, CFC

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	**Value**	**Unit**											
DRL71S4	M_{pk}	Nm	5.76	7.43	8.5								
	n_{base}	1/min	1703	1444	1346								
	I_{max}	%	200	200	188								
DRL71M4	M_{pk}	Nm	5.96	7.89	10.6	13.6	14						
	n_{base}	1/min	2078	1843	1573	1327	1334						
	I_{max}	%	200	200	200	200	158						

23061715/EN – 03/2017

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	**Value**	**Unit**											
DRL80S4	M_{pk}	Nm		8.81	12.1	15.8	22.8	25					
	n_{base}	1/min		2020	1714	1444	1057	948					
	I_{max}	%		200	200	200	200	171					
DRL80M4	M_{pk}	Nm				16.1	23.7	30					
	n_{base}	1/min				1808	1479	1311					
	I_{max}	%				200	200	200					
DRL90L4	M_{pk}	Nm						26.1	37.6	46			
	n_{base}	1/min						2008	1738	1704			
	I_{max}	%						200	200	200			
DRL100L4	M_{pk}	Nm							35.9	51.6	70.1	85	
	n_{base}	1/min							2102	1855	1644	1840	
	I_{max}	%							200	200	200	200	
DRL132S4	M_{pk}	Nm									63.8	99.3	134
	n_{base}	1/min									1986	1791	1644
	I_{max}	%									200	200	200
DRL132MC4	M_{pk}	Nm										89.3	124
	n_{base}	1/min										2231	2065
	I_{max}	%										200	200
DRL160M4	M_{pk}	Nm											127
	n_{base}	1/min											2061
	I_{max}	%											200
DRL160MC4	M_{pk}	Nm											118
	n_{base}	1/min											2263
	I_{max}	%											200

MOVIDRIVE® system - rated motor speed 3000 1/min, dynamics package 2, CFC

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	**Value**	**Unit**											
DRL71S4	M_{pk}	Nm	3.89	5.13	6.84	8.5							
	n_{base}	1/min	3053	2748	2431	2252							
	I_{max}	%	200	200	200	200							
DRL71M4	M_{pk}	Nm		5.2	7.15	9.37	13.5	14					
	n_{base}	1/min		3264	2888	2583	2184	2309					
	I_{max}	%		200	200	200	200	186					
DRL80S4	M_{pk}	Nm				10.6	15.6	20.7	25				
	n_{base}	1/min				2748	2278	1949	1735				
	I_{max}	%				200	200	200	184				
DRL80M4	M_{pk}	Nm					16	21.6	30				
	n_{base}	1/min					2665	2360	2079				
	I_{max}	%					200	200	200				
DRL90L4	M_{pk}	Nm							25.8	35.9	46		
	n_{base}	1/min							2865	2548	2446		
	I_{max}	%							200	200	200		

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	**Value**	**Unit**											
DRL100L4	M_{pk}	Nm								34	47.3	78.3	85
	n_{base}	1/min								3065	2736	2301	2757
	I_{max}	%								200	200	200	200
DRL132S4	M_{pk}	Nm										68.2	93.4
	n_{base}	1/min										2847	2671
	I_{max}	%										200	200
DRL132MC4	M_{pk}	Nm										58.8	83.1
	n_{base}	1/min										3552	3278
	I_{max}	%										200	200

23061715/EN – 03/2017

3.5.5 Technical data of CMP.. motors

Key to the technical data

n_N	Rated speed
M_0	Standstill torque (thermal continuous torque at low speeds)
I_0	Standstill current
M_{pk}	Dynamic limit torque
I_{max}	Maximum permitted motor current
M_{0VR}	Standstill torque with forced cooling fan
I_{0VR}	Standstill current with forced cooling fan
J_{mot}	Mass moment of inertia of the motor
J_{bmot}	Mass moment of inertia of the brakemotor
$M_{1\ m,100\ °C}$	Maximum dynamic braking torque in case of emergency off
M_{1max}	Minimal averaged dynamic braking torque in case of emergency off at 100 °C
$M_{2,\ 20\ °C}$	Nominal torque for slipping brake disk (relative speed between brake disk and friction surface: 1 m/s) at 20 °C
$M_{4,100\ °C}$	Minimum holding torque at 120 °C
W_{max1}	Maximum permitted braking work per braking operation
W_{max2}	Maximum permitted braking work per braking operation with optional braking torque
L_1	Inductance between connection phase and star point
R_1	Resistance between connection phase and star point
V_{p0} cold	Internal voltage at 1000 min^{-1}
m_{mot}	Mass of the motor
m_{bmot}	Mass of the brakemotor

23061715/EN – 03/2017

CMP40 – CMP112, 400 V system voltage

n_N	Motor	M_0	I_0	M_{pk}	I_{max}	M_{0VR}	I_{0VR}	m	J_{mot}
min^{-1}		Nm	A	Nm	A	Nm	A	kg	10^{-4} kgm^2
2000	CMP71S	6.4	3.4	19.2	17	8.7	4.6	7	3.04
	CMP71M	9.4	5	30.8	26	13.7	7.3	8.4	4.08
	CMP71L	13.1	6.3	46.9	39	21	10.1	11.4	6.18
	CMP80S	13.4	6.9	42.1	33	18.7	9.5	12.8	8.78
	CMP80M	18.7	9.3	62.6	48	27	13.4	16.5	11.9
	CMP80L	27.5	12.5	107	72	44	20	21.4	18.1
	CMP100S	25.5	13.3	68.3	49	36	18.8	19.8	19.59
	CMP100M	31	14.7	108	69	47	22.3	24.8	26.49
	CMP100L	47	21.8	178.8	113	70	32.5	34.6	40.24
	CMP112S	30	14.3	88	51	43	21	38.4	74
	CMP112M	45	21	136	74	68	32	46.2	103
	CMP112L	69	33	225	124	109	52	62.56	163
	CMP112H	83	38	270	148	123	57	70.43	193
	CMP112E	95	44.5	320	175	150	71	78.2	222
3000	CMP40S	0.5	1.2	1.9	6.1	–	–	1.3	0.1
	CMP40M	0.8	0.95	3.8	6.0	–	–	1.6	0.15
	CMP50S	1.3	0.96	5.2	5.1	1.7	1.25	2.3	0.42
	CMP50M	2.4	1.68	10.3	9.6	3.5	2.45	3.3	0.67
	CMP50L	3.3	2.2	15.4	13.6	4.8	3.2	4.1	0.92
	CMP63S	2.9	2.15	11.1	12.9	4	3	4.0	1.15
	CMP63M	5.3	3.6	21.4	21.6	7.5	5.1	5.7	1.92
	CMP63L	7.1	4.95	30.4	29.7	10.3	7.2	7.5	2.69
	CMP71S	6.4	4.9	19.2	25	8.7	6.7	7	3.04
	CMP71M	9.4	7.5	30.8	39	13.7	10.9	8.4	4.08
	CMP71L	13.1	9.4	46.9	58	21	15.1	11.4	6.18
	CMP80S	13.4	10	42.1	47	18.5	13.8	12.8	8.78
	CMP80M	18.7	13.4	62.6	69	27	19.3	16.5	11.9
	CMP80L	27.5	18.7	107	107	44	30	21.4	18.1
	CMP100S	25.5	19.6	68.3	73	36	27.5	19.8	19.59
	CMP100M	31	21.8	108	102	47	33	24.8	26.49
	CMP100L	47	32.3	178.8	167	70	48	34.6	40.24
	CMP112S	30	21	88	74	43	30.5	38.4	74
	CMP112M	45	32	136	113	68	49	46.2	103
	CMP112L	69	49	225	183	105	77	62.56	163
	CMP112H	83	57	270	220	123	84	70.43	193
	CMP112E	95	65	320	255	150	104	78.2	222

23061715/EN – 03/2017

n_N	Motor	M_0	I_0	M_{pk}	I_{max}	M_{0VR}	I_{0VR}	m	J_{mot}
min^{-1}		Nm	A	Nm	A	Nm	A	kg	10^{-4} kgm^2
4500	CMP40S	0.5	1.2	1.9	6.1	–	–	1.3	0.1
	CMP40M	0.8	0.95	3.8	6.0	–	–	1.6	0.15
	CMP50S	1.3	1.32	5.2	7.0	1.7	1.7	2.3	0.42
	CMP50M	2.4	2.3	10.3	13.1	3.5	3.35	3.3	0.67
	CMP50L	3.3	3.15	15.4	19.5	4.8	4.6	4.1	0.92
	CMP63S	2.9	3.05	11.1	18.3	4	4.2	4.0	1.15
	CMP63M	5.3	5.4	21.4	32.4	7.5	7.6	5.7	1.92
	CMP63L	7.1	6.9	30.4	41.4	10.3	10	7.5	2.69
	CMP71S	6.4	7.3	19.2	38	8.7	9.9	7	3.04
	CMP71M	9.4	10.9	30.8	57	13.7	15.9	8.4	4.08
	CMP71L	13.1	14.1	46.9	87	21	22.5	11.4	6.18
	CMP80S	13.4	15.3	42.1	73	18.5	21	12.8	8.78
	CMP80M	18.7	20.1	62.6	103	27	29	16.5	11.9
	CMP80L	27.5	27.8	107	159	44	44.5	21.4	18.1
	CMP100S	25.5	30	68.3	111	36	42.5	19.8	19.59
	CMP100M	31	33.1	108	154	47	50	24.8	26.49
	CMP100L	47	48.4	178.8	251	70	72	34.6	40.24
	CMP112S	30	31.5	88	112	43	45.5	38.4	74
	CMP112M	45	47	136	168	68	72	46.2	103
	CMP112L	69	73	225	275	107	114	62.56	163
	CMP112H	83	86	270	335	123	128	70.43	193
	CMP112E	95	98	320	385	150	156	78.2	222
6000	CMP40S	0.5	1.2	1.9	6.1	–	–	1.3	0.1
	CMP40M	0.8	1.1	3.8	6.9	–	–	1.6	0.15
	CMP50S	1.3	1.7	5.2	9.0	1.7	2.2	2.3	0.42
	CMP50M	2.4	3	10.3	17.1	3.5	4.4	3.3	0.67
	CMP50L	3.3	4.2	15.4	26	4.8	6.1	4.1	0.92
	CMP63S	2.9	3.9	11.1	23.4	4	5.4	4.0	1.15
	CMP63M	5.3	6.9	21.4	41.4	7.5	9.8	5.7	1.92
	CMP63L	7.1	9.3	30.4	55.8	10.3	13.5	7.5	2.69
	CMP71S	6.4	9.6	19.2	50	8.7	13.1	7	3.04
	CMP71M	9.4	14.7	30.8	76	13.7	21.5	8.4	4.08
	CMP71L	13.1	18.8	46.9	115	21	30	11.4	6.18
	CMP80S	13.4	20	42.1	95	18.5	27.5	12.8	8.78
	CMP80M	18.7	26.4	62.6	135	27	38	16.5	11.9
	CMP80L	27.5	37.6	107	215	44	60	21.4	18.1

3.5.6 Motor-inverter assignments CMP.. motors, PWM 4 kHz

Key

I_N	Nominal output current of the inverter
I_{max}	Maximum output current of inverter
M_{pk}	Peak torque of the motor
n_{base}	Base speed of the motor

MOVIDRIVE® system - rated speed 2000 1/min

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	**Value**	**Unit**											
CMP71S	M_{pk}	Nm	7.67	9.34	11.5	13.6	16.5	18.2	19.2				
	n_{base}	1/min	2000	2000	2000	2000	2000	2000	2000				
	I_{max}	%	200	200	200	200	200	200	180				
CMP71M	M_{pk}	Nm			11.8	14.5	19	22.6	26.8	30.1	30.8		
	n_{base}	1/min			2000	2000	2000	2000	2000	2000	2000		
	I_{max}	%			200	200	200	200	200	200	164		
CMP71L	M_{pk}	Nm				16.3	22.1	27.4	34.8	41	44.7	46.9	
	n_{base}	1/min				2000	2000	2000	2000	2000	2000	2000	
	I_{max}	%				200	200	200	200	200	200	161	
CMP80S	M_{pk}	Nm					21.1	26.2	32.9	37.9	41.7	42.1	
	n_{base}	1/min					2000	2000	2000	2000	2000	2000	
	I_{max}	%					200	200	200	200	200	136	
CMP80M	M_{pk}	Nm						27.8	36.6	45.4	53	62.6	
	n_{base}	1/min						2000	2000	2000	2000	2000	
	I_{max}	%						200	200	200	200	197	
CMP80L	M_{pk}	Nm							40.6	52.3	64.7	87.2	102
	n_{base}	1/min							2000	2000	2000	2000	2000
	I_{max}	%							200	200	200	200	200
CMP100S	M_{pk}	Nm							35.9	45.5	54.6	67.5	68.3
	n_{base}	1/min							2000	2000	2000	2000	2000
	I_{max}	%							200	200	200	200	154
CMP100M	M_{pk}	Nm							40	52	65	88.8	104
	n_{base}	1/min							2000	2000	2000	2000	2000
	I_{max}	%							200	200	200	200	200
CMP100L	M_{pk}	Nm									69	100	127
	n_{base}	1/min									2000	2000	2000
	I_{max}	%									200	200	200
CMP112S	M_{pk}	Nm							39.7	51.4	63.6	85.1	88
	n_{base}	1/min							2000	2000	2000	2000	2000
	I_{max}	%							200	200	200	200	158
CMP112M	M_{pk}	Nm								55.5	69.9	99.2	123
	n_{base}	1/min								2000	2000	2000	2000
	I_{max}	%								200	200	200	200
CMP112L	M_{pk}	Nm										103	133
	n_{base}	1/min										2000	2000
	I_{max}	%										200	200

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
CMP112H	M_{pk}	Nm										104	137
	n_{base}	1/min										2000	2000
	I_{max}	%										200	200
CMP112E	M_{pk}	Nm											137
	n_{base}	1/min											2000
	I_{max}	%											200

MOVIDRIVE® system - rated speed 3000 1/min

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
CMP40S	M_{pk}	Nm	1.46	1.7	1.9								
	n_{base}	1/min	3000	3000	3000								
	I_{max}	%	200	200	189								
CMP40M	M_{pk}	Nm	2.96	3.44	3.8								
	n_{base}	1/min	3000	3000	3000								
	I_{max}	%	200	200	187								
CMP50S	M_{pk}	Nm	4.48	5.13	5.2								
	n_{base}	1/min	3000	3000	3000								
	I_{max}	%	200	200	160								
CMP50M	M_{pk}	Nm	5.42	6.54	7.93	9.26	10.3						
	n_{base}	1/min	3000	3000	3000	3000	3000						
	I_{max}	%	200	200	200	200	174						
CMP50L	M_{pk}	Nm	5.92	7.25	9	10.8	13.6	15.4					
	n_{base}	1/min	3000	3000	3000	3000	3000	3000					
	I_{max}	%	200	200	200	200	200	193					
CMP63S	M_{pk}	Nm	5.16	6.17	7.42	8.62	10.3	11.1					
	n_{base}	1/min	3000	3000	3000	3000	3000	3000					
	I_{max}	%	200	200	200	200	200	185					
CMP63M	M_{pk}	Nm		7.41	9.2	11.1	14.2	16.9	20.1	21.4			
	n_{base}	1/min		3000	3000	3000	3000	3000	3000	3000			
	I_{max}	%		200	200	200	200	200	200	173			
CMP63L	M_{pk}	Nm			9.26	11.4	15	18.4	23.2	27.8	30.4		
	n_{base}	1/min			3000	3000	3000	3000	3000	3000	3000		
	I_{max}	%			200	200	200	200	200	200	185		
CMP71S	M_{pk}	Nm			8.33	10.1	13	15.3	17.7	19.2			
	n_{base}	1/min			3000	3000	3000	3000	3000	3000			
	I_{max}	%			200	200	200	200	200	200			
CMP71M	M_{pk}	Nm					13.5	16.7	21.2	25.2	28.2	30.8	
	n_{base}	1/min					3000	3000	3000	3000	3000	3000	
	I_{max}	%					200	200	200	200	200	163	
CMP71L	M_{pk}	Nm						19.1	25.4	31.9	37.8	44.8	46.9
	n_{base}	1/min						3000	3000	3000	3000	3000	3000
	I_{max}	%						200	200	200	200	200	180

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
CMP80S	M_{pk}	Nm						18.5	24.7	30.8	35.8	42.1	
	n_{base}	1/min						3000	3000	3000	3000	3000	
	I_{max}	%						200	200	200	200	198	
CMP80M	M_{pk}	Nm							26.3	33.8	41.5	54.1	61
	n_{base}	1/min							3000	3000	3000	3000	3000
	I_{max}	%							200	200	200	200	200
CMP80L	M_{pk}	Nm								35.9	45.3	64.7	80.7
	n_{base}	1/min								3000	3000	3000	3000
	I_{max}	%								200	200	200	200
CMP100S	M_{pk}	Nm								32.3	40.4	55.2	64.6
	n_{base}	1/min								3000	3000	3000	3000
	I_{max}	%								200	200	200	200
CMP100M	M_{pk}	Nm									45.4	65.8	82.7
	n_{base}	1/min									3000	3000	3000
	I_{max}	%									200	200	200
CMP100L	M_{pk}	Nm										69.8	91.3
	n_{base}	1/min										3000	3000
	I_{max}	%										200	200
CMP112S	M_{pk}	Nm									45.4	65	80.3
	n_{base}	1/min									3000	3000	3000
	I_{max}	%									200	200	200
CMP112M	M_{pk}	Nm										68.7	88.6
	n_{base}	1/min										3000	3000
	I_{max}	%										200	200
CMP112L	M_{pk}	Nm											93.3
	n_{base}	1/min											3000
	I_{max}	%											200

MOVIDRIVE® system - rated speed 4500 1/min

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	Value	Unit											
CMP40S	M_{pk}	Nm	1.46	1.7	1.9								
	n_{base}	1/min	4500	4500	4500								
	I_{max}	%	200	200	189								
CMP40M	M_{pk}	Nm	2.96	3.44	3.8								
	n_{base}	1/min	4500	4500	4500								
	I_{max}	%	200	200	187								
CMP50S	M_{pk}	Nm	3.53	4.18	4.91	5.2							
	n_{base}	1/min	4500	4500	4500	4500							
	I_{max}	%	200	200	200	177							
CMP50M	M_{pk}	Nm	4.11	5.03	6.21	7.43	9.32	10.3					
	n_{base}	1/min	4500	4500	4500	4500	4500	4500					
	I_{max}	%	200	200	200	200	200	186					

Inverter	MDX90A-..		0020	0025	0032	0040	0055	0070	0095	0125	0160	0240	0320
	Value	Unit											
	I_N	A	2	2.5	3.2	4	5.5	7	9.5	12.5	16	24	32
	I_{max}	A	4	5	6.4	8	11	14	19	25	32	48	64
Motor	**Value**	**Unit**											
CMP50L	M_{pk}	Nm	4.19	5.17	6.5	7.94	10.4	12.5	15.2	15.4			
	n_{base}	1/min	4500	4500	4500	4500	4500	4500	4500	4500			
	I_{max}	%	200	200	200	200	200	200	200	156			
CMP63S	M_{pk}	Nm	3.84	4.66	5.71	6.79	8.48	9.79	11.1				
	n_{base}	1/min	4500	4500	4500	4500	4500	4500	4500				
	I_{max}	%	200	200	200	200	200	200	192				
CMP63M	M_{pk}	Nm			6.45	7.88	10.4	12.6	15.8	18.8	21.3	21.4	
	n_{base}	1/min			4500	4500	4500	4500	4500	4500	4500	4500	
	I_{max}	%			200	200	200	200	200	200	200	134	
CMP63L	M_{pk}	Nm				8.31	11.1	13.8	17.9	22.2	26.2	30.4	
	n_{base}	1/min				4500	4500	4500	4500	4500	4500	4500	
	I_{max}	%				200	200	200	200	200	200	173	
CMP112S	M_{pk}	Nm										45.2	58.7
	n_{base}	1/min										4500	4500
	I_{max}	%										200	200
CMP112M	M_{pk}	Nm											62.4
	n_{base}	1/min											4500
	I_{max}	%											200

3.6 Selection of an application inverter

The selection of the application inverter is based on the course of the output current over time. The required current has to be determined from the required torque characteristic of the connected motor.

The application inverters are dimensioned for a nominal output current I_N. In many applications, there is a demand for short-time overload operation. For this purpose, the application inverters can be operated with up to 200% of the nominal output current for a short period of time.

For overload operation, make sure that the application inverter is not thermally overloaded. For protection of the power components, application inverters have various monitoring mechanisms.

The following thermal monitoring functions are available:

- Dynamic utilization

  The periodic current load of the switching power semiconductors lets them heat and cool down cyclically. Due to the different thermal time constants, large temperature differences can occur between power semiconductor and heat sink. Dynamic utilization monitors the permitted temperature of the barrier layer of the power semiconductors.

- Thermal utilization

  The power semiconductors are limited by the maximally permitted temperature during operation. Thermal utilization monitors the heat sink temperature of the power semiconductors.

- Electromechanical utilization (I^2t utilization)

  Electromechanical utilization protects the compared that have a large thermal time constant compared to the power semiconductors.

Due to the complexity of the utilization curves, the calculation can only be performed using software. The SEW workbench software offers supports for dimensioning an application inverter.

For a rough selection of the application inverter without using software, characteristic load cycles are given in the following section.

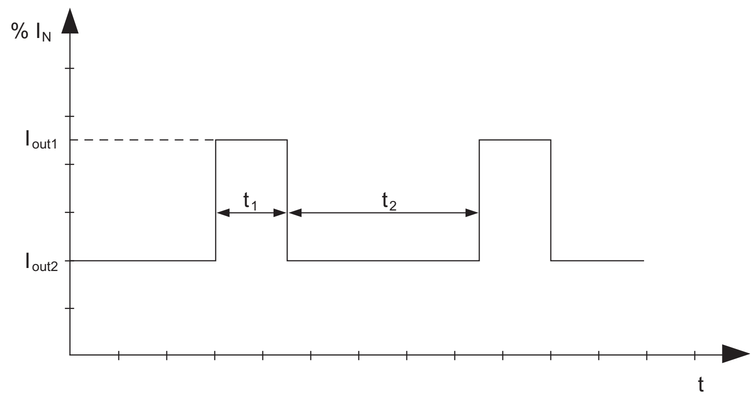
The characteristic load cycle consists of a load and a load relief period. In the load relief period, the output current must not exceed the specified value. After this load relief period, overload is possible again.

23061715/EN – 03/2017

3.6.1 Overload capacity

Load cycle with base load current – typical for the selection of asynchronous and servomotors

The characteristic load cycle consists of a load and a load relief period. In the load relief period, the output current must not exceed the specified value. After this load relief period, overload is possible again.



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Examples of permitted current profiles

Overload capacity at PWM = 4 kHz, f_{out} ≥ 3 Hz

Overload current $I_{out\,1}$ in % I_N	Overload time t_1	Base load current $I_{out\,2}$ in % I_N	Required wait time t_2
200%	3 s	50%	7 s
200%	3 s	100%	17 s
150%	60 s	100%	60 s
150%	60 s	50%	30 s

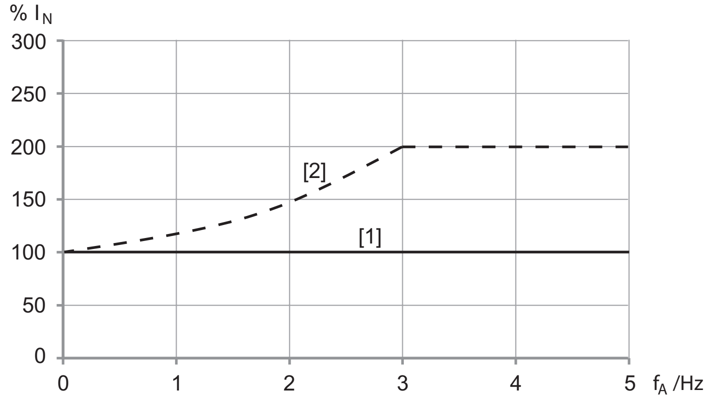
3.6.2 Derating

Due to the following operating and ambient conditions, a reduction of the output current may be necessary.

Derating due to the rotary field frequency

The specified nominal output current I_N of the application inverter is the rms value. The increased load on the power semiconductors has to be considered especially for slow rotating fields and rotating fields at standstill. In case of a rotating field at standstill, direct current that can correspond to the peak value of the sine current depending on the phase position is flowing.

It is particularly important to consider output frequencies f_O < 3 Hz.



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[1] Continuous output current with PWM = 4 kHz

[2] Temporary overload current

Derating due to the installation altitude

SEW-EURODRIVE frequency inverters are designed for overvoltage category III and for altitudes up to 2000 m according to EN 61800-5-1. The air pressure and the air density decrease depending on the installation altitude. This leads to a reduced cooling capacity and to a reduced electrical isolation effect of the air.

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 creepage distances according to EN 61800-5-1, you have to connect an overvoltage protection device in order to reduce the overvoltages from category III to category II.

Derating due to line voltage and temperature

Derating depending on the line voltage V_{line} and the ambient temperature:

Line voltage V_{line}	PWM	Continuous current $I_{continuous}$
230 V	4 kHz	$I_{continuous}/I_N$ = 133% – (T – 40 °C) × 2.65%
	8 kHz	$I_{continuous}/I_N$ = 100% – (T – 40 °C) × 2.25%
	16 kHz	$I_{continuous}/I_N$ = 66% – (T – 40 °C) × 1.55%
400 V	4 kHz	$I_{continuous}/I_N$ = 133% – (T – 40 °C) × 2.65%
	8 kHz	$I_{continuous}/I_N$ = 100% – (T – 40 °C) × 2.25%
	16 kHz	$I_{continuous}/I_N$ = 66% – (T – 40 °C) × 1.55%
500 V	4 kHz	$I_{continuous}/I_N$ = 121% – (T – 40 °C) × 2.45%
	8 kHz	$I_{continuous}/I_N$ = 86% – (T – 40 °C) × 2%
	16 kHz	$I_{continuous}/I_N$ = 53% – (T – 40 °C) × 1.8%

23061715/EN – 03/2017

3.7 Braking resistor selection

3.7.1 Table of braking resistors

The following braking resistors are intended for use with MOVIDRIVE® system. The technical data is valid in the temperature range -20 °C to +40 °C.

For ambient temperatures of more than +40°C, the continuous power must be reduced by 4% for every 10 K. The tripping current must be reduced by 2% for every 10 K. Do not exceed a maximum ambient temperature of 80 °C.

Braking resistor	Part number	Resistance	Continuous power	Peak power	Tripping current
		Ω	kW	kW	A
BW120-001	18176011	117	0.1		-
BW100-006-T	18204198	100	0.6	6.7	2.4
BW100-002	08281653	100	0.2	6.7	1
BW100-001	08281718	100	0.1	6.7	1
BW247-T	18200842	47	2	14	6.5
BW147-T	18201342	47	1.2	14	5.1
BW047-010-T	17983207	47	0.8	14	4.1
BW027-042-T	19155301	27	4.2	24.9	12.5
BW027-024-T	17983231	27	2.4	24.9	9.4
BW027-016-T	17983215	27	1.6	24.9	7.7
BW003-420-T	13302345	2.5	42	268.8	135.1
BW002-070	17983304	2.3	7	292.2	355.2
BW915-T	18204139	15	16	44.8	32.7
BW015-075-T	19155271	15	7.5	44.8	22.4
BW015-042-T	19155328	15	4.2	44.8	16.7
BW015-016	17983258	15	1.6	44.8	10.3
BW010-108-T	19155298	10	10.8	67.2	32.9
BW010-050-T	17983274	10	5	67.2	22.4
BW010-024	17983266	10	2.4	67.2	15.5
BW206-T	18204120	6	18	114	54.8
BW106-T	18200834	6	13.5	114	47.4
BW006-050-01	18200125	6	5	114	28.9
BW006-025-01	18200117	6	2.5	114	20.4
BW005-170-T	17983290	4.7	17	143	60.1
BW005-070	17983282	4.7	7	143	38.6
BW004-070-01	17967678	3.6	7	190	38.6
BW004-050-01	18200133	3.6	5	190	32.6
BW1.0-170	17985455	1	17	672	130.4

23061715/EN – 03/2017

3.7.2 Selection criteria

The selection of the braking resistor takes place via the SEW Workbench. The necessary selection parameters for the braking resistor are calculated during the project planning procedure. Depending on these selection parameters, a braking resistor is selected from the table.

The following selection parameters are the basis for selecting the braking resistor.

3.7.3 Continuous braking power

The continuous braking power is specified by the mechanical structure of the braking resistor.

The continuous braking power required by the application must be lower than the continuous braking power of the braking resistor according to the technical data.

3.7.4 Peak braking power

The permitted peak braking power is specified by the resistor and the DC link voltage.

The peak braking power required by the application results from the maximum of individual regenerative parts within a cycle.

The peak braking power required by the application must be lower than the permitted peak braking power of the braking resistor.

The permitted peak braking power of the braking resistor is calculated as follows:

$$P_{\mathrm{max}} = \frac{U_{ZK\,max}^{2}}{R \times 1.4}$$

P_{max}	Maximum peak braking power that the braking resistor can absorb
$U_{ZK\,max}$	Maximum DC link voltage: DC 970 V
R	Braking resistance value

The peak braking power for each braking resistor is listed in the table.

3.7.5 Current-carrying capacity of the brake chopper

The resistance of the braking resistor must not be smaller than the minimum permitted braking resistor according to the technical data of the application inverter. This ensures that the brake chopper is not damaged.

3.7.6 Supply cable for braking resistor

Use only shielded cables.

The cable cross section depends on the tripping current I_F.

The rated voltage of the cable must amount to at least V_0/V = 300 V / 500 V.

The maximum permitted cable length between application inverter and braking resistor is 100 m.

3.7.7 Protection against thermal overload of the braking resistor

To avoid thermal damage of the braking resistor as well as subsequent damage, the braking resistor has to be thermally monitored. SEW-EURODRIVE suggests the following options:

- TCB thermal circuit breaker

  The TCB thermal circuit breaker is installed in the control cabinet, connected to the supply cable to the braking resistor and set to the tripping current of the braking resistor. If the measured mean current exceeds the tripping current, an NC contact switches and reports overload of the braking resistor. Simultaneously the connection of braking resistor and inverter is separated, thus ending the generator mode.

- Integrated temperature switch –T

  Braking resistors with the label –T are equipped with an integrated temperature switch. The temperature switch is thermally coupled to the braking resistor and switches an NC contact in case of overtemperature of the braking resistor. The braking resistor-inverter connection is not interrupted. In case of thermal overload, the regenerative operation has to be terminated. SEW-EURODRIVE recommends to shield the connection cable of the temperature switch.

- Thermal overload relay

  A thermal overload relay is installed in the control cabinet, connected to the supply cable to the braking resistor and set to the tripping current of the braking resistor. If the measured mean current exceeds the tripping current, an NC contact switches and reports overload of the braking resistor. The braking resistor-inverter connection is not interrupted. In case of thermal overload, the regenerative operation has to be terminated.

Wiring diagrams regarding the matters described above are available in chapter "Protection against thermal overload of the braking resistor" (→ 🗎 197).

3.7.8 Parallel connection of braking resistors

It is permitted to connect several identical braking resistors in parallel. The following applies:

- The power connections of the braking resistors must be connected to +R and –R in parallel.
- Each braking resistor requires a separate protection against thermal overload.
- The signal contacts (NC contacts) of the protection devices must be connected in series.

3.8 Supply system cable and motor cable

3.8.1 Supply system cable

Dimensioning of the supply system cable generally takes place plant-specific and depends on the design of the line connection. Line connection is shown in chapter "Power connection" (→ 🖹 216). Observe the country-specific and plant-specific regulations when selecting the cross section of the supply system cable.

Recommended cross section for nominal operation

The cross section of the supply system cables must be dimensioned based on the nominal line current I_{line}.

SEW-EURODRIVE suggests the cable cross sections listed in the table. Cables with these cross sections can be used if the following conditions are met:

- The single-core cables are made of copper with PVC insulation.
- The cables are routed in cable ducts according to IEC 60204-1 installation type C at 40 °C ambient temperature.

MDX90A-…-5_3	0020	0025	0032	0040	0055	0070	0095	0125	0160
Nominal line current AC I_{line}	1.9 A	2.3 A	2.9 A	3.6 A	5 A	6.3 A	8.6 A	11.3 A	14.4 A
Supply system cable L1/L2/L3	1.5 mm^2							2.5 mm^2	
Fuse/miniature circuit breaker	10 A							16 A	

MDX90A-…-2_3	0070	0093	0140	0213	0290
Nominal line current AC I_{line}	6.4 A	8.4 A	12.4 A	18.9 A	27.4 A
Supply system cable L1/L2/L3	1.5 mm^2		2.5 mm^2		6 mm^2
Fuse/miniature circuit breaker	10 A		16 A	20 A	32 A

INFORMATION

Recommended cross section

The values are only recommendations. They are no substitute for detailed project planning of the cables depending on the concrete application and considering the applicable regulations.

INFORMATION

Securing the supply system cable

Secure the supply system cable with appropriate safety elements.

When selecting the supply system cable, make sure that the selected cross section is in the range of the connectable cross section of the terminals.

3.8.2 Motor cable

Cable length

For MOVIDRIVE® system application inverters, a maximum motor cable length must not be exceeded.

The following project planning guidelines must be observed:

- Use of shielded motor cables with a capacitance conductor/shield of maximum 280 pF/m.

MDX9_A...-5_3 at V_{line} = 3 × AC 400 V	0020 – 0040	0055	0070	0095	0125	0160	0240 – 1130
	Maximum motor cable length in m						
	Shielded cables						
PWM frequency							
4 kHz	120	200	250	300	300	400	400
8 kHz	80	120	150	250	250	300	300
16 kHz	40	60	100	150	150	200	200

MDX9_A...-5_3 at V_{line} = 3 × AC 400 V	0020 – 0040	0055	0070	0095	0125	0160	0240 – 1130
	Maximum motor cable length in m						
	Unshielded cable						
PWM frequency							
4 kHz	360	600	750	900	900	1200	1200
8 kHz	240	360	450	750	750	900	900
16 kHz	120	180	300	450	450	600	600

MDX9_A...-2_3 at V_{line} = 3 × AC 230 V	0070	0093	0140	0213 – 0290	0420 – 0950
	Maximum motor cable length in m				
	Shielded cables				
PWM frequency					
4 kHz	120	200	250	300	400
8 kHz	80	120	150	250	300
16 kHz	40	60	100	150	200

MDX9_A...-2_3 at V_{line} = 3 × AC 230 V	0070	0093	0140	0213 – 0290	0420 – 0950
	Maximum motor cable length in m				
	Unshielded cable				
PWM frequency					
4 kHz	360	600	750	900	1200
8 kHz	240	360	450	750	900
16 kHz	120	180	300	450	600

23061715/EN – 03/2017

INFORMATION

SEW-EURODRIVE recommends not to use a ground fault circuit interrupter with long motor cables. The leakage currents caused by cable capacitance may cause mis-tripping.

Voltage drop

Select the cable cross section of the motor cable so the voltage drop is as small as possible. An excessively high voltage drop means that the full motor torque is not achieved.

Determine the expected voltage drop based on the following tables. With shorter cables, you can convert the voltage drop proportionally.

Cable cross section	Load with I in A =																				
	4	6	8	10	13	16	20	25	30	40	50	63	80	100	125	150	200	250	300	350	400
Copper	Voltage drop ΔV in V with length = 100 m and ϑ = 70 °C																				
1.5 mm²	5.3	8	10.6	13.3	17.3	21.3	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)
2.5 mm²	3.2	4.8	6.4	8.1	10.4	12.8	16	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)
4 mm²	1.9	2.8	3.8	4.7	6.5	8.0	10	12.5	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)
6 mm²					4.4	5.3	6.4	8.3	9.9	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)
10 mm²						3.2	4.0	5.0	6.0	8.2	10.2	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)
16 mm²								3.3	3.9	5.2	6.5	7.9	10.0	1)	1)	1)	1)	1)	1)	1)	1)
25 mm²									2.5	3.3	4.1	5.1	6.4	8.0	1)	1)	1)	1)	1)	1)	1)
35 mm²											2.9	3.6	4.6	5.7	7.2	8.6	1)	1)	1)	1)	1)
50 mm²														4.0	5.0	6.0	1)	1)	1)	1)	1)
70 mm²																	5.8	1)	1)	1)	1)
95 mm²																	4.2	5.3	1)	1)	1)
150 mm²																		3.3	4.0	1)	1)
185 mm²																			3.2	3.8	1)
240 mm²																			2.5	2.9	3.3

1) Load not permitted according to IEC 60364-5-52.

3.9 Signal lines

3.9.1 Encoder cables

Connection/Encoder	Cable length
HTL encoder ES7C and EG7C	300 m
Standard HTL encoder	200 m
Other encoders	100 m

23061715/EN – 03/2017

3.10 EMC-compliant installation according to EN 61800-3

MOVIDRIVE® application inverters are designed for use as components for installation in machinery and systems. They comply with the EMC product standard EN 61800-3 "Variable-speed electrical drives".

Provided the information relating to EMC-compliant installation is observed, they satisfy the appropriate requirements for CE marking on the basis of the EMC Directive 2014/30/EU.

3.10.1 Interference emission

To comply with limit classes C1 and C2 according to EN 61800-3, the measures listed in the tables must be taken.

Limit value class C1

Inverter	Measures			
	On the line side	On the motor side		
	NF line filter	HF output filter HD output choke	Shielded cables	Max. cable length
MDX90A-0020 – 0320-5_3-.. MDX90A-0070 – 0290-2_3-..	NF	-	Yes	20 m
MDX90A-0020 – 0320-5_3-..[1)] MDX90A-0070 – 0290-2_3-..[1)]	NF	HF	No	20 m

1) PWM frequency ≠ 16 kHz

Class C2 limit

Inverter	Measures			
	On the line side	On the motor side		
	NF line filter	HF output filter HD output choke	Shielded cables	Max. cable length
MDX90A-0020 – 0160-5_3-.. MDX90A-0070 – 0140-2_3-..	-	-	Yes	20 m
	NF	-	Yes	100 m
	NF	HD	No	100 m
	NF	HF	No	In preparation
MDX90A-0240-5_3-.. and higher MDX90A-0213 – 0290-2_3-..	NF	-	Yes	100 m
	NF	HD	No	100 m
	NF	HF	No	In preparation

3.11 Line components

3.11.1 Line fuses and miniature circuit breakers

Line fuses and miniature circuit breakers are used for protecting the supply system cables. For fusing, use fuses and miniature circuit breakers with the following properties:

Type class	Requirement
Line protection types in operation classes gL, gG	Fusing voltage ≥ nominal line voltage
Miniature circuit breaker of Characteristics D	Nominal miniature circuit breaker voltage ≥ nominal line voltage
	Nominal currents of the miniature circuit breaker must be 10% higher than the nominal line current of the application inverter.

Adhere to the country and system specific regulations when carrying out the fusing. If required, observe the notes in chapter "UL-compliant installation" (→ 🗎 228).

3.11.2 Line contactor

Operation without line contactor

A line contactor is used to separate the application inverter from the supply system in case of an error and to switch the power supply on and off.

For more information on operation with line contactor, refer to chapter Line connection.

INFORMATION

Use a line contactor in utilization category AC-3 (IEC 158-1) or better.

The line contactor must be installed before the line filter and the line choke.

Operation without line contactor

Operation without line contactor is possible for application inverters MDX90A-0240-5_3-.. and MDX90A-0213-2_3-.. and higher. The application inverters are equipped with a controlled rectifier input stage. In case of operation without line contactor, the temperature evaluation of the braking resistor via a digital input of the application inverter must be ensured. The connected digital input must be parameterized for monitoring the braking resistor temperature evaluation.

INFORMATION

Operation without line contactor is not possible for application inverters up to MDX90A-0160-5_3-.. and MDX90A-0140-2_3-...

Also when operated without line contactor, it must be possible to de-energize the application inverter. The switch-off design is always done system-specific depending on the specific application considering the applicable regulations.

23061715/EN – 03/2017

3.11.3 NF line filter

A line filter reduces interference emission via the supply system cable, which is generated by the application inverter. The line filter mainly serves to meet interference voltage limit requirements in the frequency range from 150 kHz to 30 MHz at the line connection. In addition, a line filter dampens the interference from the supply system affecting the application inverter. The selection of the line filter depends on the nominal line current and the line voltage of the frequency inverter.

The line filter has to be selected according to the following table.

Technical data

Line filter	NF0055-503	NF0120-503	NF0220-503	NF0420-513
Part number	17984319	17984270	17984300	17983789
Nominal line voltage V_N	3 × AC 230 V - 500 V, 50/60 Hz			
Nominal current I_N	5.5 A	12 A	22 A	42 A
Nominal power loss			9 W	30 W
Ambient temperature ϑ_A	0 to 45 °C (reduction: x% I_N up to max. 60 °C)			
Connection contacts L1/L2/L3 - L1'/L2'/L3'	Cage clamp terminals max. 6 mm^2			2.5 – 16 mm^2
Tightening torque L1/L2/L3 - L1'/L2'/L3'	-			2 - 4 Nm
PE terminal contacts			M5	M6
Tightening torque PE			3 Nm	6 Nm
Degree of protection	IP20 according to EN 60529			
Weight			1.4 kg	3 kg

Assignment to an inverter

Line filter	NF0055-503	NF0120-503	NF0220-503	NF0420-513
MDX90A-...-5_3-..	0020 – 0040	0055 – 0095	0125 – 0160	0240 – 0320
MDX90A-...-2_3-..	-	0070 – 0093	0140	0213 – 0290

23061715/EN – 03/2017

3.11.4 ND line choke

The main reason for using line chokes is the reduction of grid disturbances that may occur due to harmonic currents. In addition, line chokes improve the overvoltage protection.

The line choke has to be selected according to the following table.

Technical data

Line choke	ND0070-503	ND0160-503	ND0300-503	ND0420-503
Part number	17984173	17984181	17983800	17983819
Nominal line voltage V_N	3 × AC 230 V - 500 V, 50/60 Hz			
Nominal current I_N	7 A	16 A	30 A	42 A
Nominal inductance	0.36 mH	0.2 mH	0.1 mH	0,045 mH
Nominal power loss	4 W	9 W	11 W	13 W
Ambient temperature ϑ_A	-10 °C to 45 °C (reduction: 3% I_N up to max. 60 °C)			
Terminal contacts L1/L2/L3 - L1'/L2'/L3'	0.2 – 4 mm^2		0.2 – 10 mm^2	2.5 – 16 mm^2
Tightening torque L1/L2/L3 - L1'/L2'/L3'	0.5 – 1 Nm		1.2 – 2 Nm	2.5 Nm
PE terminal contact	M4		M5	
Tightening torque PE	1.5 Nm		3 Nm	
Degree of protection	IPXXB to EN 60529			
Weight	0.5 kg	1.3 kg	1.95 kg	1.82 kg

Assignment to an inverter

Line choke	ND0070-503	ND0160-503	ND0300-503	ND0420-503
MDX90A-...-5_3-..	0020 – 0055	0070 – 0125	0160 – 0240	0320
MDX90A-...-2_3-..	-	0070 – 0093	0140 – 0213	0290

3.11.5 Residual current device

⚠ WARNING

No protection against electric shock if an incorrect type of residual current device is used.

Severe or fatal injuries.

- Use only universal current sensitive residual current devices of type B for inverters.

- Inverters generate a DC current component in the leakage current and can significantly reduce the sensitivity of a residual current device of type A. A type A residual current device is thus not permitted as protection device.
- If the use of a residual current device is not mandatory according to the standards, SEW-EURODRIVE recommends not to use a residual current device.

3.12 24 V supply voltage selection

The MDX90A-... application inverter requires an external 24 V voltage supply for electronics.

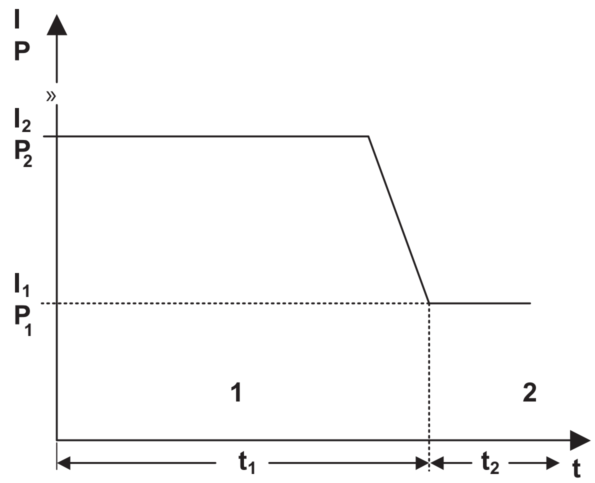
The MDX91A-... application inverter has an internal 24 V voltage supply that can also be supported externally.

3.12.1 Project planning for 24 V supply power

For dimensioning the 24 V supply voltage, it is necessary to know the power and current consumption of the application inverter.

The current path and power ratios present when switching on the 24 V voltage supply are shown in the figure below.

The path is divided into the time ranges 1 and 2, see the following figure.



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I_1	Nominal current
P_1	Nominal power
I_2	Inrush current
P_2	Inrush power
t_1	Power-applied hours
t_2	Steady-state condition

1. t_1 is the period when the device's internal switched-mode power supplies start up. The total of the maximum power and current consumption must be calculated for this time period. The power supply must be capable of providing this total power and total current for at least 100 ms.
2. t_2 is the range of the projected 24 V power consumption.

INFORMATION

Commercially available switched-mode power supplies can reliably switch on the maximally occurring capacities.

3.12.2 Power consumption of the 24 V supply

Tables for the power demand of the 24 V supply depending on the used modules and the installed options.

Power consumption

Inverter 3 × AC 400 V	Power consumption (without I/O, motor encoder, motor brake) W
MDX90A-0020.. – ..0040-5_3-..	20
MDX90A-0055.. – ..0095-5_3-..	20
MDX90A-0125.. – ..0160-5_3-..	20
MDX90A-0240.. – ..0320-5_3-..	30

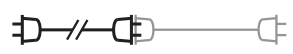
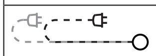
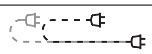
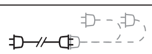
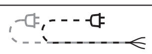
Inverter 3 × AC 230 V	Power consumption (without I/O, motor encoder, motor brake) W
MDX90A-0070.. – ..0093-2_3-..	20
MDX90A-0140-2_3-..	20
MDX90A-0213.. – ..0290-2_3-..	30
MDX90A-0420.. – ..0570-2_3-..	
MDX90A-840.. – ..1080-2_3-..	

Power consumption of the option cards

Option card	Power consumption W
CIO21A	1.2
CID21A	0.4
CES11A	0.8

4 Prefabricated cables

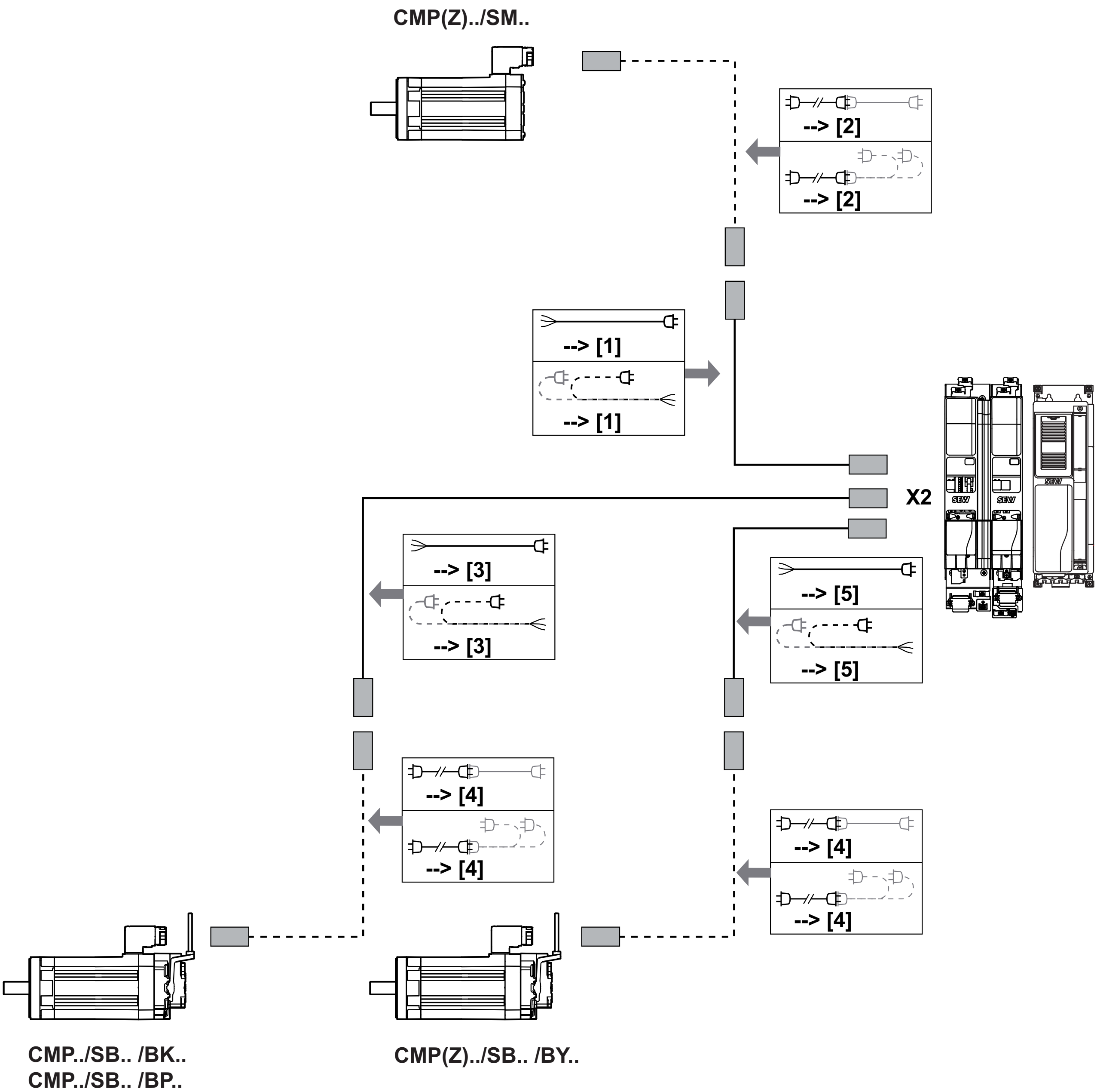
4.1 Meaning of the symbols

Icon	Meaning
	Connection cables: Connector → connector for fixed installation
	Connection cable extension: Connector → connector for fixed installation
	Connection cables: Connector → encoder connection cover for fixed installation
	Connection cables: Connector → encoder connection cover for cable carrier installation
	Connection cables: Connector → connector for cable carrier installation
	Connection cable extension: Connector → connector for cable carrier installation
	Connection cables: Connector → open end for fixed installation
	Connection cables: Connector → open end for cable carrier installation

23061715/EN – 03/2017

4.2 Power cables for CMP.. motors

4.2.1 Overview



9007214010255627

[1] Motor cable ../SM.. (→ 🗎 120)

[2] Motor extension cable ../SM.. (→ 🗎 121)

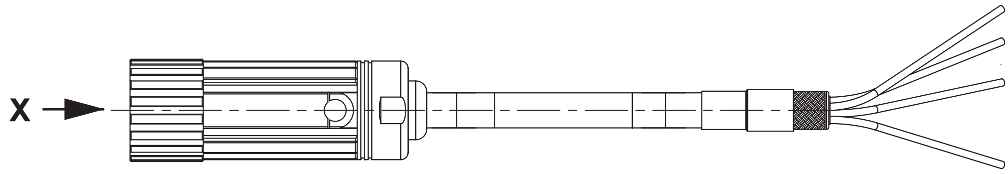
[3] Brakemotor cable ../SB.. for brake /BK and /BP (→ 🗎 122)

[4] Brakemotor extension cable ../SB.. for /BK, /BP and /BY brake (→ 🗎 124)

[5] Brakemotor cable ../SB.. for brake /BY (→ 🗎 123)

4.2.2 Motor cable with connector on motor end

Motor cable illustration



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Types of CMP.. motor cables

Plug connector	Number of cores and cable cross section	Part number	Installation type
SM11	4 × 1.5 mm^2	05904544	Fixed installation
SM11	4 × 1.5 mm^2	05906245	Cable carrier installation
SM12	4 × 2.5 mm^2	05904552	Fixed installation
SM12	4 × 2.5 mm^2	05906253	Cable carrier installation
SM14	4 × 4 mm^2	05904560	Fixed installation
SM14	4 × 4 mm^2	05904803	Cable carrier installation
SMB6	4 × 6 mm^2	13350269	Fixed installation
SMB6	4 × 6 mm^2	13350293	Cable carrier installation
SMB10	4 × 10 mm^2	13350277	Fixed installation
SMB10	4 × 10 mm^2	13350307	Cable carrier installation
SMB16	4 × 16 mm^2	13350285	Fixed installation
SMB16	4 × 16 mm^2	13350315	Cable carrier installation
SMC16	4 × 16 mm^2	18148476	Fixed installation
SMC16	4 × 16 mm^2	18148484	Cable carrier installation
SMC25	4 × 25 mm^2	18148581	Cable carrier installation
SMC35	4 × 35 mm^2	18148697	Cable carrier installation

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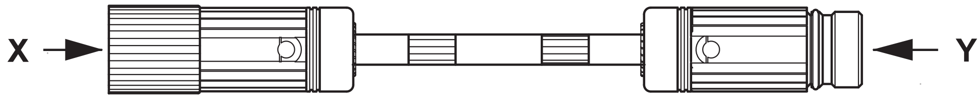
Illustration of motor extension cable



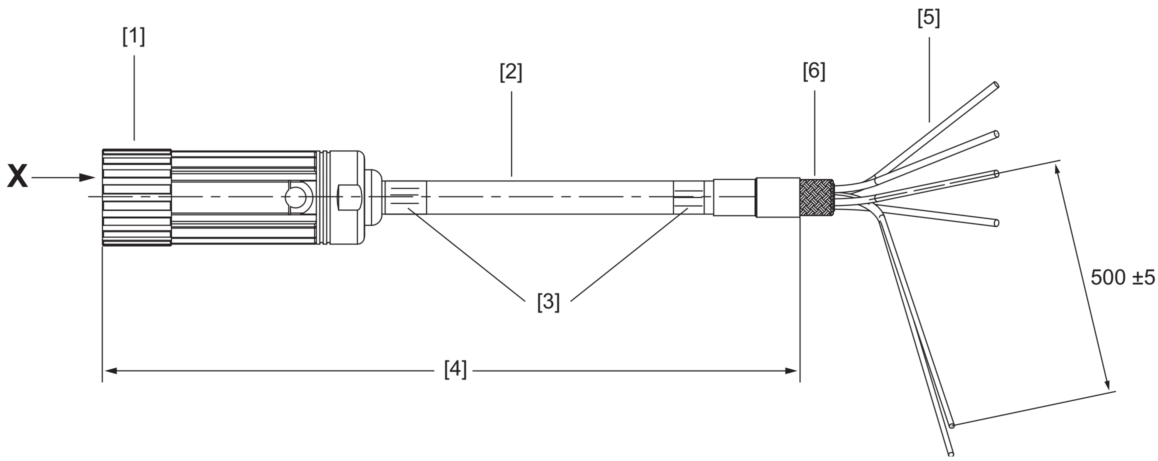
4818839179

Types of CMP.. motor extension cables

Plug connector	Number of cores and cable cross section	Part number	Installation type
SM11	4 × 1.5 mm²	13332457	Cable carrier installation
SM12	4 × 2.5 mm²	13332465	Cable carrier installation
SM14	4 × 4 mm²	13332473	Cable carrier installation
SMB6	4 × 6 mm²	13350021	Cable carrier installation
SMB10	4 × 10 mm²	13350048	Cable carrier installation
SMB16	4 × 16 mm²	13350056	Cable carrier installation
SMC16	4 × 16 mm²	18156819	Cable carrier installation
SMC25	4 x 25 mm²	18156827	Cable carrier installation
SMC35	4 x 35 mm²	18156835	Cable carrier installation

4.2.3 Brakemotor cables for BP/BK brake with connector at motor end

Figure of CMP.. brakemotor cables



4818640779

Types of CMP.. brakemotor cables

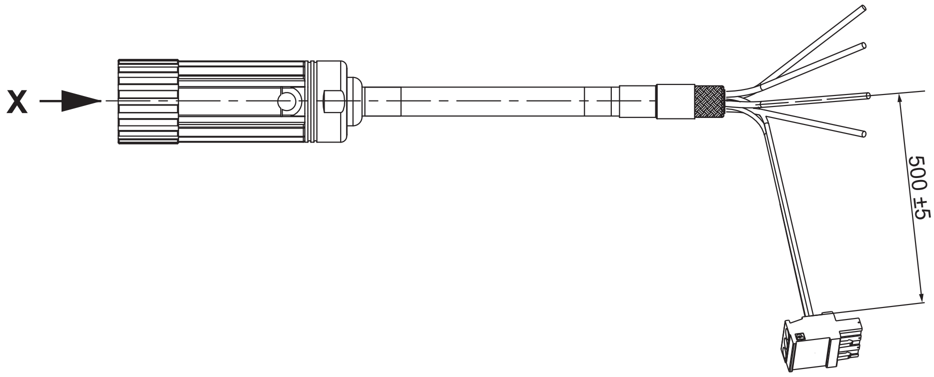
Plug connector	Number of cores and cable cross section	Part number	Installation type
SB11	4 × 1.5 mm² + 3 × 1 mm²	13354345	Fixed installation
SB11	4 × 1.5 mm² + 3 × 1 mm²	13354388	Cable carrier installation
SB12	4 × 2.5 mm² + 3 × 1 mm²	13354353	Fixed installation
SB12	4 × 2.5 mm² + 3 × 1 mm²	13354396	Cable carrier installation
SB14	4 × 4 mm² + 3 × 1 mm²	13354361	Fixed installation
SB14	4 × 4 mm² + 3 × 1 mm²	13421603	Cable carrier installation
SBB6	4 × 6 mm² + 3 × 1.5 mm²	13350196	Fixed installation
SBB6	4 × 6 mm² + 3 × 1.5 mm²	13350234	Cable carrier installation
SBB10	4 × 10 mm² + 3 × 1.5 mm²	13350218	Fixed installation
SBB10	4 × 10 mm² + 3 × 1.5 mm²	13350242	Cable carrier installation
SBB16	4 × 16 mm² + 3 × 1.5 mm²	13350226	Fixed installation
SBB16	4 × 16 mm² + 3 × 1.5 mm²	13350250	Cable carrier installation

INFORMATION

As for the power cables for brakemotors with BP/BK brake only two signal cables are required, the third signal core is cut off during cable assembly.

4.2.4 Brakemotor cables for BY brake with connector at motor end

Figure of CMP.. brakemotor cables



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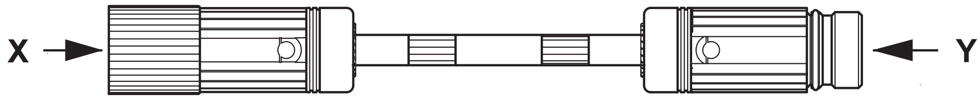
Types of CMP.. brakemotor cables

Plug connector	Number of cores and cable cross section	Part number	Installation type
SB11	4 × 1.5 mm^2 + 3 × 1 mm^2	13354272	Fixed installation
SB11	4 × 1.5 mm^2 + 3 × 1 mm^2	13354302	Cable carrier installation
SB12	4 × 2.5 mm^2 + 3 × 1 mm^2	13354280	Fixed installation
SB12	4 × 2.5 mm^2 + 3 × 1 mm^2	13354310	Cable carrier installation
SB14	4 × 4 mm^2 + 3 × 1 mm^2	13354299	Fixed installation
SB14	4 × 4 mm^2 + 3 × 1 mm^2	13354329	Cable carrier installation
SBB6	4 × 6 mm^2 + 3 × 1.5 mm^2	13350129	Fixed installation
SBB6	4 × 6 mm^2 + 3 × 1.5 mm^2	13350153	Cable carrier installation
SBB10	4 × 10 mm^2 + 3 × 1.5 mm^2	13350137	Fixed installation
SBB10	4 × 10 mm^2 + 3 × 1.5 mm^2	13350161	Cable carrier installation
SBB16	4 × 16 mm^2 + 3 × 1.5 mm^2	13350145	Fixed installation
SBB16	4 × 16 mm^2 + 3 × 1.5 mm^2	13350188	Cable carrier installation
SBC16	4 × 16 mm^2 + 3 × 1.5 mm^2	18148514	Fixed installation
SBC16	4 × 16 mm^2 + 3 × 1.5 mm^2	18148522	Cable carrier installation

4.2.5 Extension cables BP/BK and BY brakes

Illustration of brakemotor extension cable

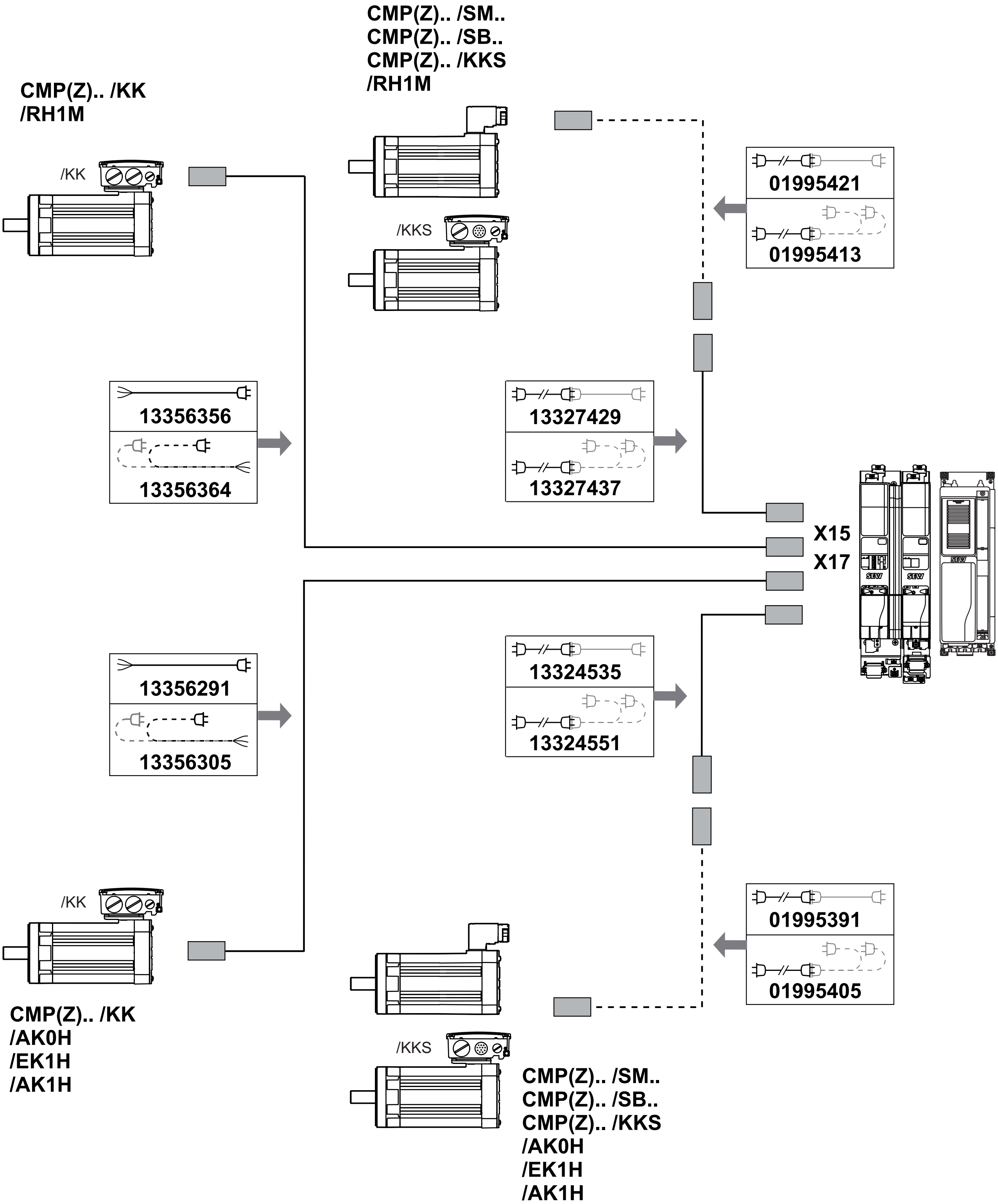


Types of CMP.. brakemotor extension cables

Plug connector	Number of cores and cable cross section	Part number	Installation type
SB11	4 × 1.5 mm^2 + 3 × 1 mm^2	13354221	Cable carrier installation
SB12	4 × 2.5 mm^2 + 3 × 1 mm^2	13354248	Cable carrier installation
SB14	4 × 4 mm^2 + 3 × 1 mm^2	13354337	Cable carrier installation
SBB6	4 × 6 mm^2 + 3 × 1.5 mm^2	13350099	Cable carrier installation
SBB10	4 × 10 mm^2 + 3 × 1.5 mm^2	13350102	Cable carrier installation
SBB16	4 × 16 mm^2 + 3 × 1.5 mm^2	13350110	Cable carrier installation
SBC16	4 × 16 mm^2 + 3 × 1.5 mm^2	18156843	Cable carrier installation

4.3 Encoder cables for CMP.. motors

4.3.1 Overview



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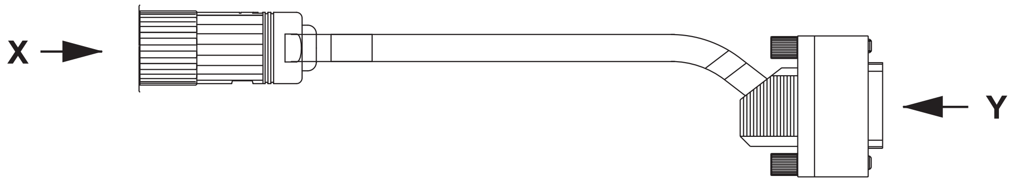
4.3.2 Resolver

Illustration of RH1M resolver cable

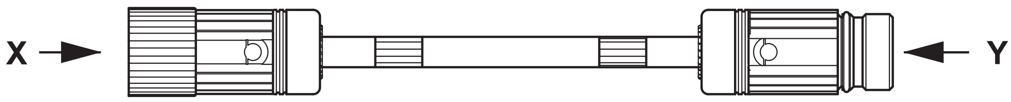


4819185931

Types of RH1M resolver cables

Number of cores and cable cross section	Part number	Installation type
5 × 2 × 0.25 mm²	13327429	Fixed installation
5 × 2 × 0.25 mm²	13327437	Cable carrier installation

Illustration of RH1M extension cable



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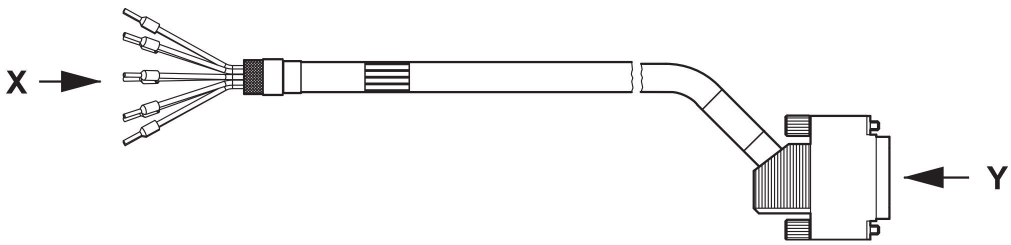
Types of RH1M extension cables

Number of cores and cable cross section	Part number	Installation type
5 × 2 × 0.25 mm²	01995421	Fixed installation
5 × 2 × 0.25 mm²	01995413	Cable carrier installation

Illustration of RH1M resolver cable for terminal box



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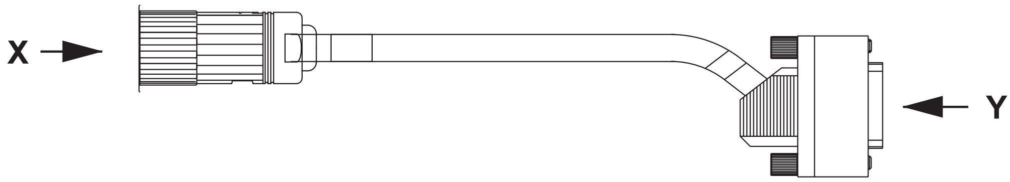
RH1M resolver cables for terminal box

Number of cores and cable cross section	Part number	Installation type
5 × 2 × 0.25 mm²	13356356	Fixed installation
5 × 2 × 0.25 mm²	13356364	Cable carrier installation

4.3.3 HIPERFACE® encoders

Illustration of HIPERFACE® encoder cable



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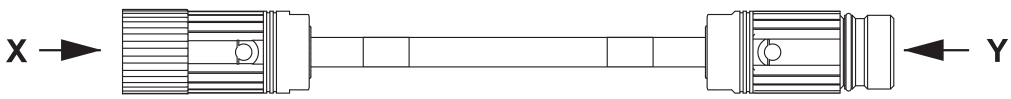
Types of HIPERFACE® encoder cables

Number of cores and cable cross section	Part number	Installation type
4 × 2 × 0.25 mm² + 2 × 0.5 mm²	13324535	Fixed installation
4 × 2 × 0.25 mm² + 2 × 0.5 mm²	13324551	Cable carrier installation

Illustration of HIPERFACE® encoder extension cable



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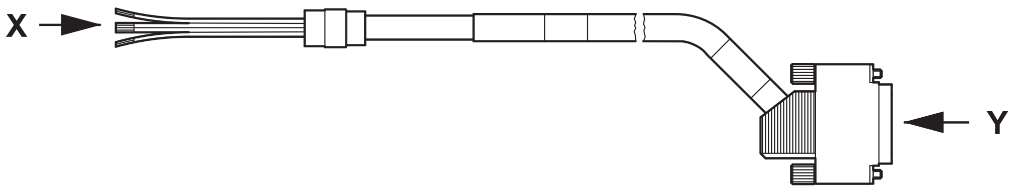
Types of HIPERFACE® encoder extension cables

Number of cores and cable cross section	Part number	Installation type
6 × 2 × 0.25 mm²	01995391	Fixed installation
6 × 2 × 0.25 mm²	01995405	Cable carrier installation

Illustration of HIPERFACE® encoder cable for terminal box



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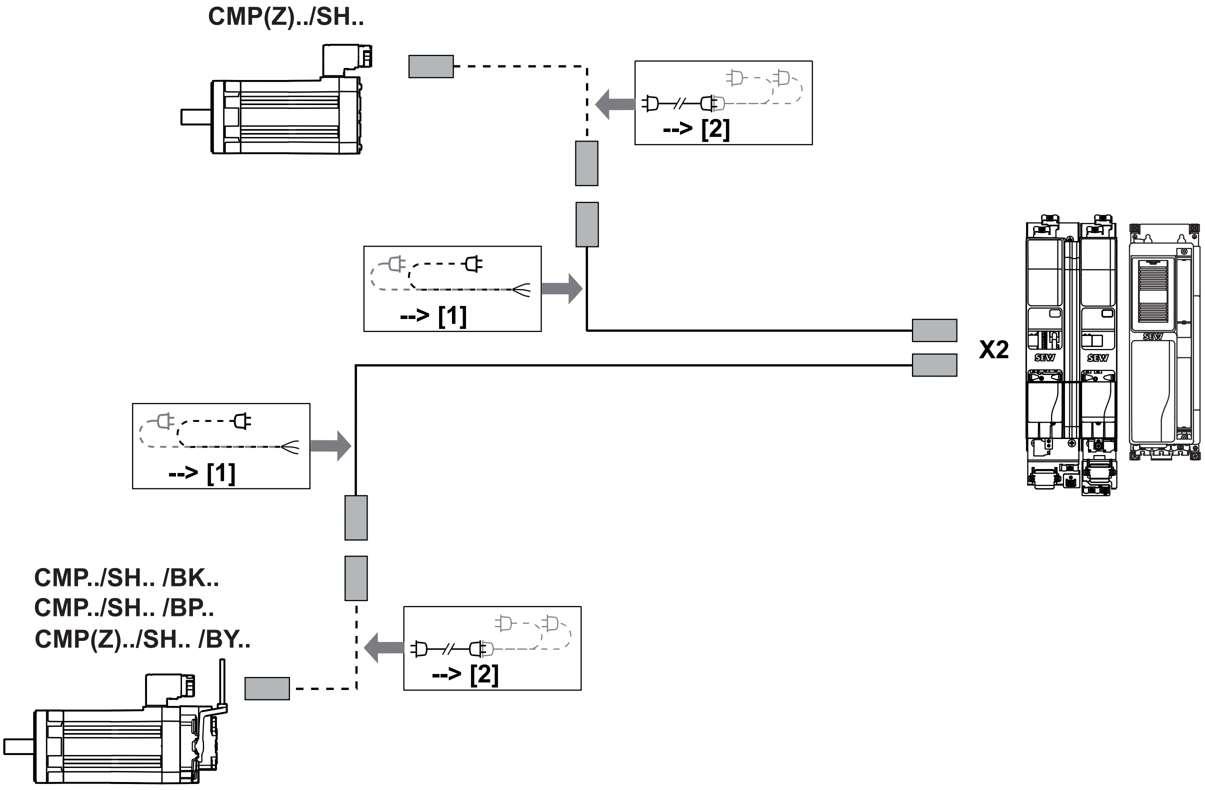
Types of HIPERFACE® encoder cables for terminal box

Number of cores and cable cross section	Part number	Installation type
6 × 2 × 0.25 mm²	13356291	Fixed installation
6 × 2 × 0.25 mm²	13356305	Cable carrier installation

4.4 Single-cable technology for CMP.. motors

4.4.1 Overview



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[1] Motor/brakemotor cable   [2] Extension cable

4.4.2 Types of motor/brakemotor cable

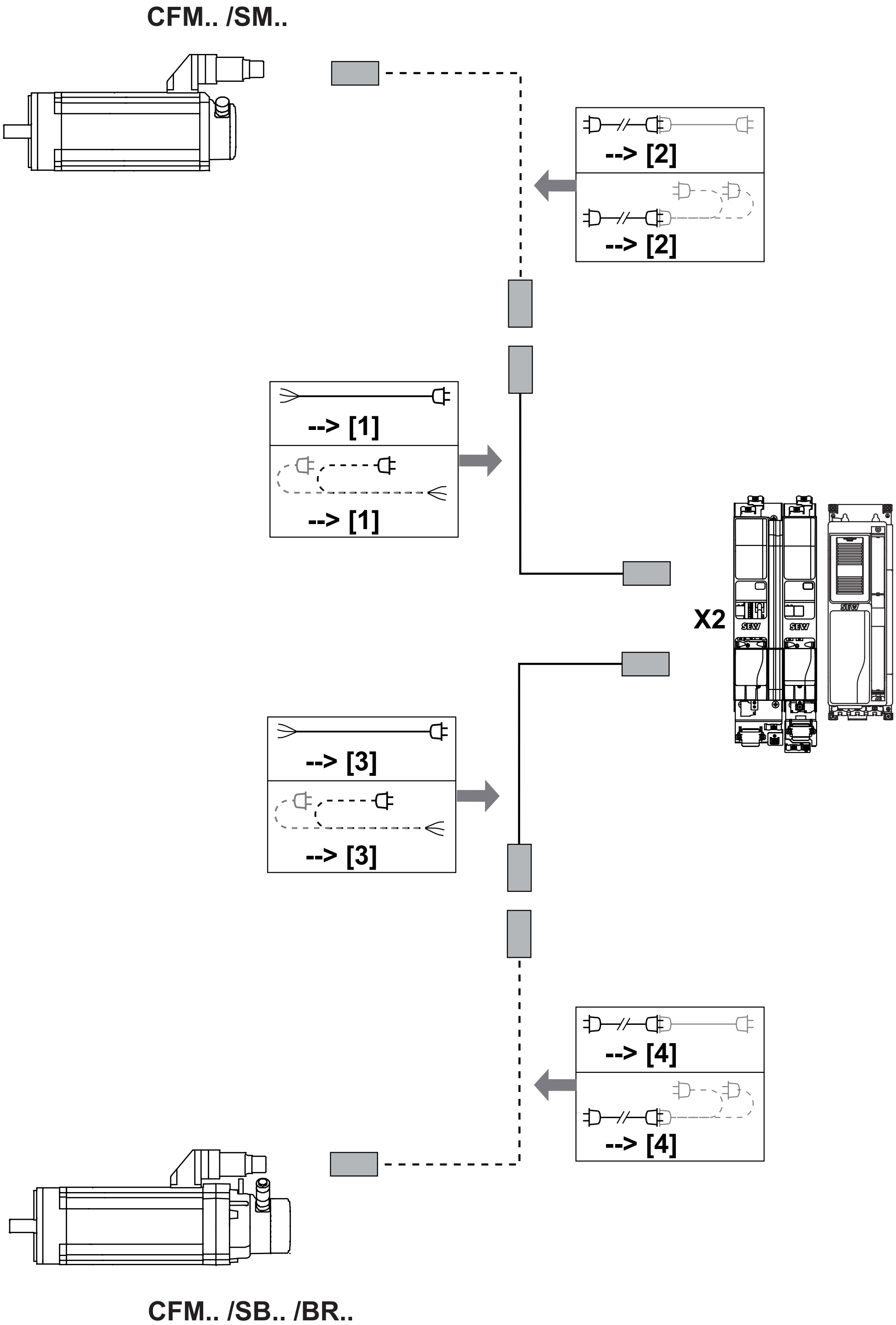
Plug connector	Number of cores and cable cross section	Part number	Installation type
SH11	$4 \times 1.5\ mm^2 + 3 \times 1\ mm^2 + 4 \times 0.34\ mm^2$	18177018	Cable carrier installation
SH12	$4 \times 2.5\ mm^2 + 3 \times 1\ mm^2 + 4 \times 0.34\ mm^2$	18177026	
SH14	$4 \times 4\ mm^2 + 3 \times 1\ mm^2 + 4 \times 0.34\ mm^2$	18177034	
SHB6	$4 \times 6\ mm^2 + 3 \times 1.5\ mm^2 + 4 \times 0.34\ mm^2$	18177042	
SHB10	$4 \times 10\ mm^2 + 3 \times 1.5\ mm^2 + 4 \times 0.34\ mm^2$	18177050	

4.4.3 Types of extension cables

Plug connector	Number of cores and cable cross section	Part number	Installation type
SH11	$4 \times 1.5\ mm^2 + 3 \times 1\ mm^2 + 4 \times 0.34\ mm^2$	18177069	Cable carrier installation
SH12	$4 \times 2.5\ mm^2 + 3 \times 1\ mm^2 + 4 \times 0.34\ mm^2$	18177077	
SH14	$4 \times 4\ mm^2 + 3 \times 1\ mm^2 + 4 \times 0.34\ mm^2$	18177085	
SHB6	$4 \times 6\ mm^2 + 3 \times 1.5\ mm^2 + 4 \times 0.34\ mm^2$	18177093	
SHB10	$4 \times 10\ mm^2 + 3 \times 1.5\ mm^2 + 4 \times 0.34\ mm^2$	18177107	

4.5 Power cables for CFM.. motors

4.5.1 Overview



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[1] Motor cable ../SM.. (→ 🗎 131)

[2] Motor extension cable ../SM.. (→ 🗎 132)

[3] Brakemotor cable ../SB.. /BR (→ 🗎 133)

[4] Brakemotor extension cable ../SB.. /BR (→ 🗎 134)

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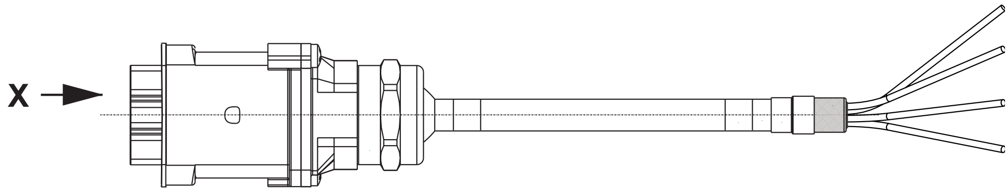
4.5.2 Motor cable

Motor cable illustration



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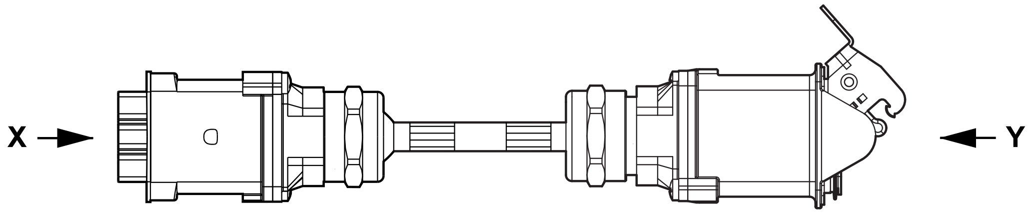
Motor cable types

The cables are equipped with a connector for motor connection and conductor end sleeves for inverter connection.

Plug connector	Number of cores and cable cross section	Part number	Installation type
SM51/SM61	4 × 1.5 mm²	01991795	Fixed installation
SM51/SM61	4 × 1.5 mm²	13331140	Cable carrier installation
SM52/SM62	4 × 2.5 mm²	01991817	Fixed installation
SM52/SM62	4 × 2.5 mm²	13331159	Cable carrier installation
SM54/SM64	4 × 4 mm²	01991833	Fixed installation
SM54/SM64	4 × 4 mm²	01991841	Cable carrier installation
SM56/SM66	4 × 6 mm²	0199185X	Fixed installation
SM56/SM66	4 × 6 mm²	01991868	Cable carrier installation
SM59/SM69	4 × 10 mm²	01991876	Fixed installation
SM59/SM69	4 × 10 mm²	01991884	Cable carrier installation

4.5.3 Motor extension cable

Illustration of motor extension cable



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Types of motor extension cables

The cables are equipped with a connector and adapter for extending the CFM motor cable.

Plug connector	Number of cores and cable cross section	Part number	Installation type
SM51/SM61	4 × 1.5 mm^2	01995499	Fixed installation
SM51/SM61	4 × 1.5 mm^2	13331183	Cable carrier installation
SM52/SM62	4 × 2.5 mm^2	01995510	Fixed installation
SM52/SM62	4 × 2.5 mm^2	13331191	Cable carrier installation
SM54/SM64	4 × 4 mm^2	01995537	Fixed installation
SM54/SM64	4 × 4 mm^2	01995545	Cable carrier installation
SM56/SM66	4 × 6 mm^2	01995553	Fixed installation
SM56/SM66	4 × 6 mm^2	01995561	Cable carrier installation
SM59/SM69	4 × 10 mm^2	0199557X	Fixed installation
SM59/SM69	4 × 10 mm^2	01995588	Cable carrier installation

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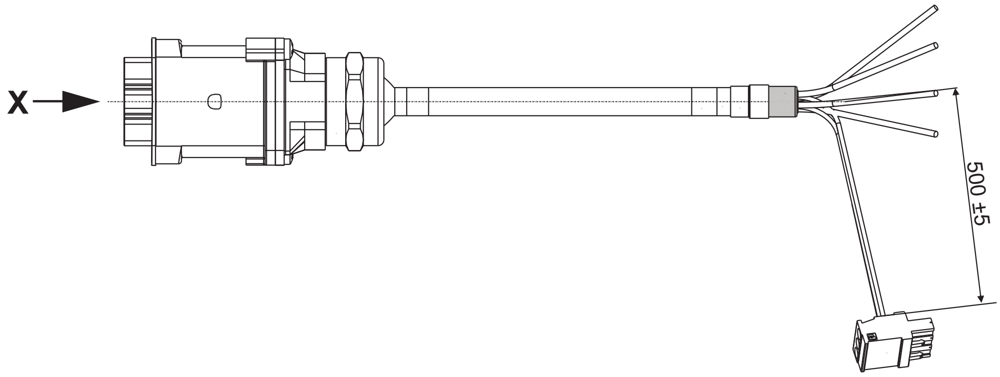
4.5.4 Brakemotor cable

Illustration of brakemotor cable



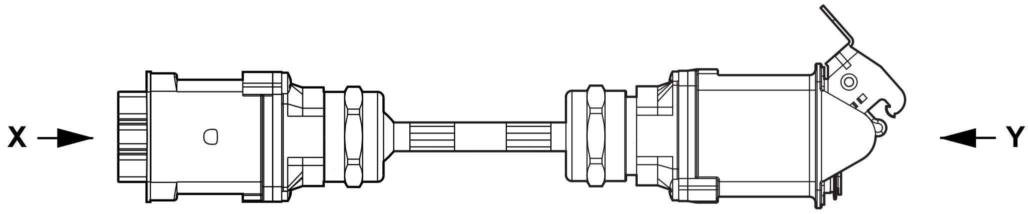
4838352907

Types of brakemotor cables

Plug connector	Number of cores and cable cross section	Part number	Installation type
SB51/SB61	4 × 1.5 mm² + 3 × 1.0 mm²	01991892	Fixed installation
SB51/SB61	4 × 1.5 mm² + 3 × 1.0 mm²	13331167	Cable carrier installation
SB52/SB62	4 × 2.5 mm² + 3 × 1.0 mm²	01991914	Fixed installation
SB52/SB62	4 × 2.5 mm² + 3 × 1.0 mm²	13331175	Cable carrier installation
SB54/SB64	4 × 4 mm² + 3 × 1.0 mm²	01991930	Fixed installation
SB54/SB64	4 × 4 mm² + 3 × 1.0 mm²	01991949	Cable carrier installation
SB56/SB66	4 × 6 mm² + 3 × 1.5 mm²	01991957	Fixed installation
SB56/SB66	4 × 6 mm² + 3 × 1.5 mm²	01991965	Cable carrier installation
SB59/SB69	4 × 10 mm² + 3 × 1.5 mm²	01991973	Fixed installation
SB59/SB69	4 × 10 mm² + 3 × 1.5 mm²	01991981	Cable carrier installation

4.5.5 Brakemotor extension cables

Illustration of brakemotor extension cable



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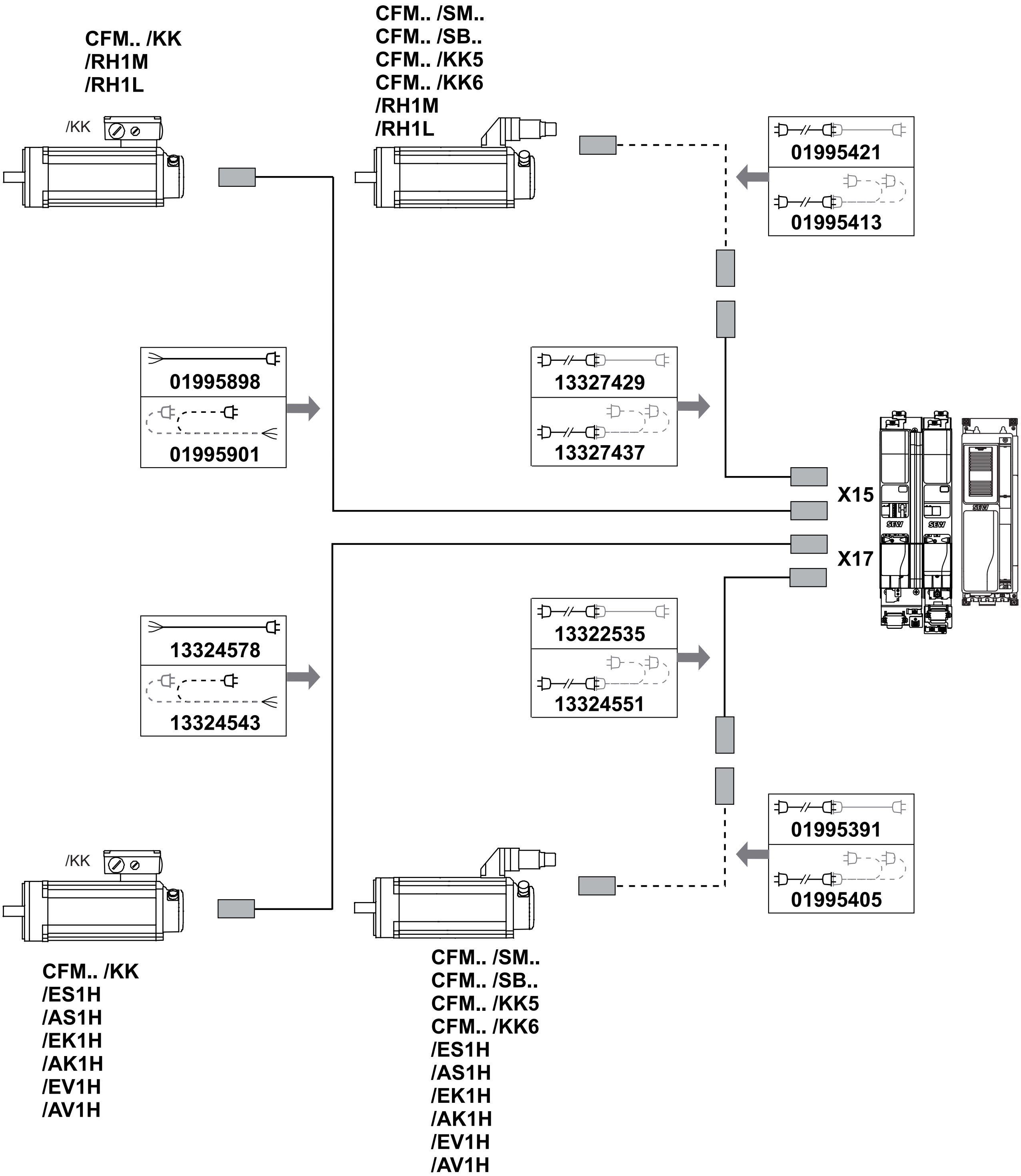
Types of brakemotor extension cables

Plug connector	Number of cores and cable cross section	Part number	Installation type
SK51/SK61	4 × 1.5 mm² + 3 × 1.0 mm²	0199199X	Fixed installation
SK51/SK61	4 × 1.5 mm² + 3 × 1.0 mm²	13331205	Cable carrier installation
SK52/SK62	4 × 2.5 mm² + 3 × 1.0 mm²	01992015	Fixed installation
SK52/SK62	4 × 2.5 mm² + 3 × 1.0 mm²	13331213	Cable carrier installation
SK54/SK64	4 × 4 mm² + 3 × 1.0 mm²	01992031	Fixed installation
SK54/SK64	4 × 4 mm² + 3 × 1.0 mm²	0199204X	Cable carrier installation
SK56/SK66	4 × 6 mm² + 3 × 1.5 mm²	01992058	Fixed installation
SK56/SK66	4 × 6 mm² + 3 × 1.5 mm²	01992066	Cable carrier installation
SK59/SK69	4 × 10 mm² + 3 × 1.5 mm²	01992074	Fixed installation
SK59/SK69	4 × 10 mm² + 3 × 1.5 mm²	01992082	Cable carrier installation

4.6 Encoder cables for CFM.. motors

4.6.1 Overview



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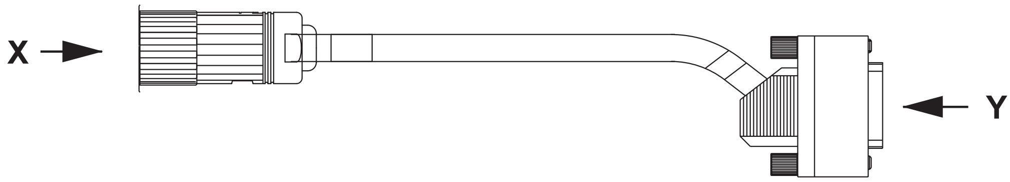
4.6.2 Resolver

Illustration of RH1M/RH1L resolver cable



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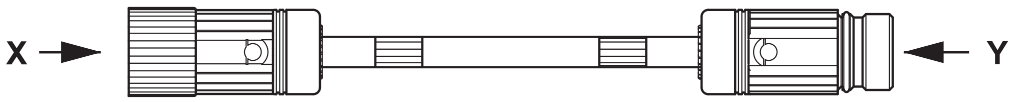
Types of RH1M/RH1L resolver cables

Number of cores and cable cross section	Part number	Installation type
5 × 2 × 0.25 mm^2	13327429	Fixed installation
5 × 2 × 0.25 mm^2	13327437	Cable carrier installation

Illustration of RH1M/RH1L extension cable



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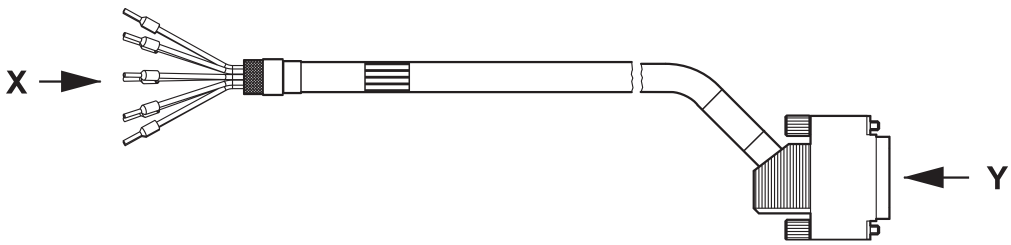
Types of RH1M/RH1L extension cables

Number of cores and cable cross section	Part number	Installation type
5 × 2 × 0.25 mm^2	01995421	Fixed installation
5 × 2 × 0.25 mm^2	01995413	Cable carrier installation

Illustration of RH1M/RH1L resolver cable for terminal box



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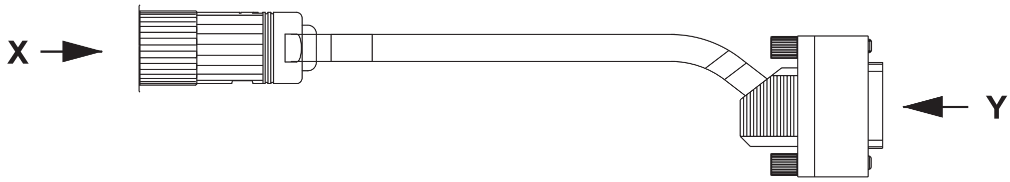
Types of RH1M/RH1L resolver cables for terminal box

Number of cores and cable cross section	Part number	Installation type
5 × 2 × 0.25 mm^2	13327623	Fixed installation
5 × 2 × 0.25 mm^2	13327631	Cable carrier installation

4.6.3 HIPERFACE® encoders

Illustration of HIPERFACE® encoder cable



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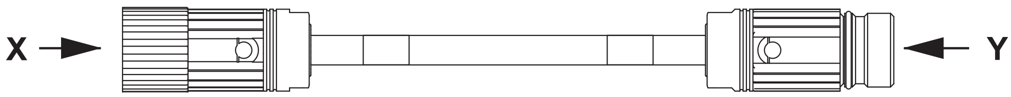
Types of HIPERFACE® encoder cables

Number of cores and cable cross section	Part number	Routing
6 × 2 × 0.25 mm^2	13324535	Fixed installation
6 × 2 × 0.25 mm^2	13324551	Cable carrier installation

Illustration of HIPERFACE® encoder extension cable

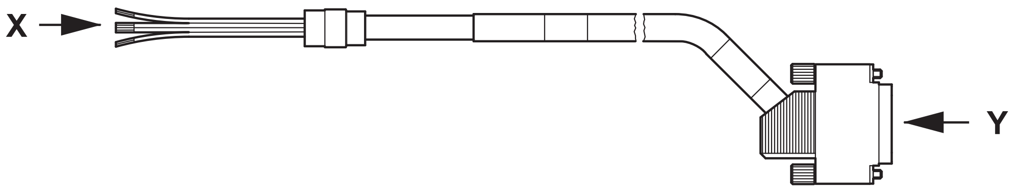


4819207051

Types of HIPERFACE® encoder extension cables

Number of cores and cable cross section	Part number	Routing
6 × 2 × 0.25 mm^2	01995391	Fixed installation
6 × 2 × 0.25 mm^2	01995405	Cable carrier installation

Illustration of HIPERFACE® encoder cable for terminal box



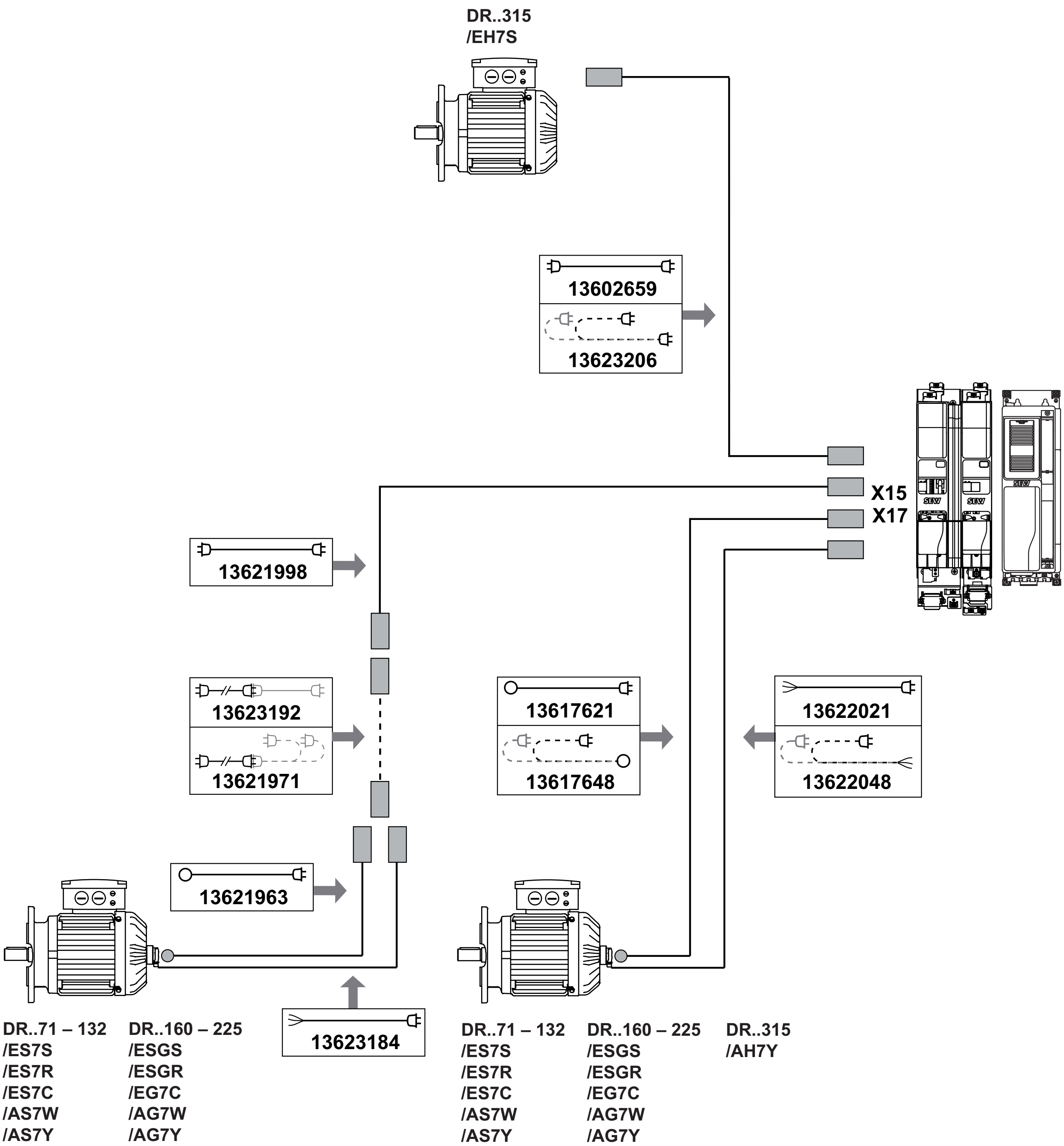
4838486411

Types of HIPERFACE® encoder cables for terminal box

Number of cores and cable cross section	Part number	Routing
5 × 2 × 0.25 mm^2	13356291	Fixed installation
5 × 2 × 0.25 mm^2	13356305	Cable carrier installation

4.7 Encoder cables for DR.. motors

4.7.1 Overview

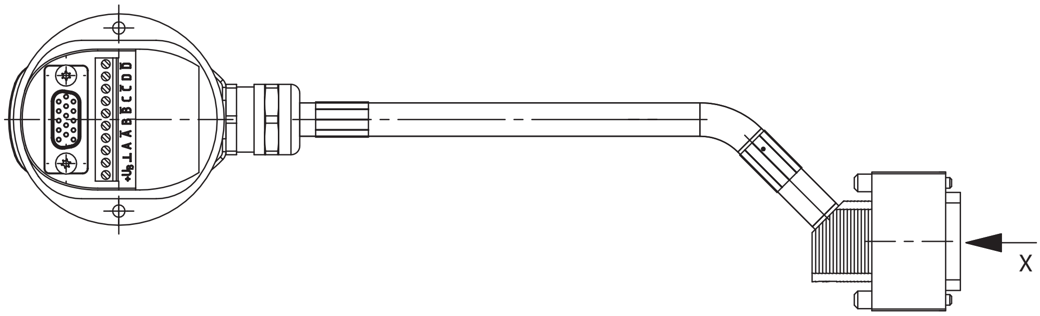


9007214071050635

SSI encoders can only be evaluated with the CES11A (X17) multi-encoder card.

4.7.2 Encoder cable with connection cover and D-sub

Illustration of encoder cable



14818281099

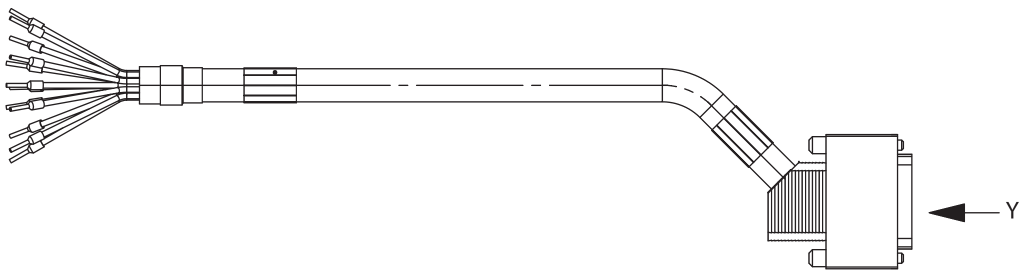
Types of encoder cables and encoders

Number of cores and cable cross section	Part number	Installation type
6 × 2 × 0.25 mm^2	13617621	Fixed installation
6 × 2 × 0.25 mm^2	13617648	Cable carrier installation

Encoder types	DR.71 – 132	DR.160 – 280
Sine encoder	ES7S	EG7S
TTL	ES7R	EG7R
RS485	AS7W	AG7W

4.7.3 Encoder cable with conductor end sleeves and D-sub

Illustration of encoder cable



14818291467

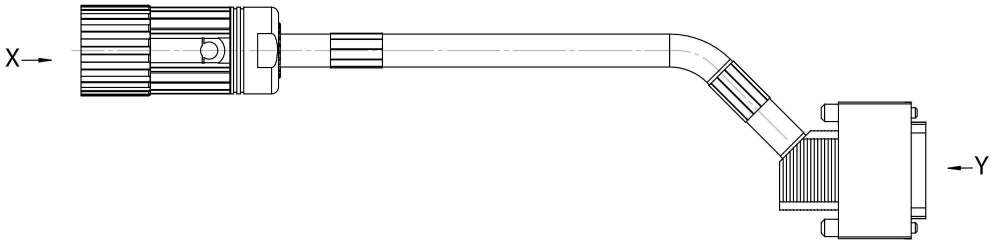
Types of encoder cables and encoders

Number of cores and cable cross section	Part number	Installation type
6 × 2 × 0.25 mm^2		Fixed installation
6 × 2 × 0.25 mm^2		Cable carrier installation

Encoder types	DR.71 – 132	DR.160 – 280
Sine encoder	ES7S	EG7S
TTL	ES7R	EG7R
RS485	AS7W	AG7W

4.7.4 Encoder cable with M23 and D-sub

Illustration of encoder cable



14818370059

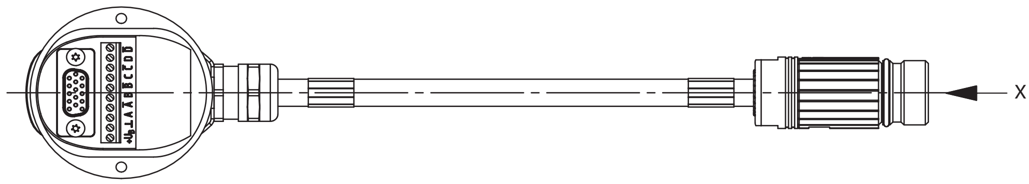
Types of encoder cables

Number of cores and cable cross section	Part number	Installation type
5 × 2 × 0.25 mm^2	13602659	Fixed installation
5 × 2 × 0.25 mm^2	13623206	Cable carrier installation

Encoder types	DR.315
Sine encoder	EH7S

4.7.5 Encoder extension cable with connection cover and M23

Illustration of encoder extension cable



14818380043

Types of encoder extension cables

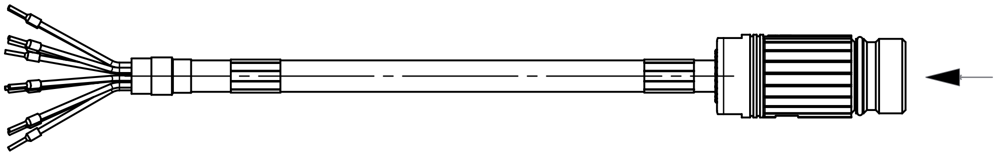
Number of cores and cable cross section	Part number	Installation type
6 × 2 × 0.25 mm^2	13621963	Fixed installation

Encoder types	DR.71 – 132	DR.160 – 280
Sine encoder	ES7S	EG7S
TTL	ES7R	EG7R
RS485	AS7W	AG7W

23061715/EN – 03/2017

4.7.6 Encoder extension cable with conductor end sleeves and M23

Illustration of encoder extension cable



14818388875

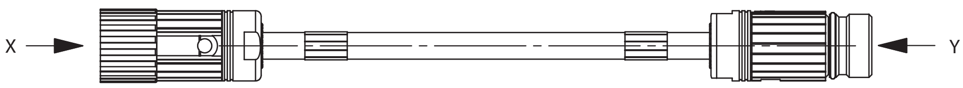
Types of encoder extension cables

Number of cores and cable cross section	Part number	Installation type
6 × 2 × 0.25 mm^2	13623184	Fixed installation

Encoder types	DR.71 – 132	DR.160 – 280
Sine encoder	ES7S	EG7S
TTL	ES7R	EG7R
RS485	AS7W	AG7W

4.7.7 Encoder extension cable with two M23

Illustration of encoder extension cable



14818397963

Types of encoder extension cables

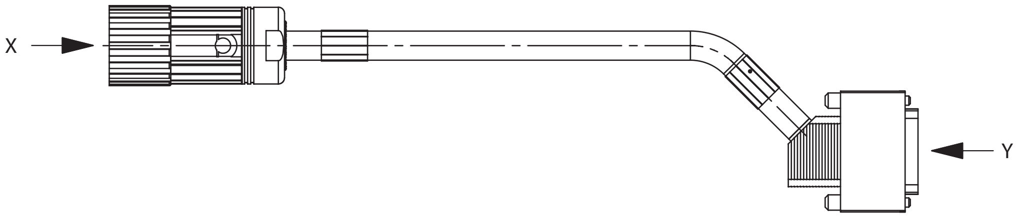
Number of cores and cable cross section	Part number	Installation type
6 × 2 × 0.25 mm^2	13623192	Fixed installation
6 × 2 × 0.25 mm^2	13621971	Cable carrier installation

Encoder types	DR.71 – 132	DR.160 – 280
Sine encoder	ES7S	EG7S
TTL	ES7R	EG7R
RS485	AS7W	AG7W

23061715/EN – 03/2017

4.7.8 Encoder extension cable with M23 and D-sub

Illustration of encoder extension cable



14818406795

Types of encoder extension cables

Number of cores and cable cross section	Part number	Installation type
6 × 2 × 0.25 mm^2	13621998	Fixed installation

Encoder types	DR.71 – 132	DR.160 – 280
Sine encoder	ES7S	EG7S
TTL	ES7R	EG7R
RS485	AS7W	AG7W

4.8 System bus and module bus cable

The RJ45 connectors of the system bus and module bus cables, the connectors that can be preassembled in the field, and the sockets in the application inverters have been checked for mechanical stability and contact reliability by SEW-EURODRIVE. SEW-EURODRIVE recommends to use the system bus and module bus cables listed below, and the connectors that can be preassembled in the field. If other cables and connectors are used, SEW-EURODRIVE does not make any statements regarding the quality of the plug-in connection.

NOTICE

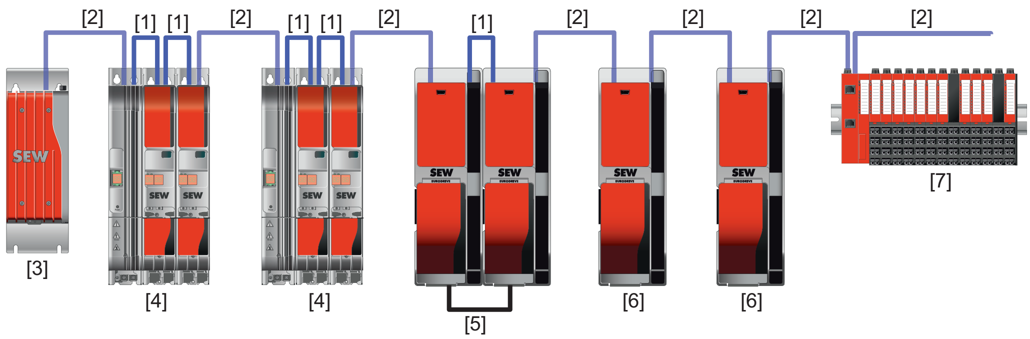
Use of wrong cables.

Damage to the application inverter.

The system bus cables [2] must only be 4-pole cables. If an 8-pole cable is used, malfunctions or failures may occur at the connected devices.

4.8.1 System bus and module bus cabling

Example of a system bus and module bus cabling



18016992651

[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

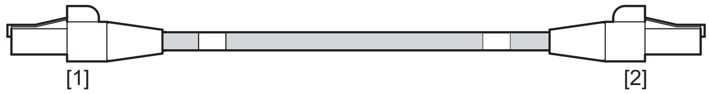
[6] MOVIDRIVE® system

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

23061715/EN – 03/2017

4.8.2 System bus cable

Figure of the cable



9007214291596811

[1] Connector red [2] Connector red

The 4-pole system bus cable [2] is used between automation components, see figure (→ 🗎 143). Some of these components are listed here as examples:

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

The following lengths of the system bus cable is available for fixed installation.

Cable length	Part number
0.29 m	18179959
0.75 m	18167039
1.5 m	18179975
3.0 m	18167047
5 m	18179983
10 m	18179991

RJ45 connector

<table>
<tr><th>Part number of RJ45 connector</th><th>Description</th><th>Core cross section</th></tr>
<tr><td>19174594</td><td rowspan="2">RJ45 connector to IEC 60603-7, 4-pin</td><td>• Litz wire: AWG 22 – AWG 24
• Wire: AWG 22 – AWG 23
• Cable jacket: Ø 6.1 – 6.9 mm</td></tr>
<tr><td>19174586 1)</td><td>• Litz wire: AWG 26
• Wire: AWG 24
• Cable jacket: Ø 6.1 – 6.9 mm</td></tr>
</table>

1) Use this connector for the operation at a data cable of SEW-EURODRIVE or when the preassembled system cable is shortened

Plug connector characteristics:

- Can be preassembled in the field without tools.
- Transmission category Cat. 5.
- Suitable for connecting litz wires and wires.
- UL approval.

Pin assignment

The prefabricated system bus cables are assigned according to EIA/TIA-568A. Also use this assignment for prefabrication in the field.

Pin	Color coding
1	white/green
2	Green
3	white/orange
4	Reserved
5	Reserved
6	Orange
7	Reserved
8	Reserved

4.8.3 Module bus cable

Figure

18027071371

[1] Connector black [2] Connector red

For MOVIDRIVE® modular, the 8-core module bus cable [1] connects the power supply module to the first axis module and the axis modules to each other, see figure (→ 🗎 143).

For MOVIDRIVE® system the module bus cable is used when 2 MOVIDRIVE® system devices are connected in the DC link.

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

A module bus cable for MOVIDRIVE® system in the required length must be ordered separately.

If the module bus cable for MOVIDRIVE® modular is needed as a spare part, it can be ordered with the following part numbers.

Cable length	Part number	Replacement cable for MOVIDRIVE® modular	Cable assignment for MOVIDRIVE® system
0.23 m	18166989	MDA90A-0020 – 0120-.. MDD90A-0020 – 0040-..	-
0.26 m	18166997	MDA90A-0160 – 0240-.. MDD90A-0020 – 0080-..	-
0.29 m	18167004	MDP90A-0100-...-C00 MDA90A-0320 – 0480-..	MDX90A-0020 – 0160-.. to install the devices directly next to each other
0.35 m	18167012	MDP90A-0500 – 0750-.. MDA90A-0640 – 1000-..	-
0.44 m	18167020	MDA90A-1400-..	MDX90A-0460 – 1130-.. to install the devices directly next to each other
1.6 m	18174205	-	MDX90A-.. with devices not directly next to each other

23061715/EN – 03/2017

5 General information

5.1 About this documentation

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.

5.2 Structure of the safety notes

5.2.1 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.	

5.2.2 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

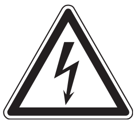
Type and source of hazard.

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

5.2.3 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.

5.3 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.

5.4 Content of the documentation

The current version of the documentation is the original.

This document contains additional safety-relevant information and conditions for use in safety-related applications.

5.5 Exclusion of liability

Read the information in this documentation, otherwise safe operation is impossible. You must comply with the information contained in this documentation to achieve the specified product characteristics and performance features. SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, SEW-EURODRIVE assumes no liability for defects.

5.6 Other applicable documentation

Observe the corresponding documentation for all further components.

5.7 Product names and trademarks

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

5.8 Copyright notice

5.9 Device availability

This documentation lists modules of the application inverter and accessories that are not yet available at the time of the publication of this document.

The following table lists the available application inverters. Accessories required for the inverter operation such as braking resistors, chokes, and filters are available.

Type designation
MDX90A-0020-5E3-4-S00
MDX90A-0025-5E3-4-S00
MDX90A-0032-5E3-4-S00
MDX90A-0040-5E3-4-S00
MDX90A-0055-5E3-4-S00
MDX90A-0070-5E3-4-S00
MDX90A-0950-5E3-4-S00
MDX90A-0125-5E3-4-S00
MDX90A-0160-5E3-4-S00
MDX90A-0240-503-4-S00

Type designation
MDX90A-0320-503-4-S00
MDX90A-0070-2E3-4-S00
MDX90A-0093-2E3-4-S00
MDX90A-0140-2E3-4-S00
MDX90A-0213-2E3-4-S00
MDX90A-0290-2E3-4-S00

23061715/EN – 03/2017

6 Safety notes

6.1 Preliminary information

The following general safety notes have the purpose to avoid injury 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.

6.2 Operator's duties

Make sure that the basic safety notes are read and observed. 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. If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE.

The operator must ensure that the following works are only performed by qualified personnel:

- Transport
- Storage
- Setup and assembly
- Installation and connection
- Startup
- Maintenance and repair
- Shutdown
- Disassembly
- Waste disposal

Make sure persons working on the product adhere to the following regulations, requirements, documents 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, wiring diagrams and schematics
- Do not assemble, install or operate damaged products
- All specific specifications and requirements for the system

Make sure that systems with the product installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical equipment and accident prevention regulations.

6.3 Target group

Specialist for mechanical work

Any mechanical work may only be performed by adequately qualified personnel. Qualified personnel 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 field of mechanics according to applicable national regulation.
- They are familiar with this documentation

23061715/EN – 03/2017

Specialist for electrotechnical work

Any electronic work may only be performed by adequately skilled persons (electrically). Qualified electricians in the context of this documentation are persons familiar with electrical installation, startup, troubleshooting and servicing of the product who possess the following qualifications:

- Qualification in the field of electrical engineering according to applicable national regulation.
- They are familiar with this documentation

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 above mentioned persons must have the authorization expressly issued by the company to operate, program, configure, label and ground devices, 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.

6.4 Designated use

The product is intended for control cabinet installation in electrical plants or machines.

In case of installation in electrical systems or machines, startup of the product is prohibited until it is determined that the machine meets the requirements stipulated in the local laws and directives. For Europe, Machinery Directive 2006/42/EC as well as the EMC Directive 2014/30/EU apply. Observe EN 60204-1 (Safety of machinery - electrical equipment of machines). The product meets the requirements stipulated in the Low Voltage Directive 2014/35/EU.

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

The systems can be mobile or stationary. The motors must be suitable for operation with inverters. Do not connect any other loads to the product. Never connect capacitive loads to the product.

The product can be used to operate the following motors in industrial and commercial systems:

- AC asynchronous motors with squirrel-cage rotor
- Permanent-field AC synchronous motors

Technical data and information on the connection conditions are provided on the nameplate and in chapter "Technical data" in the documentation. Always comply with the data and conditions.

Unintended or improper use of the product may result in severe injury to persons and damage to property.

6.4.1 Hoist applications

To avoid danger of fatal injury by falling hoists, observe the following points when using the product in lifting applications:

- Use mechanical protection devices.
- Perform a hoist startup.

23061715/EN – 03/2017

Application in ELSM® control mode

When the inverter is operated in ELSM® control mode, using it in lifting applications is not permitted. In this control mode only applications of horizontal materials handling are permitted.

6.5 Functional safety technology

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

6.6 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 during transportation.
- 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.

23061715/EN – 03/2017

6.7 Installation/assembly

Ensure that the product is installed and cooled according to the regulations in this documentation.

Protect the product from excessive mechanical strain. Ensure that elements are not deformed or insulation spaces are maintained, particularly during transportation. Electric components must not be mechanically damaged or destroyed.

Observe the notes in the chapter "Mechanical installation".

6.7.1 Restrictions of use

The following applications are prohibited unless explicitly permitted:

- Use in potentially explosive atmospheres
- 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)

23061715/EN – 03/2017

6.8 Electrical connection

Make yourself familiar with the applicable national accident prevention guidelines before you work on the product.

Perform electrical installation according to the pertinent regulations (e.g. cable cross sections, fusing, protective conductor connection). The documentation at hand contains additional information.

Make sure that all required covers are installed correctly after 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).

6.8.1 Required preventive measure

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

6.8.2 Stationary application

Necessary preventive measure for the product is:

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

6.8.3 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.

6.9 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.

23061715/EN – 03/2017

6.10 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.

6.10.1 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".

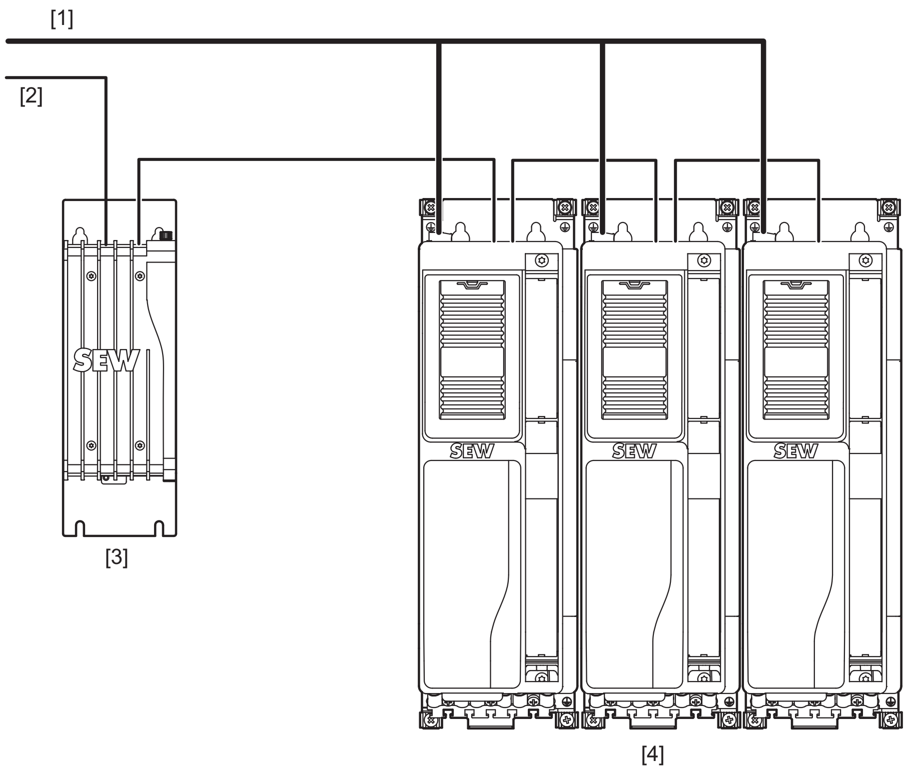
23061715/EN – 03/2017

7 Device structure

7.1 Connection variants

The application inverter MOVIDRIVE® system can be used in the following connection variants:

- As application inverter in connection with a MOVI-C® CONTROLLER



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[1] Line voltage

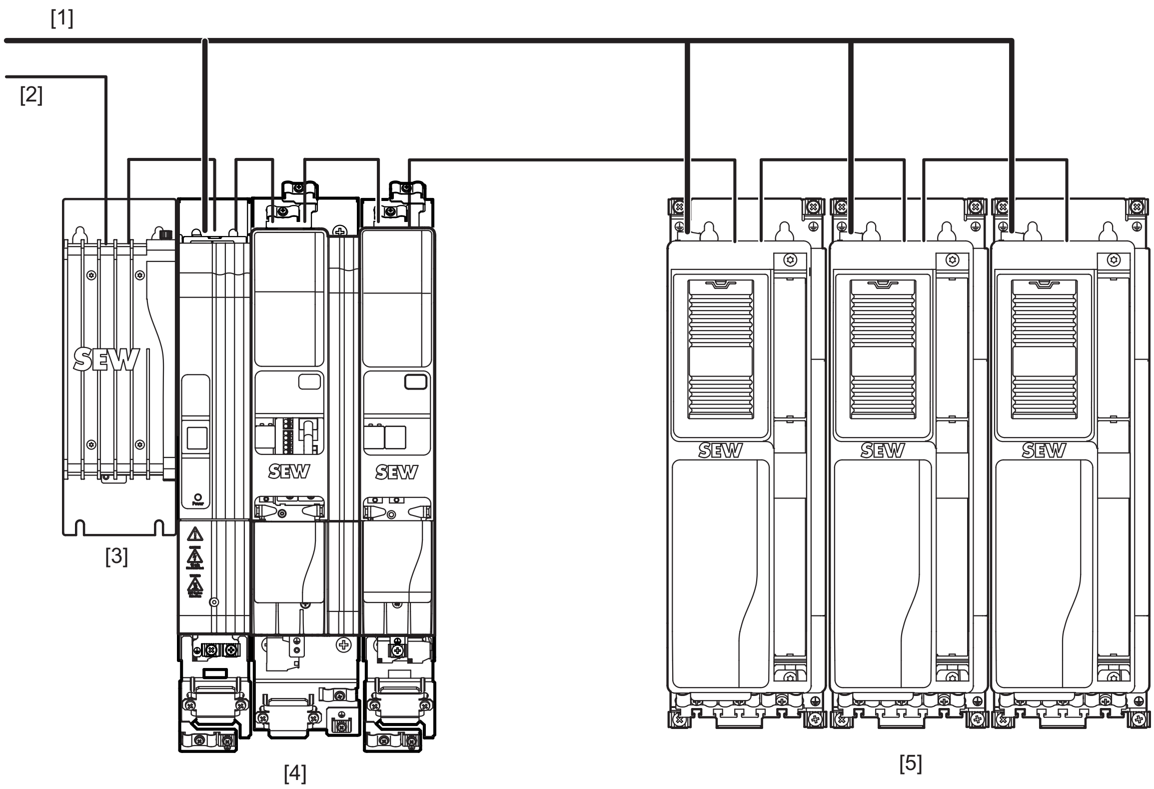
[2] Industrial communication

[3] MOVI-C® CONTROLLER

[4] MOVIDRIVE® system

and/or

- as extension of a MOVIDRIVE® modular axis system



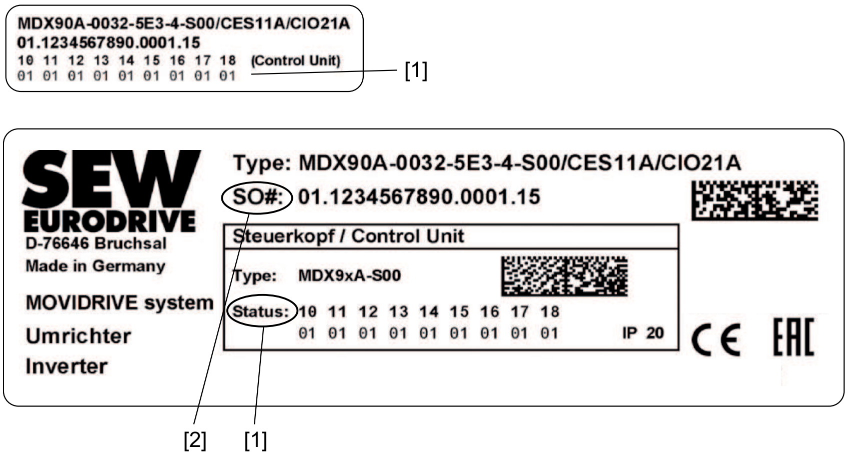
9007214127262859

[1] Line voltage
[2] Industrial communication
[3] MOVI-C® CONTROLLER
[4] MOVIDRIVE® modular axis system
[5] MOVIDRIVE® system

23061715/EN – 03/2017

7.2 Nameplates

7.2.1 System nameplate

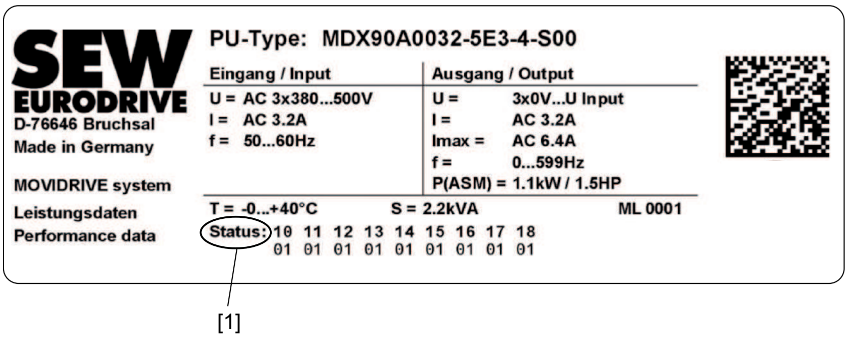


15058460683

[1] Device status

[2] Serial number

7.2.2 Performance data nameplate



15058465035

[1] Device status

23061715/EN – 03/2017

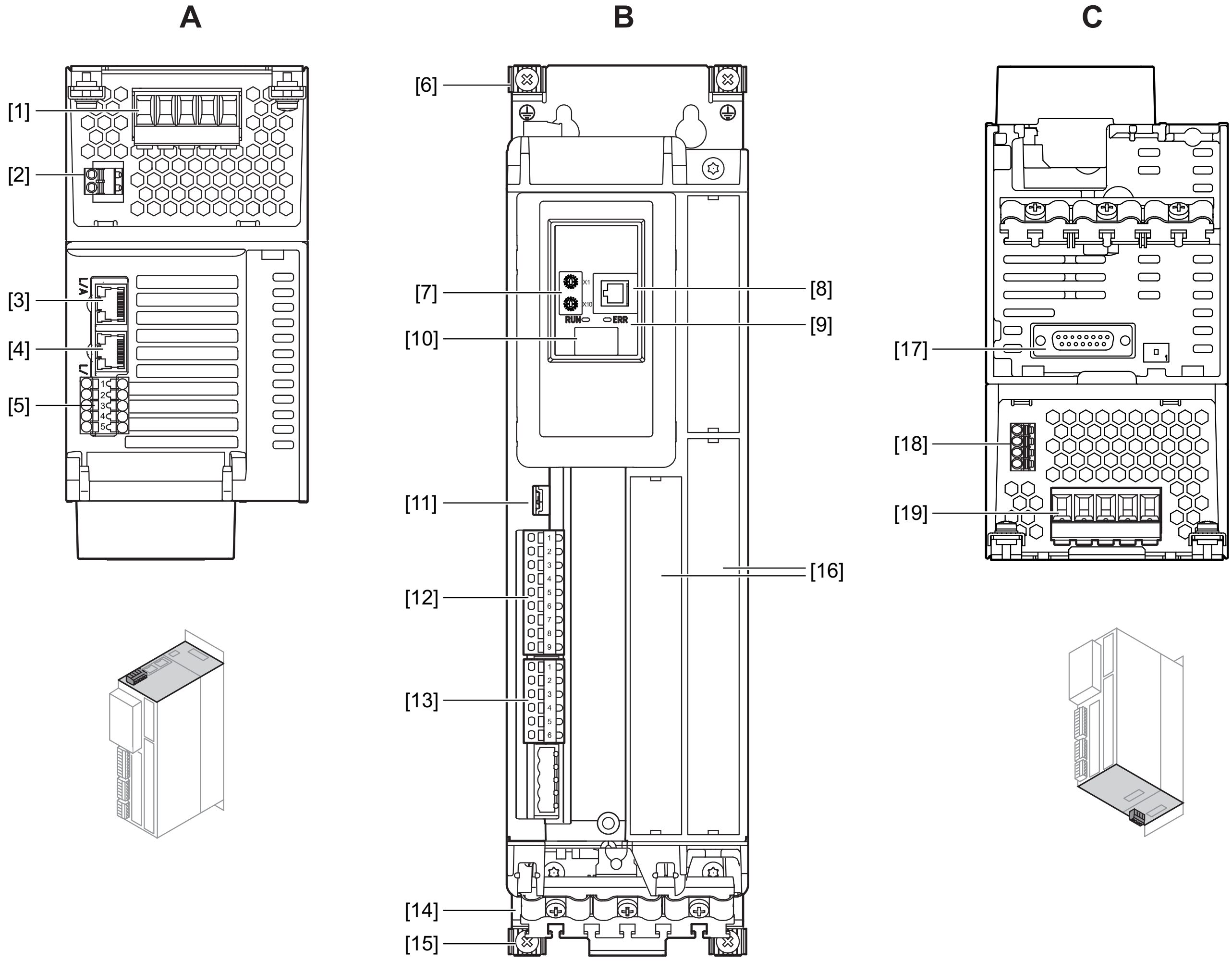
7.3 Type code

The following type code applies to MOVIDRIVE® system.

Example: MDX90A-0125-5E3-X-S00		
Product name	MD	MOVIDRIVE®
Device type	X	• X = Single-axis inverter
Series	90	• 90 = Without DC 24 V switched-mode power supply • 91 = With DC 24 V switched-mode power supply
Version	A	• A = Version status of the device series
Performance class	0125	• MDX = Nominal output current – e.g. 0125 = 12.5 A
Connection voltage	5	• 2 = AC 200 – 230 V • 5 = AC 380 – 500 V
EMC variant of power section	E	• 0 = Interference suppression integrated • E = EMC filter limit value category C2 acc. to EN 61800-3
Number of phases	3	• 3 = 3-phase connection type
Operating mode	X	• 4 = 4-quadrant operation • X = Not relevant
Variants	S	• 0 = not relevant • S = Control MOVI-C® CONTROLLER
Designs	00	• 00 = Standard design
Options		The following list serves as an example: • /CES11A = Multi-encoder card • /CID21A, /CIO21A = I/O expansion card

7.4 Device structure of the application inverter

7.4.1 MDX90A-0020 – 0040-5_3-..



9007213554101515

A: View from top

[1] X1: Line connection

[2] X5: 24 V supply voltage

[3] X30 OUT: System bus

[4] X30 IN: System bus

[5] X6: Connection for safe disconnection (STO)

B: View from front

[6] PE connection housing

[7] EtherCAT® ID switch

[8] X31: SEW-EURODRIVE service interface

[9] Status LEDs EtherCAT®/SBus^{PLUS} "RUN", "ERROR"

[10] 7-segment display

[11] S3: Operating mode module bus

[12] X20: Digital inputs

[13] X21: Digital outputs

[14] Shield plate

[15] PE connection housing

[16] Option card slot

C: View from bottom

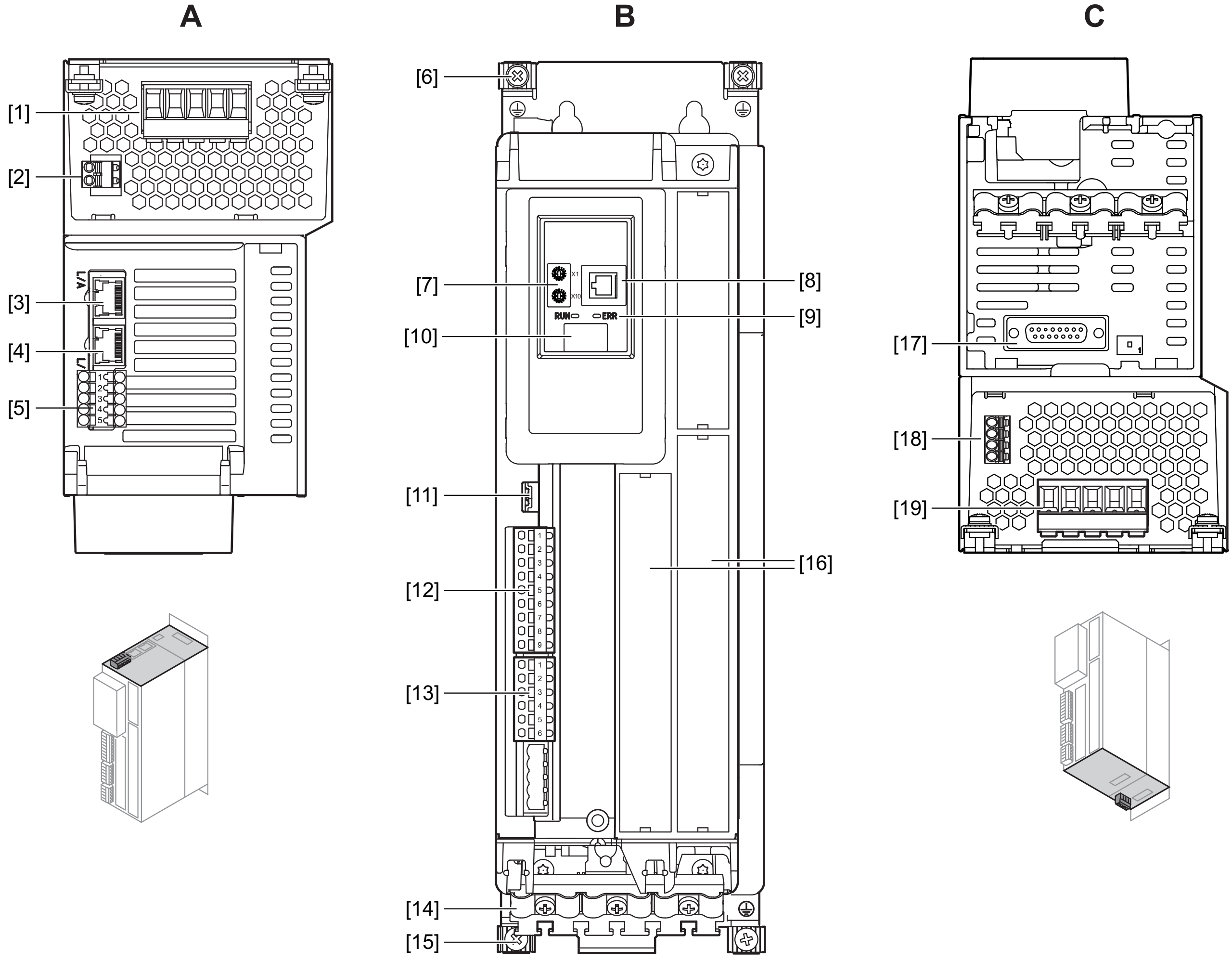
[17] X15: Motor encoder connection

[18] X10: Brake control and temperature monitoring motor

[19] X2: Motor and braking resistor connection

23061715/EN – 03/2017

7.4.2 MDX90A-0055 – 0095-5_3-.. , MDX90A-0070 – 0093-2_3-..



9007213554111243

A: View from top

[1] X1: Line connection

[2] X5: 24 V supply voltage

[3] X30 OUT: System bus

[4] X30 IN: System bus

[5] X6: Connection for safe disconnection (STO)

B: View from front

[6] PE connection housing

[7] EtherCAT® ID switch

[8] X31: SEW-EURODRIVE service interface

[9] Status LEDs EtherCAT®/SBus^{PLUS} "RUN", "ERROR"

[10] 7-segment display

[11] S3: Operating mode module bus

[12] X20: Digital inputs

[13] X21: Digital outputs

[14] Shield plate

[15] PE connection housing

[16] Option card slot

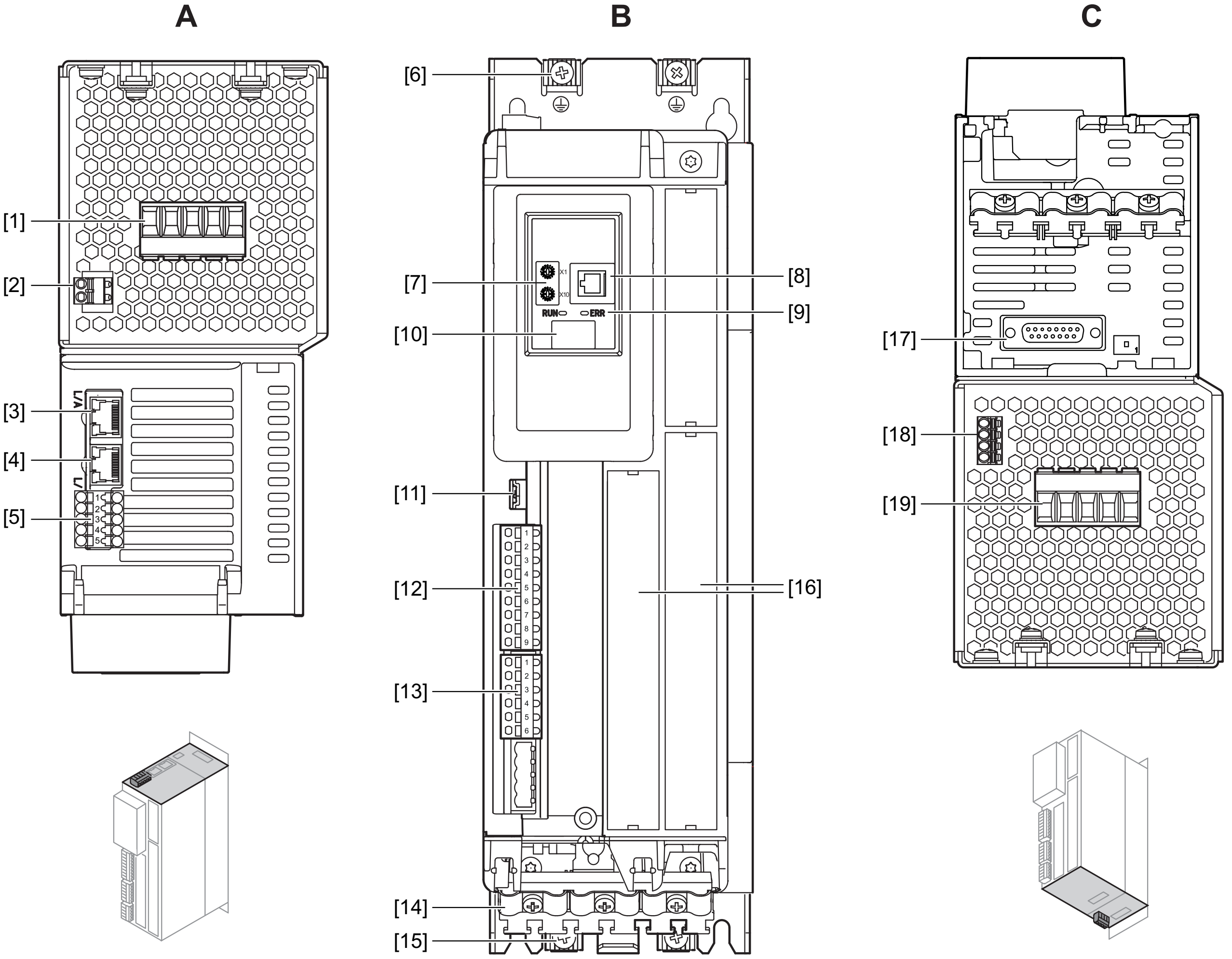
C: View from bottom

[17] X15: Motor encoder connection

[18] X10: Brake control and temperature monitoring motor

[19] X2: Motor and braking resistor connection

7.4.3 MDX90A-0125 – 0160-5_3-.. , MDX90A-0140-2_3-..



9007213554120971

A: View from top

[1] X1: Line connection

[2] X5: 24 V supply voltage

[3] X30 OUT: System bus

[4] X30 IN: System bus

[5] X6: Connection for safe disconnection (STO)

B: View from front

[6] PE connection housing

[7] EtherCAT® ID switch

[8] X31: SEW-EURODRIVE service interface

[9] Status LEDs EtherCAT®/SBus^{PLUS} "RUN", "ERROR"

[10] 7-segment display

[11] S3: Operating mode module bus

[12] X20: Digital inputs

[13] X21: Digital outputs

[14] Shield plate

[15] PE connection housing

[16] Option card slot

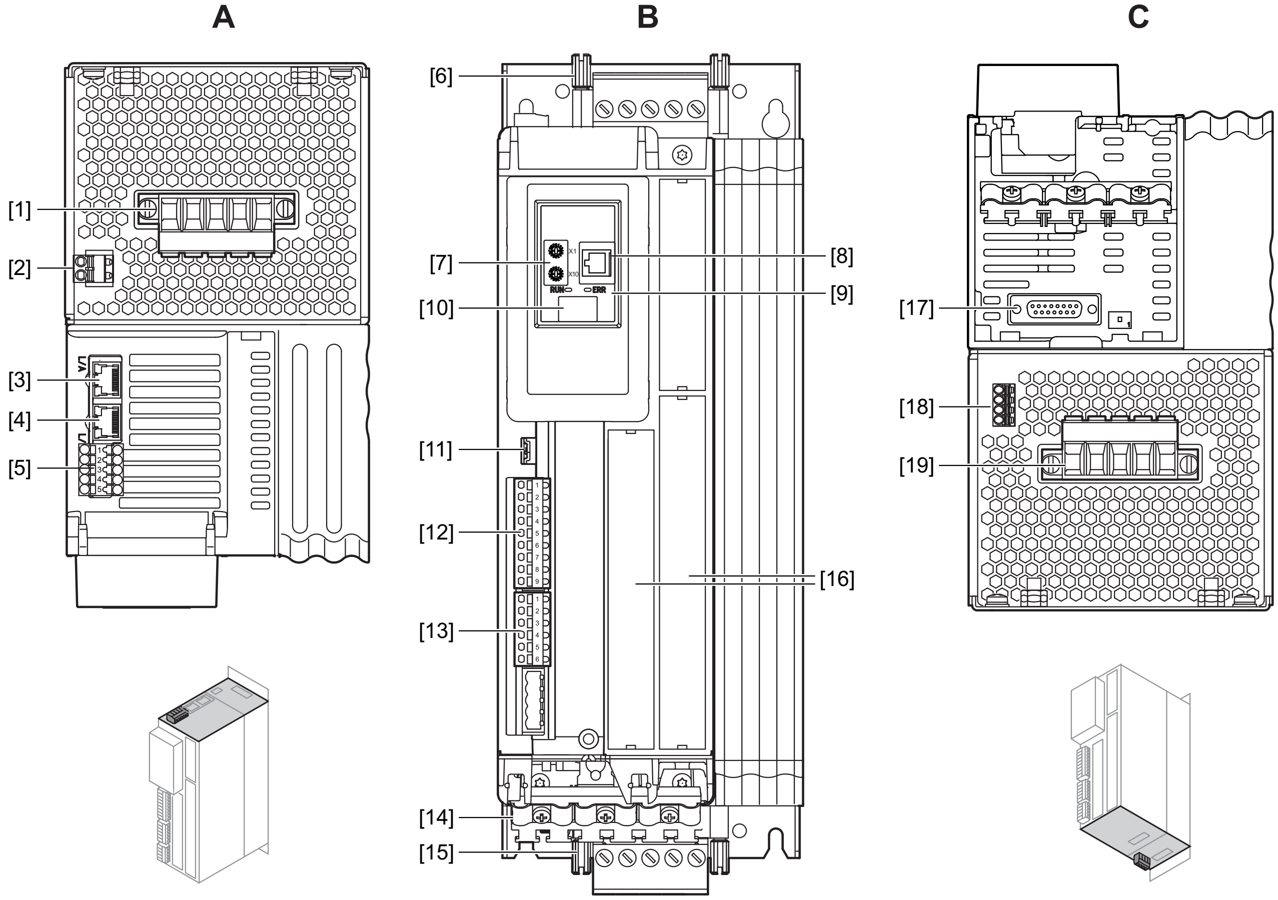
C: View from bottom

[17] X15: Motor encoder connection

[18] X10: Brake control and temperature monitoring motor

[19] X2: Motor and braking resistor connection

7.4.4 MDX90A-0240 – 0320-5_3-.. , MDX90A-0210 – 0290-2_3-..



9007213554130699

A: View from top

[1] X1: Line connection

[2] X5: 24 V supply voltage

[3] X30 OUT: System bus

[4] X30 IN: System bus

[5] X6: Connection for safe disconnection (STO)

B: View from front

[6] PE connection housing

[7] EtherCAT® ID switch

[8] X31: SEW-EURODRIVE service interface

[9] Status LEDs EtherCAT®/SBus^{PLUS} "RUN", "ERROR"

[10] 7-segment display

[11] S3: Operating mode module bus

[12] X20: Digital inputs

[13] X21: Digital outputs

[14] Shield plate

[15] PE connection housing

[16] Option card slot

C: View from bottom

[17] X15: Motor encoder connection

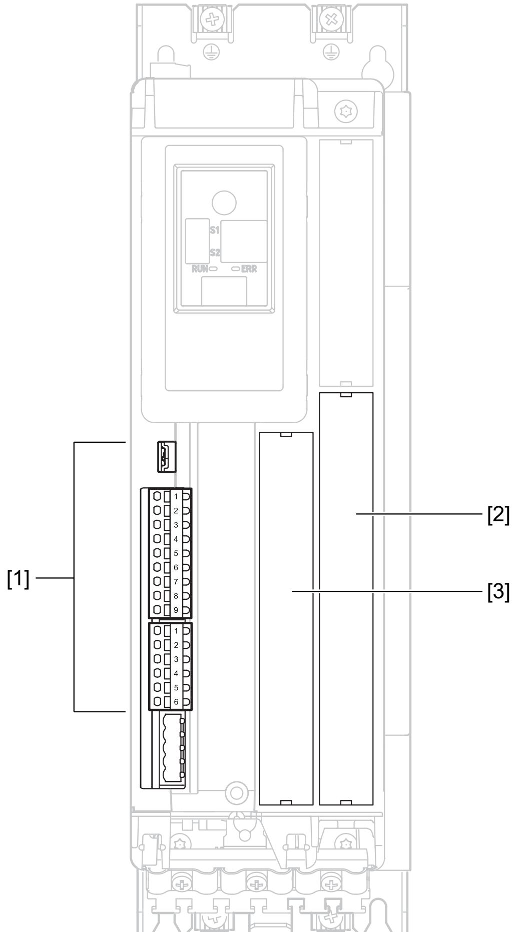
[18] X10: Brake control and temperature monitoring motor

[19] X2: Motor and braking resistor connection

7.5 Use of option cards

The application inverters can have up to 2 option cards installed. The following section describes the assignment of the slots and possible combinations of cards.

Type designation	Description	Slot
CES11A	Multi-encoder card	[2]
CID21A, CIO21A	I/O expansion	[3]



[1] Connector panel of basic device

[2] Safety module/additional encoder slot

[3] I/O expansion slot

23061715/EN – 03/2017

8 Installation

MOVIDRIVE® system application inverters are exclusively suitable for control cabinet installation according to the degree of protection.

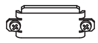
8.1 Installation accessories

8.1.1 Standard accessories

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

Standard accessories – mechanical accessories

	Inverter								
MDX90A-....-5_3-..	**0020 – 0040**	**0055 – 0095**	**0125 – 0160**	**0240 – 0320**	**0460 – 0750**	**0910 – 1490**	**1770 – 2200**	**2500 – 3000**	**3800 – 47009**
MDX90A-....-2_3-..	**-**	**0070 – 0093**	**0140**	**0213 – 0290**	**0420 – 0570**	**0840 – 0950**	**-**	**-**	**-**
Electronics shield clamp									
	3×								

	Inverter								
MDX90A-....-5_3-..	**0020 – 0040**	**0055 – 0095**	**0125 – 0160**	**0240 – 0320**	**0460 – 0750**	**0910 – 1490**	**1770 – 2200**	**2500 – 3000**	**3800 – 47009**
MDX90A-....-2_3-..	**-**	**0070 – 0093**	**0140**	**0213 – 0290**	**0420 – 0570**	**0840 – 0950**	**-**	**-**	**-**
Power shield clamp									
	2×		1×						

8.2 Permitted tightening torques

MDX90A-....-5_3-..		0020 – 0040	0055 – 0095	0125 – 0160	0240 – 0320	0460 – 0750	0910 – 1490	1770 – 2200	2500 – 3000	3800 – 47009
MDX90A-....-2_3-..		-	0070 – 0093	0140	0213 – 0290	0420 – 0570	0840 – 0950	-	-	-
Screw connection		**Tightening torque in Nm**								
Line connection	X1	0.5 – 0.8			1.7 – 1.8	8.5 – 9.5	18 – 22			
Motor and braking resistor connection	X2	0.5 – 0.8			1.7 – 1.8	8.5 – 9.5	18 – 22			
Terminal screw for TN/IT systems	EMC	1 – 1.2								
PE connections - M4 - M6		 1 – 1.2 3 – 4								
Installing option cards		0.6 – 0.8								

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.
- Exceeding the tightening torques may result in a rupture of the screw.

8.3 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.

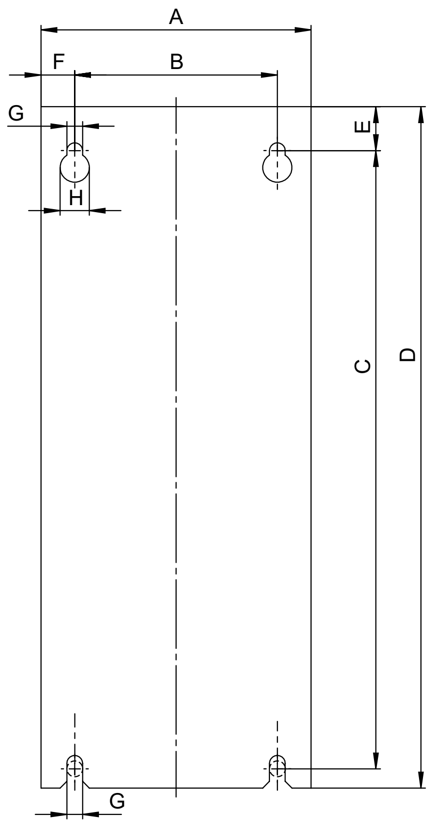
- The mounting plate in the control cabinet must be conductive over a large area for the mounting surface of the application inverter (metallically pure, good conductivity). EMC-compliant installation of the application inverter can only be accomplished with a mounting plate that is conductive over a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

23061715/EN – 03/2017

8.3.1 Bore patterns

Dimensions
Device base plate

Inverter	Dimensions of the device base plate in mm								
	A	B	C	D	E	F	G	H	T
MDX90A-0020 – 0040-5_3-..	95	50	325	350	17.5	22.5	6	12	215
MDX90A-0055 – 0095-5_3-.. MDX90A-0070 – 0093-2_3-..	105	50	325	350	17.5	27.5	6	12	215
MDX90A-0125 – 0160-5_3-.. MDX90A-0140-2_3-..	105	80	325	350	17.5	12.5	6	12	260
MDX90A-0240 – 0320-5_3-.. MDX90A-0213 – 0290-2_3-..	135	80	325	350	17.5	27.5	6	12	260



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8.3.2 Minimum clearance and mounting position

When installing the application inverters in the control cabinet, observe the following:

- To ensure unobstructed cooling, leave a minimum clearance of 100 mm above and below the application inverter housings. Make sure air circulation in the clearance is not impaired by cables or other installation equipment.
- Make sure that the application inverters are not subjected to heated exhaust air from nearby components.
- Install the application inverters only vertically. You must not install them horizontally, tilted or upside down.

INFORMATION

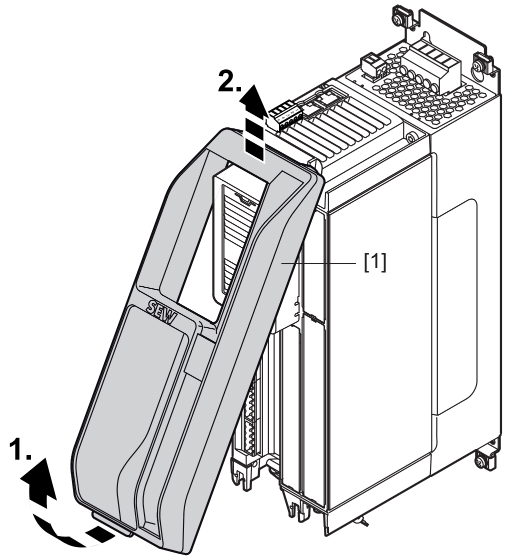
Special bending spaces are required according to EN 61800-5-1 for cables with a cross section of 10 mm^2 and larger. This means the clearance must be increased if required.

23061715/EN – 03/2017

8.4 Covers

The application inverters are equipped with a safety cover [1], see following figures.

Removing the safety cover



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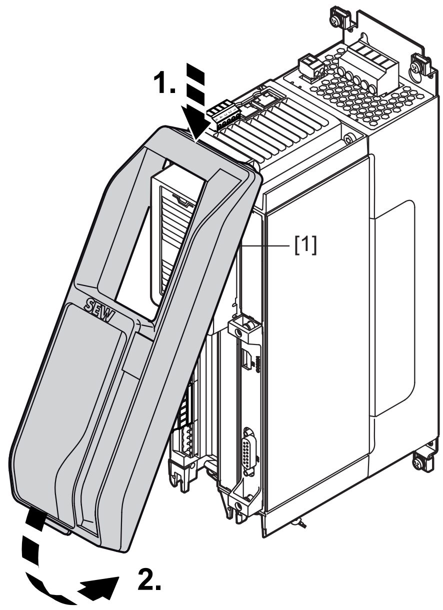
- The safety cover [1] has a latching mechanism at the bottom. Pull the lower part of the safety cover away from the application inverter to unlatch it.
- Pivot the safety cover forward and lift it to remove it from the application inverter.

Installing the safety cover



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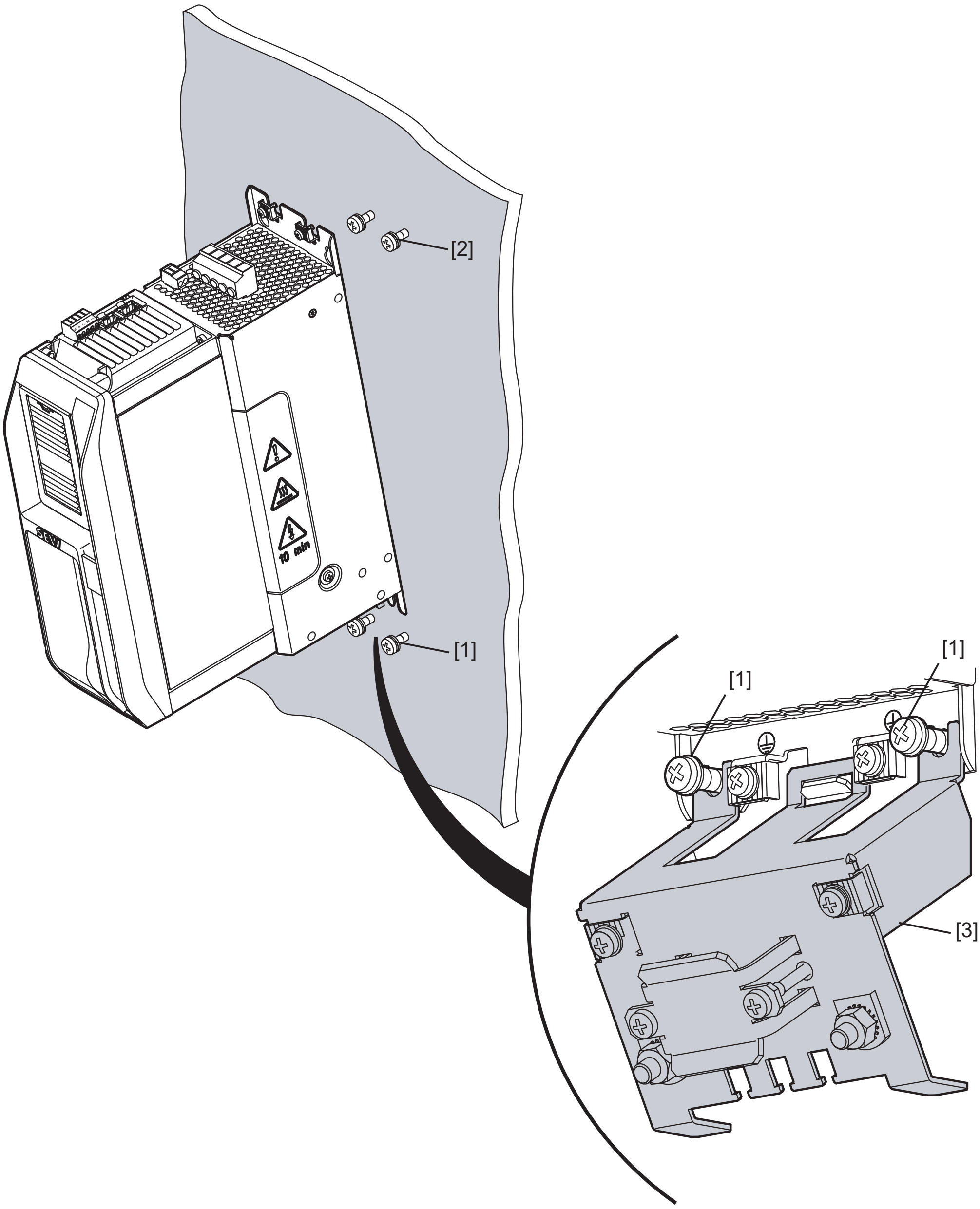
- Place the safety cover [1] into the upper recess and move it towards the application inverter until it clicks into place.
- Always install the safety cover [1] after having worked on the application inverter.

8.5 Control cabinet installation

The retaining screws [1] and [2] are screwed into the prepared tapped holes in the mounting plate in the control cabinet but not tightened.

1. Place the application inverter with the slotted holes in the device base plate onto the retaining screws [1] from the top.



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2. Push the application inverter backwards to insert the retaining screws [2] into the upper holes in the device base plate.
3. Lower the application inverter.
4. Install the shield plate [3] as shown above.
5. Tighten the retaining screws [1] and [2].

8.6 Electrical installation

⚠ DANGER

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

Severe or fatal injuries from electric shock.

To prevent electric shocks:

- Disconnect the application inverter from the supply system and wait 10 minutes before removing the protective covers.

⚠ DANGER

A leakage current > 3.5 mA can occur during operation of the 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 lead < 10 mm^2:
  - Route a second PE conductor with the cable cross section of the supply system lead 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 protective earth conductor with the cable cross section of the supply system lead.
- 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 cable cross section of the supply cable.
- If an earth leakage circuit breaker is used for protection against direct and indirect contact, 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 have to meet the 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.

8.6.1 General information

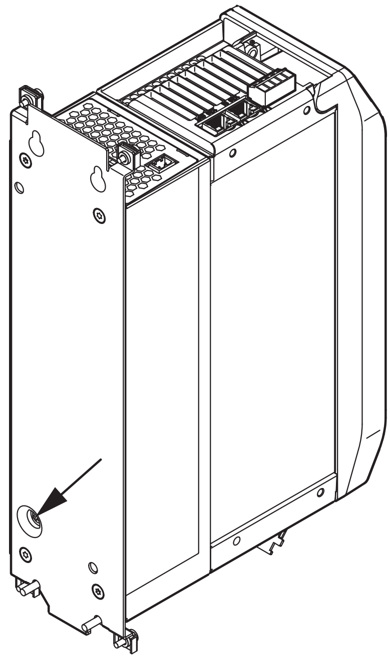
- Take suitable measures to prevent the motor starting up inadvertently, for example by removing the electronics terminal block X20. Take additional safety measures depending on the application to prevent possible injuries to people and damage to machinery.
- Only use closed cable lugs for connection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

8.6.2 Permitted voltage systems

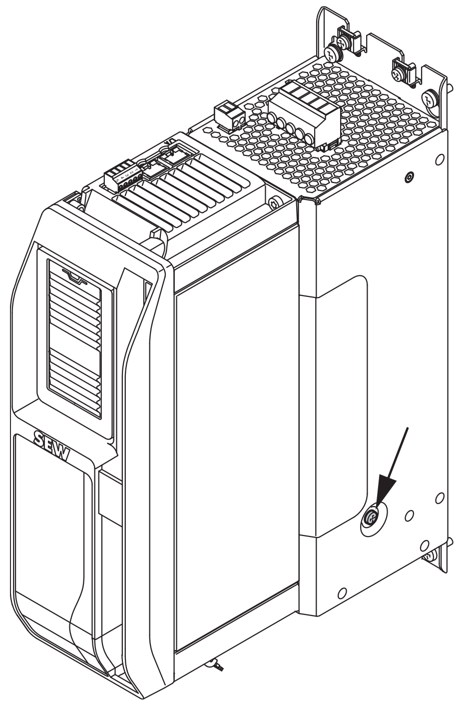
Information on the voltage systems	Information on permissibility
TN and TT systems – voltage systems with directly grounded star point.	Use is possible without restrictions.
IT systems – voltage systems with non-grounded star point.	Use is only permitted adhering to specific measures. The measures are described in chapter "Use in IT systems" (→ 🗎 174):
Voltage systems with grounded outer conductor.	Use only for line voltages up to max. 240 V.

8.6.3 Use in IT systems

To ensure IT system-capability, the terminal screw shown in the following figure must be removed from the application inverter.

Application inverter	Position of the terminal screw
MDX90A-0020 – 0095-5_3-.. MDX90A-0070 – 0093-2_3-..	On the back of the application inverter.  15144351755

23061715/EN – 03/2017

Application inverter	Position of the terminal screw
MDX90A-0125 – 0320-5_3-.. MDX90A-0140 – 0290-2_3-..	On the right side of the application inverter.  15026230411

INFORMATION

Use of regenerative power supply unit

When using a regenerative power supply unit, the terminal screw must always be removed.

INFORMATION

EMC limit values

No EMC limits are specified for interference emission in voltage supply systems without a grounded star point (IT systems). The efficiency of line filters is severely limited.

SEW-EURODRIVE recommends the use of an pulse-code-modulated insulation monitor for operation in IT systems.

8.6.4 Line fuses, fuse types

Type class	Requirement
Fuses in utilization categories gL, gG	Fusing voltage ≥ rated line voltage
Miniature circuit breaker of characteristics D	Nominal miniature circuit breaker voltage ≥ nominal line voltage
	Nominal currents of the miniature circuit breaker must be 10% higher than the nominal line current of the application inverter

8.6.5 Line connection

The operation of the application inverter with connected braking resistor is possible with and without line contactor.

NOTICE

Frequent switch-on may destroy the application inverter or lead to unexpected 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 turn the power of the supply system on or off more than once per minute.

- The line contactor must always be located before the line filter.
- Use only line contactors in 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.

23061715/EN – 03/2017

8.6.6 Line contactor

The following table provides an overview of when a line contactor is required and what kind of preventive measures must be taken for the used braking resistor, see also chapter "Protection against thermal overload of the braking resistor" (→ 🗎 197).

<table>
<tr><th>Inverter type</th><th>Braking resistor type</th><th>Protective element/preventive measure</th><th>Line contactor required?</th></tr>
<tr><td rowspan="7">MDX90A-0020 – 0160-5_3-..

MDX90A-0070 – 0140-2_3-..</td><td>No BR</td><td>-</td><td>No</td></tr>
<tr><td>BR... flat design</td><td>-</td><td>No</td></tr>
<tr><td>BR... as PTC</td><td>-</td><td>No</td></tr>
<tr><td rowspan="2">BW...</td><td>External bimetallic relay</td><td>Yes</td></tr>
<tr><td>TBC circuit breaker</td><td>No</td></tr>
<tr><td rowspan="2">BR...-T</td><td>External bimetallic relay</td><td>Yes</td></tr>
<tr><td>TBC circuit breaker</td><td>No</td></tr>
<tr><td rowspan="8">MDX90A-0240-5_3-.. and higher

MDX90A-0213-2_3-.. and higher</td><td>No BR</td><td>-</td><td>No</td></tr>
<tr><td>BR... flat design</td><td>-</td><td>No</td></tr>
<tr><td>BR... as PTC</td><td>-</td><td>No</td></tr>
<tr><td rowspan="2">BW...</td><td>External bimetallic relay</td><td>No</td></tr>
<tr><td>TBC circuit breaker</td><td>No</td></tr>
<tr><td rowspan="3">BR...-T</td><td>Temperature contact evaluation</td><td>No</td></tr>
<tr><td>External bimetallic relay</td><td>No</td></tr>
<tr><td>TBC circuit breaker</td><td>No</td></tr>
</table>

INFORMATION

When connecting a braking resistor without using a line contactor or a TCB circuit breaker, it is mandatory to connect an external DC 24 V voltage supply to the application inverter.

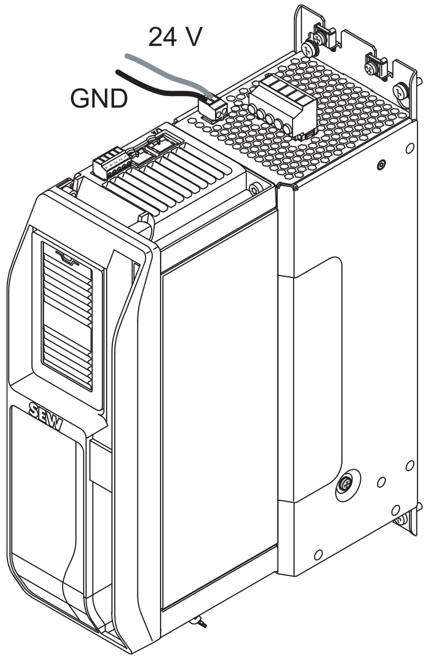
8.6.7 24 V supply voltage

MOVIDRIVE® system **MDX90A**... must be connected to an external 24 V supply voltage.

MOVIDRIVE® system **MDX91A**... has an integrated 24 V power supply unit with a power rating of 80 W. An external power supply unit can be connected as well.

The maximum cable cross section is 2.5 mm^2.

Whether an external 24 V supply is required for MDX91A depends on the load e.g. the encoder supply and the outputs.



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Select the cross section of the supply cable according to the power demand of the device to be supplied.

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

8.6.8 Motor output

NOTICE

Connecting capacitive loads to the application inverter.

Destruction of the application inverter.

- Only connect ohmic/inductive loads (motors).
- Never connect capacitive loads.

8.6.9 Output brake chopper

NOTICE

Connecting capacitive loads to the application inverter.
Connecting inductive loads to the application inverter.

Destruction of the application inverter.

- Only connect ohmic loads (braking resistors).
- Never connect capacitive or inductive loads.

8.6.10 Temperature evaluation of the motor

The temperature evaluation can be connected in 2 ways:

- The encoder cable includes the cables of the temperature evaluation.
- The temperature evaluation is connected separately.

⚠ WARNING

Dangerous contact voltages at the terminals of the application inverter when connecting the wrong temperature sensors.

Severe or fatal injuries from electric shock.

- Connect only temperature sensors with protective separation from the motor winding to the temperature evaluation. Otherwise, the requirements for protective separation are not met. Dangerous contact voltages may occur at the terminals of the application inverter via the signal electronics in case of an error.

8.6.11 Brake output

INFORMATION

- If the brake connection and the motor connection are combined in one power cable, the brake cable must be shielded separately. The shielding of the power cable and the brake cable must be connected to the motor and application inverter over a large area.
- SEW-EURODRIVE recommends to also use a shielded brake cable for separate brake cable routing.
- Note the different project planning criteria to determine the length of brake cable and motor cable.

8.6.12 Digital inputs, digital outputs

NOTICE

Destruction of digital inputs and digital outputs.

The digital inputs are not electrically isolated. Incorrectly applied voltages can damage the digital inputs.

- Do not apply external voltages to the digital outputs.
- The digital inputs and outputs are dimensioned according to IEC 61131-2.

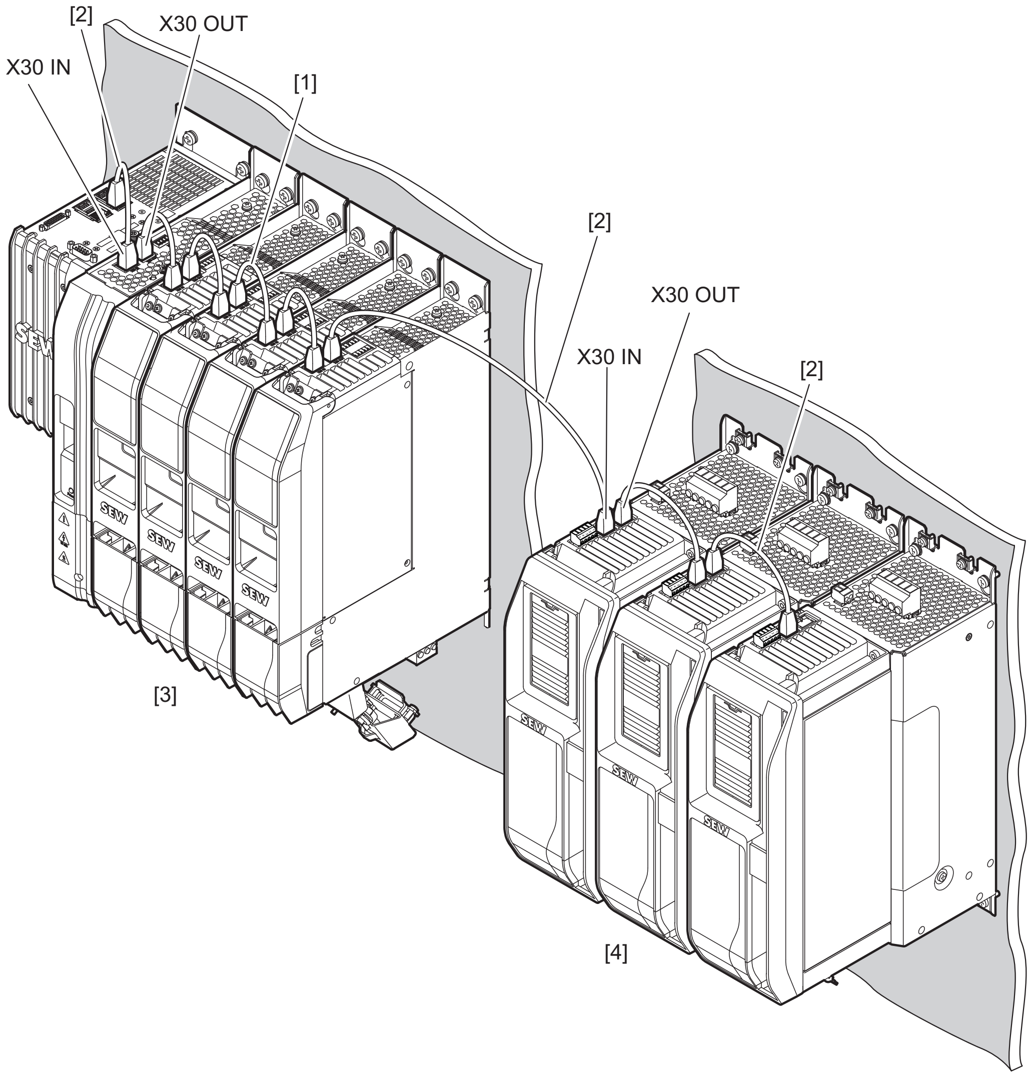
If you route the cables outside the control cabinet, you have to shield them irrespective of the length.

When connecting the shielding, ensure equipotential bonding.

23061715/EN – 03/2017

8.6.13 System bus EtherCAT®/SBus^{PLUS}

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



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[1] Module bus cable, 8-pin, color: anthracite gray. The cable is included in the delivery.

[2] System bus cable, 4-pin, color: light gray. The cable is **not** included in the delivery.

[3] MOVIDRIVE® modular

[4] MOVIDRIVE® system

Cabling

The connectors of the module bus cable are red and black to simplify correct installation.

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

Axis systems are interconnected using the system bus cable, see figure above.

8.6.14 Encoders

The encoder cable may include the cables of the temperature evaluation.

For information on the pin assignment, refer to chapter "Terminal assignment" (→ 🗎 212).

⚠ WARNING

Dangerous contact voltages at the terminals of the application inverter when connecting the wrong temperature sensors.

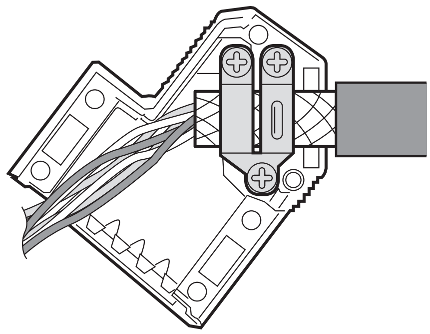
Severe or fatal injuries from electric shock.

- Connect only temperature sensors with protective separation from the motor winding to the temperature evaluation. Otherwise, the requirements for protective separation are not met. Dangerous contact voltages may occur at the terminals of the application inverter via the signal electronics in case of an error.

Installation notes for encoder connection

Encoder cables

- Use shielded cables with twisted pair cores. Connect the shield over a wide area at both ends:
  - At the encoder in the cable gland or in the encoder plug,
  - To the application inverter in the housing of the D-sub connector.



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- Route the encoder cable separately from the power cables.
- Connect the shield on the inverter end in the housing of the D-sub connector over a large area.

On the encoder/resolver

- To ensure a flawless shield connection, an EMC screw fitting must be used for the cable entry of the signal line.
- For drives with a plug connector, connect the shield on the encoder plug.

Prefabricated cables

SEW-EURODRIVE offers pre-fabricated cables for connecting encoders. SEW-EURODRIVE recommends to use these prefabricated cables.

Encoder connection/cable lengths

Connection/Encoder	Cable length
HTL encoder ES7C and EG7C	300 m
Standard HTL encoder	200 m
Other encoders	100 m

INFORMATION

The maximum cable length might be reduced depending on the technical data of the respective encoder. Observe the manufacturer specifications.

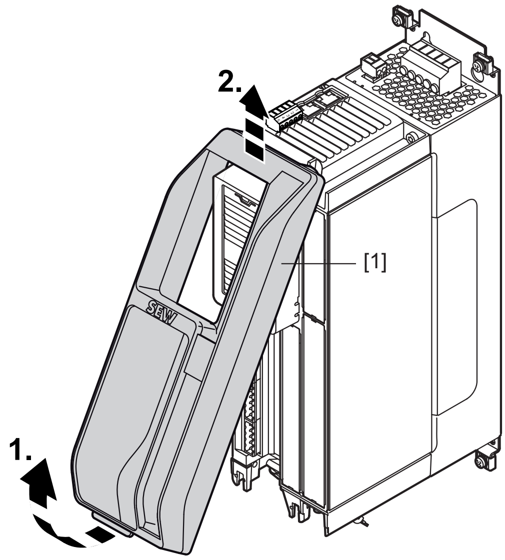
8.7 Installing options and accessories

8.7.1 Installing an option card

Observe the safety notes in chapter "Electrical installation" (→ 🗎 173).

For information on which option card can be installed in which slot, refer to chapter "Use of option cards" (→ 🗎 165).

1. Disconnect the application inverter from the power supply. Disconnect the DC 24 V supply and the line voltage.
2. Ensure electrostatic discharge with suitable measures before starting the work. Suitable measures for equipotential bonding are e.g. the use of a discharge strap or wearing conductive shoes.
3. Remove the safety cover [1] from the front of the application inverter.



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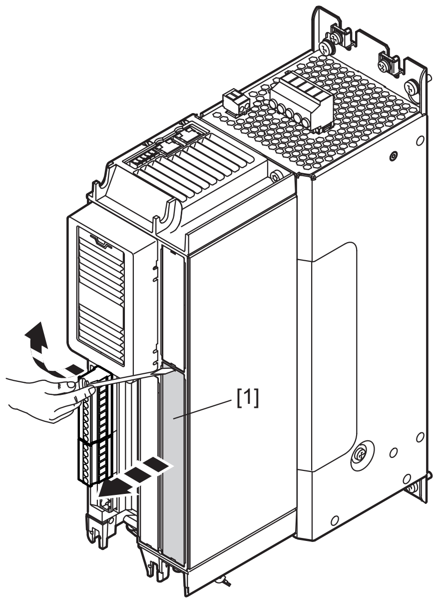
4. Remove the plastic cover [1] of the card slot using a screwdriver.



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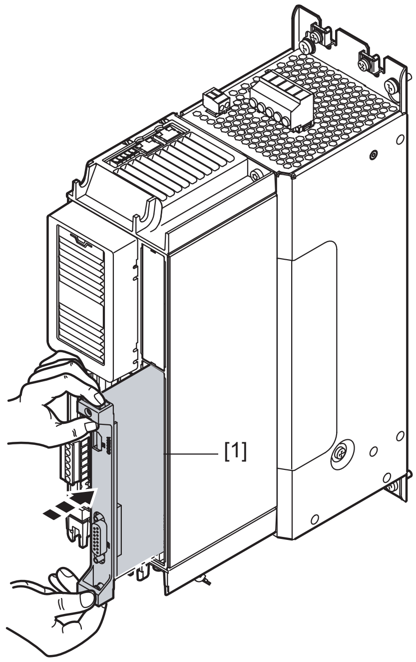
INFORMATION

Hold the option card by its edges only.

5. Take the option card [1] and insert it in the slot with slight pressure.



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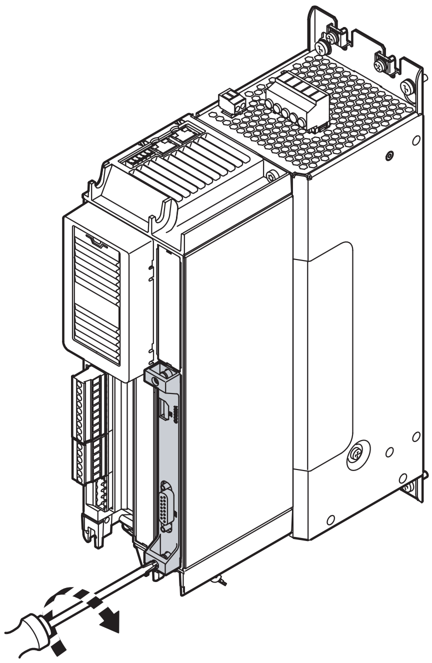
6. Screw in the card with the specified tightening torque (→ 🗎 167).



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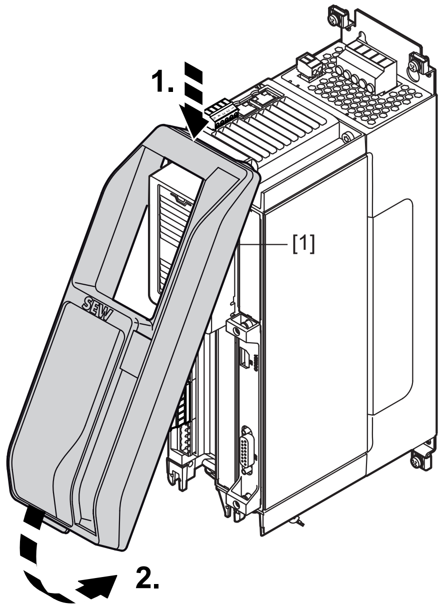
23061715/EN – 03/2017

7. Install the safety cover [1] at the front of the application inverter.



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23061715/EN – 03/2017

8.7.2 CIO21A and CID21A input/output card

INFORMATION

Technical data of the option cards

For technical data and a detailed description of the encoder interface, refer to chapter "Technical data of the option cards".

Voltage supply

The I/O cards are supplied by the basic unit via the 24 V voltage supply.

Short-circuit behavior of digital outputs

The digital outputs are short-circuit-proof.

As soon as the short circuit is remedied, the target output voltage is output, meaning the output does not switch off.

Short circuit behavior of analog outputs

The analog outputs are short-circuit-proof.

In the event of a short circuit, the output current is limited to a maximum value of 30 mA. The short circuit current is not pulsating.

As soon as the short circuit is remedied, the target output voltage is output, meaning the output does not switch off.

Connecting inductive loads at digital outputs

For inductive loads an external protective element (e.g. freewheeling diode) is required.

Connecting digital outputs in parallel

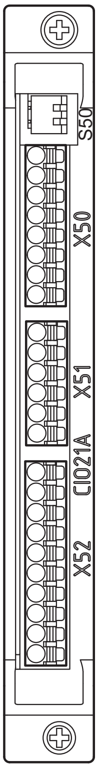
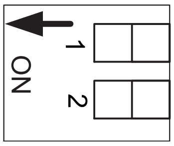
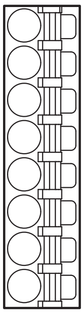
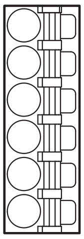
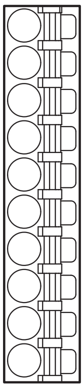
Connecting digital outputs in parallel is possible. The possible output current is doubled. Ensure identical parameterization of the digital outputs.

Cable lengths and shielding

Cable length — The maximum cable length of connections on the inputs and outputs is 30 m.

Shielding of signal lines — Cables outside the control cabinet must be shielded.

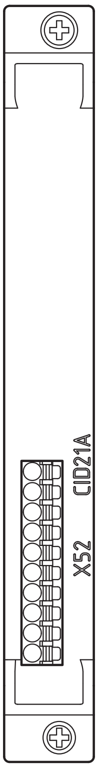
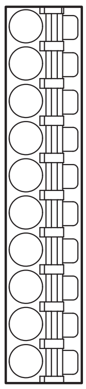
CIO21A terminal assignment

	Terminal		Connection	Brief description
				S50/1 on: Current input active for AI2x S50/2 on: Current input active for AI3x S50/1 off[1] : Voltage input active for AI2x S50/2 off[1]: Voltage input active for AI3x
		X50:1	REF1	+10 V reference voltage output
		X50:2	AI21	Analog current and voltage input
		X50:3	AI22	Analog current and voltage input
		X50:4	GND	Reference potential
		X50:5	AI31	Analog current and voltage input
		X50:6	AI32	Analog current and voltage input
		X50:7	GND	Reference potential
		X50:8	REF2	-10 V reference voltage output
		X51:1	AOV2	Analog voltage output 1, freely programmable
		X51:2	AOC2	Analog current output 1, freely programmable
		X51:3	GND	Reference potential for the outputs AOV2 and AOC2
		X51:4	AOV3	Analog voltage output 2, freely programmable
		X51:5	AOC3	Analog current output 2, freely programmable
		X51:6	GND	Reference potential for the outputs AOV3 and AOC3
		X52:1	DI10	Digital input 1, freely programmable
		X52:2	DI11	Digital input 2, freely programmable
		X52:3	DI12	Digital input 3, freely programmable
		X52:4	DI13	Digital input 4, freely programmable
		X52:5	GND	Reference potential for the digital inputs DI10 – DI13
		X52:6	DO10	Digital output 1, freely programmable
		X52:7	DO11	Digital output 2, freely programmable
		X52:8	DO12	Digital output 3, freely programmable
		X52:9	DO13	Digital output 4, freely programmable
		X52:10	GND	Reference potential for the digital outputs DO10 – DO13

1) Delivery state

23061715/EN – 03/2017

CID21A terminal assignment

	Terminal		Connec-tion	Brief description
		X52:1	DI10	Digital input 1, freely programmable
		X52:2	DI11	Digital input 2, freely programmable
		X52:3	DI12	Digital input 3, freely programmable
		X52:4	DI13	Digital input 4, freely programmable
		X52:5	GND	Reference potential for the digital inputs DI10 – DI13
		X52:6	DO10	Digital output 1, freely programmable
		X52:7	DO11	Digital output 2, freely programmable
		X52:8	DO12	Digital output 3, freely programmable
		X52:9	DO13	Digital output 4, freely programmable
		X52:10	GND	Reference potential for the digital outputs DO10 – DO13

8.7.3 CES11A multi-encoder card

INFORMATION

Technical data of the option cards

For technical data and a detailed description of the encoder interface, refer to chapter "Technical data of the option cards".

Overview of functions

The CES11A multi-encoder card expands the functionality of the application inverter in a way that an additional encoder can be evaluated. The encoder connected to the CES11A multi-encoder card can be used as motor encoder or external encoder.

Supported encoder types

The following encoder types can be evaluated by the CES11A multi-encoder card:

HTL 12/24 V (differential)
TTL/RS422 (differential)
SIN/COS 1 V_{SS} (differential)
HIPERFACE® with SIN/COS signals 1 V_{SS}
SEW encoder (RS485) with SIN/COS signals 1 V_{SS}, e.g. AS7W, AG7W
EnDat 2.1 with SIN/COS signals 1 V_{SS}
SSI encoder with/without SIN/COS signals 1 V_{SS}
CANopen encoder

Encoder connection/cable lengths

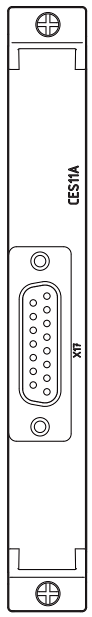
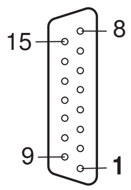
Connection/Encoder	Cable length
HTL encoder ES7C and EG7C	300 m
Standard HTL encoder	200 m
Other encoders	100 m

INFORMATION

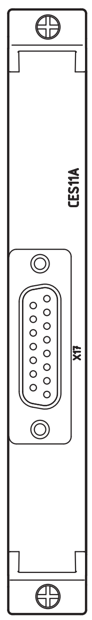
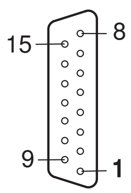
The maximum cable length might be reduced depending on the technical data of the respective encoder. Observe the manufacturer specifications.

23061715/EN – 03/2017

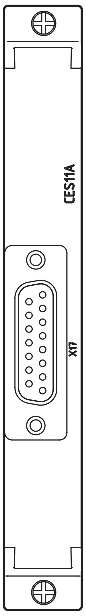
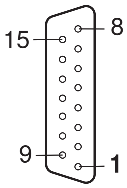
Terminal assignment of TTL, HTL, SIN/COS encoder

Card	Terminal		Connection	Brief description
		X17:1	A (COS+) (K1)	Signal track A (COS+) (K1)
		X17:2	B (SIN+) (K2)	Signal track B (SIN+) (K2)
		X17:3	C	Signal track C (K0)
		X17:4	Reserved	–
		X17:5	Reserved	–
		X17:6	-TEMP_M	Motor temperature evaluation
		X17:7	Reserved	–
		X17:8	GND	Reference potential
		X17:9	$\overline{A}$ (COS-) ($\overline{K1}$)	Negated signal track $\overline{A}$ (COS-) ($\overline{K1}$)
		X17:10	$\overline{B}$ (SIN-) ($\overline{K2}$)	Negated signal track $\overline{B}$ (SIN-) ($\overline{K2}$)
		X17:11	$\overline{C}$	Negated signal track $\overline{C}$ ($\overline{K0}$)
		X17:12	Reserved	–
		X17:13	V_{S24VG}	24 V encoder supply
		X17:14	+TEMP_M	Motor temperature evaluation
		X17:15	V_{S12VG}	12 V encoder supply

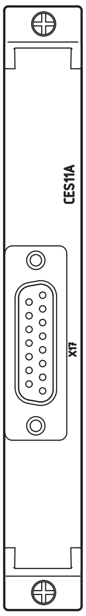
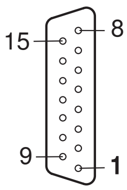
Terminal assignment HIPERFACE® and SEW encoder (RS485)

Card	Terminal		Connection	Brief description
		X17:1	A (COS+) (K1)	Signal track A (COS+) (K1)
		X17:2	B (SIN+) (K2)	Signal track B (SIN+) (K2)
		X17:3	Reserved	–
		X17:4	DATA+	Data line RS485
		X17:5	Reserved	–
		X17:6	-TEMP_M	Motor temperature evaluation
		X17:7	Reserved	–
		X17:8	GND	Reference potential
		X17:9	$\overline{A}$ (COS-) ($\overline{K1}$)	Negated signal track $\overline{A}$ (COS-) ($\overline{K1}$)
		X17:10	$\overline{B}$ (SIN-) ($\overline{K2}$)	Negated signal track $\overline{B}$ (SIN-) ($\overline{K2}$)
		X17:11	Reserved	–
		X17:12	DATA-	Data line
		X17:13	V_{S24VG}	24 V encoder supply
		X17:14	+TEMP_M	Motor temperature evaluation
		X17:15	V_{S12VG}	12 V encoder supply

Terminal assignment EnDat encoder

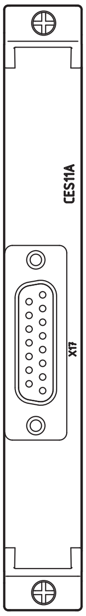
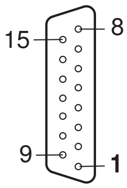
Card	Terminal		Connection	Brief description
		X17:1	A (COS+)	Signal track A (COS+)
		X17:2	B (SIN+)	Signal track B (SIN+)
		X17:3	PULSE+	Clock signal
		X17:4	DATA+	Data line
		X17:5	Reserved	–
		X17:6	-TEMP_M	Motor temperature evaluation
		X17:7	Reserved	–
		X17:8	GND	Reference potential
		X17:9	$\overline{A}$ (COS-)	Negated signal track $\overline{A}$ (COS-)
		X17:10	$\overline{B}$ (SIN-)	Negated signal track $\overline{B}$ (SIN-)
		X17:11	PULSE-	Clock signal
		X17:12	DATA-	Data line
		X17:13	V_{S24VG}	24 V encoder supply
		X17:14	+TEMP_M	–
		X17:15	V_{S12VG}	12 V encoder supply

Terminal assignment SSI encoder

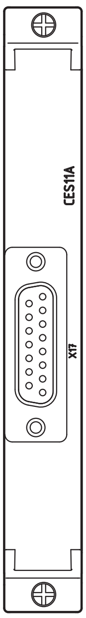
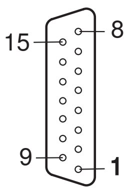
Card	Terminal		Connection	Brief description
		X17:1	Reserved	–
		X17:2	Reserved	–
		X17:3	PULSE+	Clock signal
		X17:4	DATA+	Data line RS485
		X17:5	Reserved	–
		X17:6	-TEMP_M	Motor temperature evaluation
		X17:7	Reserved	–
		X17:8	GND	Reference potential
		X17:9	Reserved	–
		X17:10	Reserved	–
		X17:11	PULSE-	Clock signal
		X17:12	DATA-	Data line
		X17:13	V_{S24VG}	24 V encoder supply
		X17:14	+TEMP_M	Motor temperature evaluation
		X17:15	V_{S12VG}	12 V encoder supply

23061715/EN – 03/2017

Terminal assignment SSI and SIN/COS combination encoders

Card	Terminal		Connection	Brief description
		X17:1	A (COS+)	Signal track A (COS+)
		X17:2	B (SIN+)	Signal track B (SIN+)
		X17:3	PULSE+	Clock signal
		X17:4	DATA+	Data line
		X17:5	Reserved	–
		X17:6	-TEMP_M	Motor temperature evaluation
		X17:7	Reserved	–
		X17:8	GND	Reference potential
		X17:9	$\overline{A}$ (COS-)	Negated signal track $\overline{A}$ (COS-)
		X17:10	$\overline{B}$ (SIN-)	Negated signal track $\overline{B}$ (SIN-)
		X17:11	PULSE-	Clock signal
		X17:12	DATA-	Data line
		X17:13	V_{S24VG}	24 V encoder supply
		X17:14	+TEMP_M	Motor temperature evaluation
		X17:15	V_{S12VG}	12 V encoder supply

Terminal assignment CANopen encoder

Card	Terminal		Connection	Brief description
		X17:1	Reserved	–
		X17:2	Reserved	–
		X17:3	Reserved	–
		X17:4	CAN_H	CAN high data cable
		X17:5	Reserved	–
		X17:6	-TEMP_M	Motor temperature evaluation
		X17:7	Reserved	–
		X17:8	GND	Reference potential
		X17:9	Reserved	–
		X17:10	Reserved	–
		X17:11	Reserved	–
		X17:12	CAN_L	CAN low data cable
		X17:13	V_{S24VG}	24 V encoder supply
		X17:14	+TEMP_M	Motor temperature evaluation
		X17:15	V_{S12VG}	12 V encoder supply

23061715/EN – 03/2017

8.8 Braking resistors

Observe the following points if braking resistors are installed:

- The supply cables to the braking resistors carry a high pulsed DC voltage during nominal operation.

⚠ DANGER

Dangerous clocked DC voltage of up to 970 V.

Severe or fatal injuries from electric shock.

To prevent electric shocks:

- Disconnect the application inverter from the supply system and wait 10 minutes before working on a braking resistor or its supply cables.
- Never operate the application inverter without touch guards and installed closing covers.

- Braking resistors get very hot during operation.

⚠ WARNING

The surfaces of the braking resistors will reach temperatures of up to 250 °C when the braking resistors are loaded with the nominal power.

Severe burns.

To prevent burns:

- Do not touch any braking resistor.
- Select a suitable installation location for the braking resistors such as the control cabinet roof.

23061715/EN – 03/2017

8.8.1 Permitted installation of braking resistors

The surfaces of the resistors get very hot if loaded with nominal power. Make sure that you select an installation site that will accommodate these high temperatures. Braking resistors are therefore usually mounted on the control cabinet roof.

NOTICE

Braking resistors can overheat.

Non-permissible installation might lead to an accumulation of heat in the braking resistor due to reduced convection. A tripping temperature contact or an overheated braking resistor can lead to a system standstill.

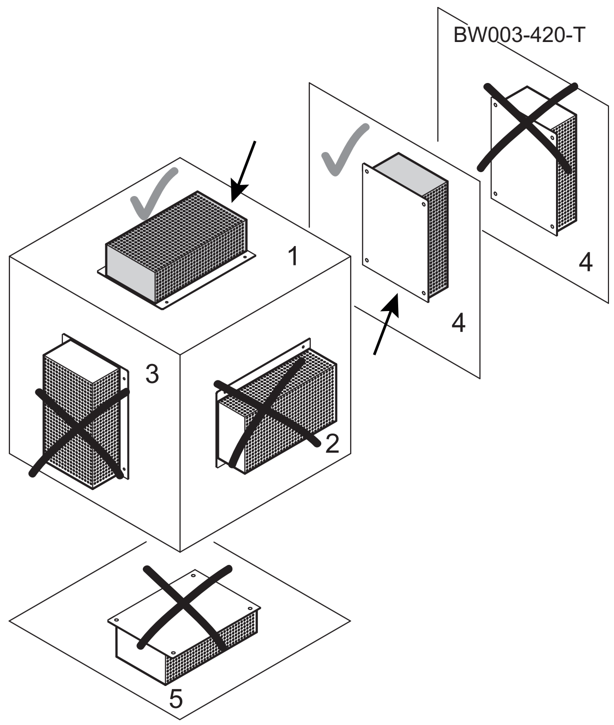
✓ Adhere to the following minimum clearances:

- About 200 mm to adjacent components and walls.
- About 300 mm to above components/ceilings.

8

Observe the following permitted mounting positions when installing the resistors:

- Grid resistor



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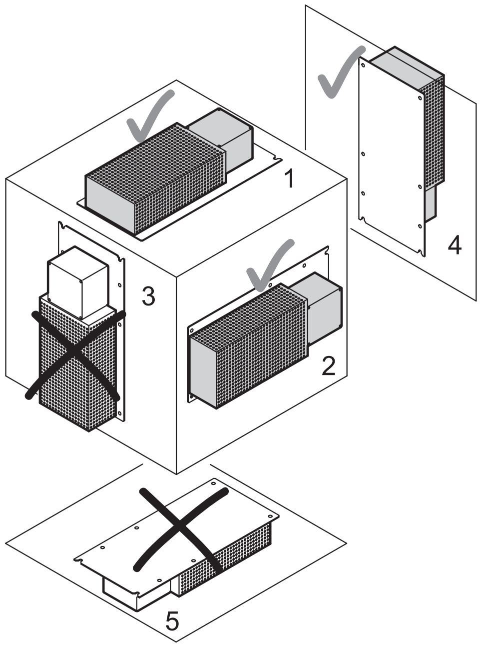
The arrow marks the connection side.

- Wire resistor



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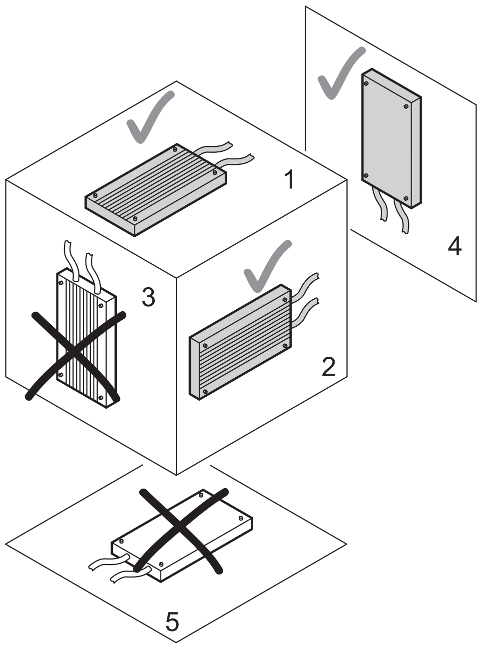
- Flat type resistor



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8.8.2 Protection against thermal overload of the braking resistor

INFORMATION

PTC braking resistor

A PTC braking resistor goes to high resistance in case of overload.

INFORMATION

Flat-type resistor

Flat-design resistors have an internal thermal protection (non-replaceable fuse) that interrupts the current circuit in the event of overload. The project planning guidelines and the documented assignments of drive inverter and braking resistor must be adhered to.

Parallel connection of braking resistors

It is permitted to connect several identical braking resistors in parallel. The following applies:

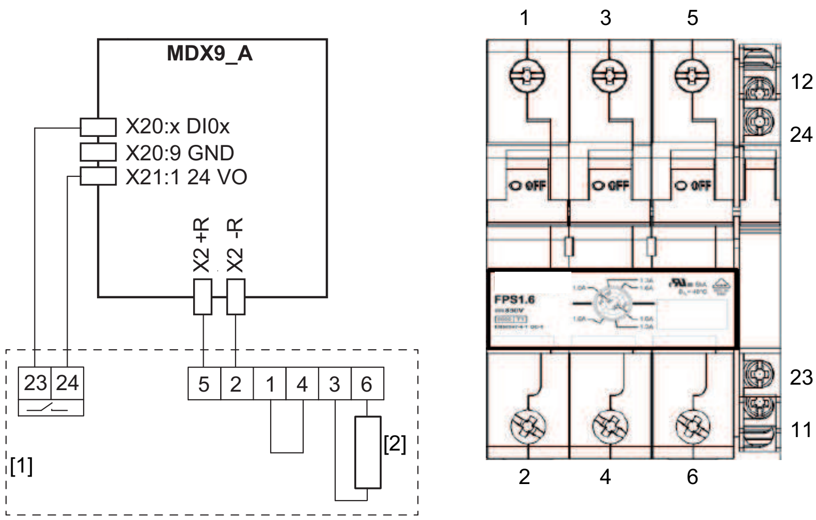
- The power connections of the braking resistors must be connected to +R and –R in parallel.
- Each braking resistor requires a separate protection against thermal overload.
- The signal contacts (NC contacts) of the protection devices must be connected in series.

23061715/EN – 03/2017

External thermal circuit breaker TCB

If an external TCB thermal circuit breaker is used for this application inverter, the following connection applies.

Connection



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[1] TCB thermal circuit breaker

[2] Braking resistor

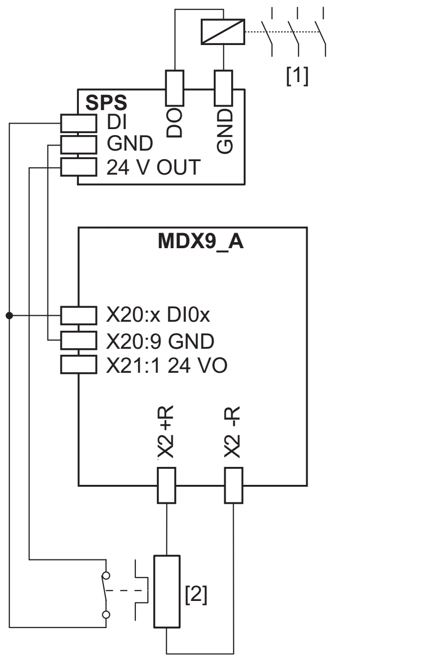
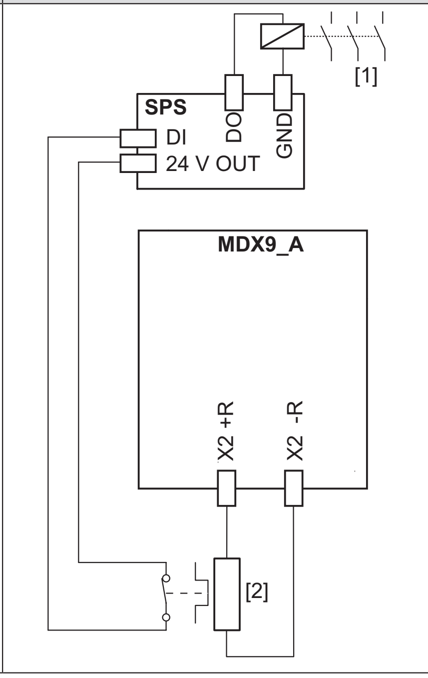
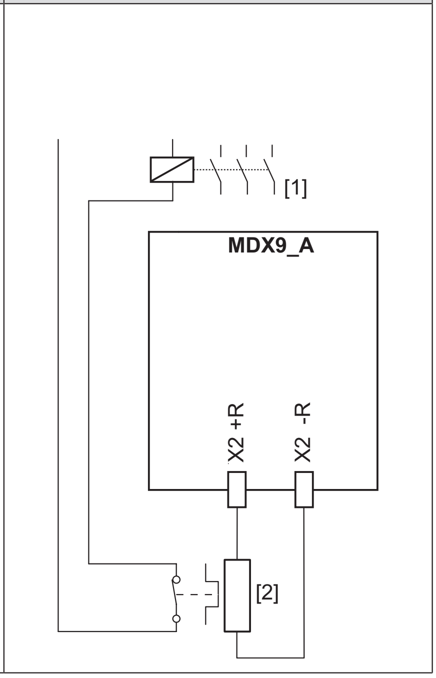
The digital input of the application inverter connected to the signal contact of the TCB thermal circuit breaker must be parameterized to the function "External braking resistor error".

- If the thermal circuit breaker trips, the signal contact is set (connection 23-24 is opened) and evaluated in the application inverter.
- The connection between application inverter and braking resistor is disconnected.
- This does not require a response by the PLC.
- It is not required to disconnect the supply system connection with an external switching device.
- The following applies to application inverters MDX90A-**0240**-5_3 and higher and MDX90A-**0213**-2_3 and higher: If the thermal circuit breaker trips, the application inverter disconnects the power supply by inhibiting the rectifier.
- If the thermal circuit breaker trips, the application inverter switches to "Output stage inhibit".
- Set the thermal circuit breaker TCB to the tripping current I_F of the connected braking resistor.
- After all cables are connected, the 3 upper screw holes must be covered with 3 touch guard caps. The touch guard lids are included in the delivery.

Internal temperature switch -T

Application inverter: MDX90A-0020 – 0160-5_3-.., MDX90A-0070 – 0140-2_3-..

If an BW...-T braking resistor with internal temperature switch is used with the application inverter, there are 3 possible connections.

Connection 1	Connection 2	Connection 3
		

[1] Line contactor

[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

  The digital input of the application inverter connected to the signal contact of the internal temperature switch must be parameterized to the function "External braking resistor error".

  – If the thermal circuit breaker trips, the signal is evaluated in the application inverter and the PLC is evaluated.

  – If the thermal circuit breaker trips, the PLC must interrupt the power supply.

  – If the thermal circuit breaker trips, the application inverter switches to "Output stage inhibit".

- Connection 2

  – If the thermal circuit breaker trips, the signal in the PLC is evaluated.

  – If the thermal circuit breaker trips, the PLC must interrupt the power supply.

  – If the thermal circuit breaker trips, there is no direct response in the application inverter.

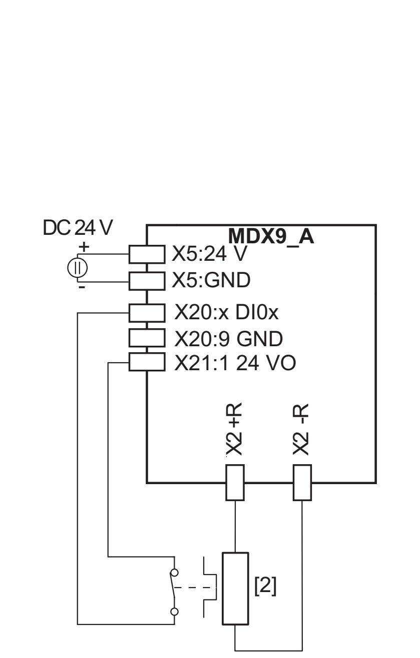
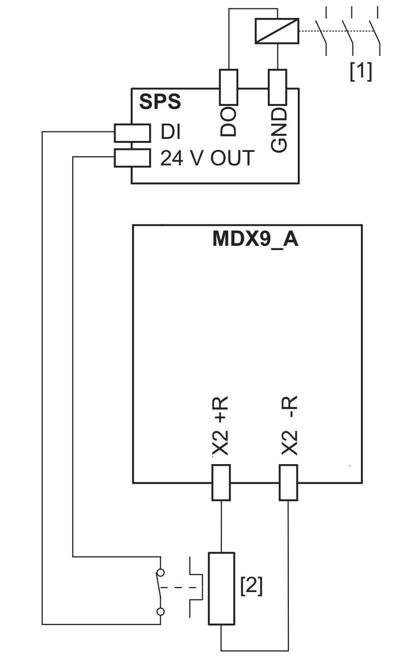
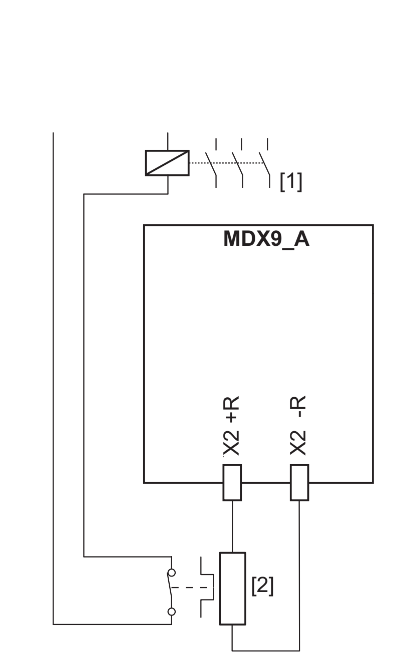
23061715/EN – 03/2017

– With connection 2, it is possible that the PLC finishes the current travel cycle although the thermal circuit breaker has tripped. Only then, the power supply is disconnected. In this case, the residual braking energy $W_{Rest} = R_{BRnom} \times 20$ s must not be exceeded.

- Connection 3
  – If the thermal circuit breaker trips, the signal directly affects the line contactor.
  – This does not require a response by the PLC.
  – If the thermal circuit breaker trips, there is no direct response in the application inverter.

Application inverter: MDX90A-0240-5_3-.. and higher, MDX90A-0213-2_3-.. and higher

If an BW...-T braking resistor with internal temperature switch is used with the application inverter, there are 3 possible connections.

Connection 1	Connection 2	Connection 3
		

[1] Line contactor

[2] Braking resistor

- Connection 1

  The digital input of the application inverter connected to the signal contact of the internal temperature switch must be parameterized to the function "External braking resistor error".

  – If the thermal circuit breaker trips, the signal is evaluated in the application inverter.

  – This does not require a response by the PLC.

  – It is not required to disconnect the supply system connection with an external switching device.

  – If the thermal circuit breaker trips, the application inverter interrupts the power supply by inhibiting the rectifier.

  – If the thermal circuit breaker trips, the application inverter switches all axis modules to "Output stage inhibit".

INFORMATION

When using connection variant 1 (connection of braking resistor without line contactor), the application inverter must be supplied with external DC 24 V.

- Connection 2

  – If the thermal circuit breaker trips, the signal in the PLC is evaluated.

  – If the thermal circuit breaker trips, the PLC must interrupt the power supply.

8

23061715/EN – 03/2017

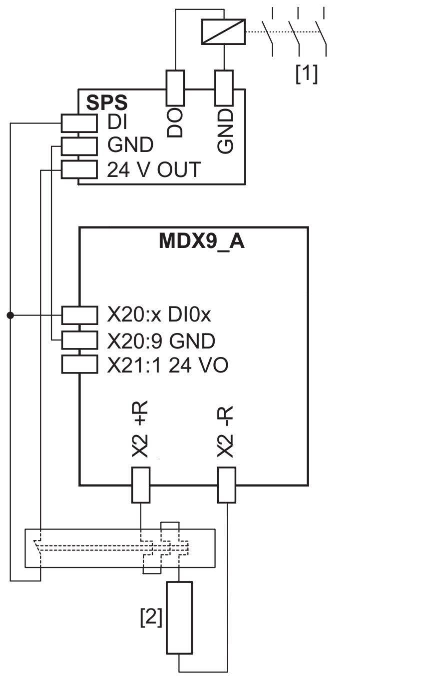
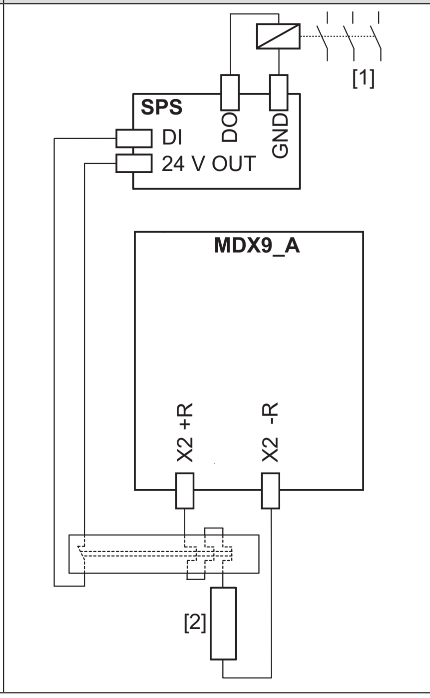
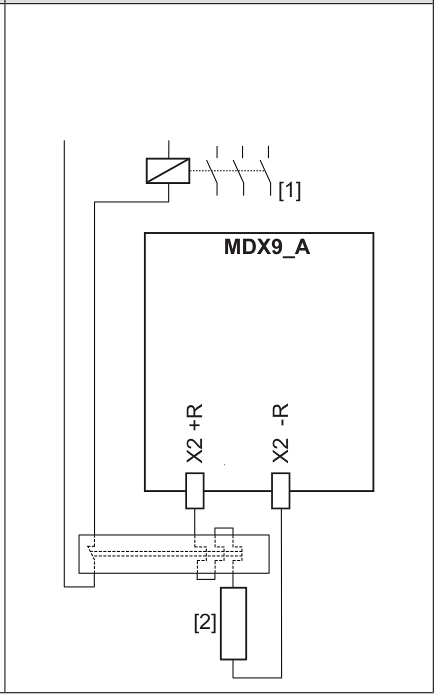
- If the thermal circuit breaker trips, there is no direct response in the application inverter.
- With connection 2, it is possible that the PLC finishes the current travel cycle although the thermal circuit breaker has tripped. Only then, the power supply is disconnected. In this case, the residual braking energy $W_{Rest} = R_{BRnom} \times 20$ s must not be exceeded.

• Connection 3
  - If the thermal circuit breaker trips, the signal directly affects the line contactor.
  - This does not require a response by the PLC.
  - If the thermal circuit breaker trips, there is no direct response in the application inverter.

External bimetallic relay

Application inverter: MDX90A-0020 – 0160-5_3-.., MDX90A-0070 – 0140-2_3-..

If an external bimetallic relay is used with the application inverter, there are 3 possible connections.

<table>
<tr><th>Connection 1</th><th>Connection 2</th><th>Connection 3</th></tr>
<tr>
<td>
</td>
<td>
</td>
<td>
</td>
</tr>
</table>

[1] Line contactor

[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

  The digital input of the application inverter connected to the signal contact of the external bimetallic relay must be parameterized to the function "External braking resistor error".

  - If the thermal circuit breaker trips, the signal is evaluated in the application inverter and the PLC is evaluated.
  - If the thermal circuit breaker trips, the PLC must interrupt the power supply.
  - If the thermal circuit breaker trips, the application inverter switches to "Output stage inhibit".
- Connection 2
  - If the thermal circuit breaker trips, the signal in the PLC is evaluated.
  - If the thermal circuit breaker trips, the PLC must interrupt the power supply.
  - If the thermal circuit breaker trips, there is no direct response in the application inverter.

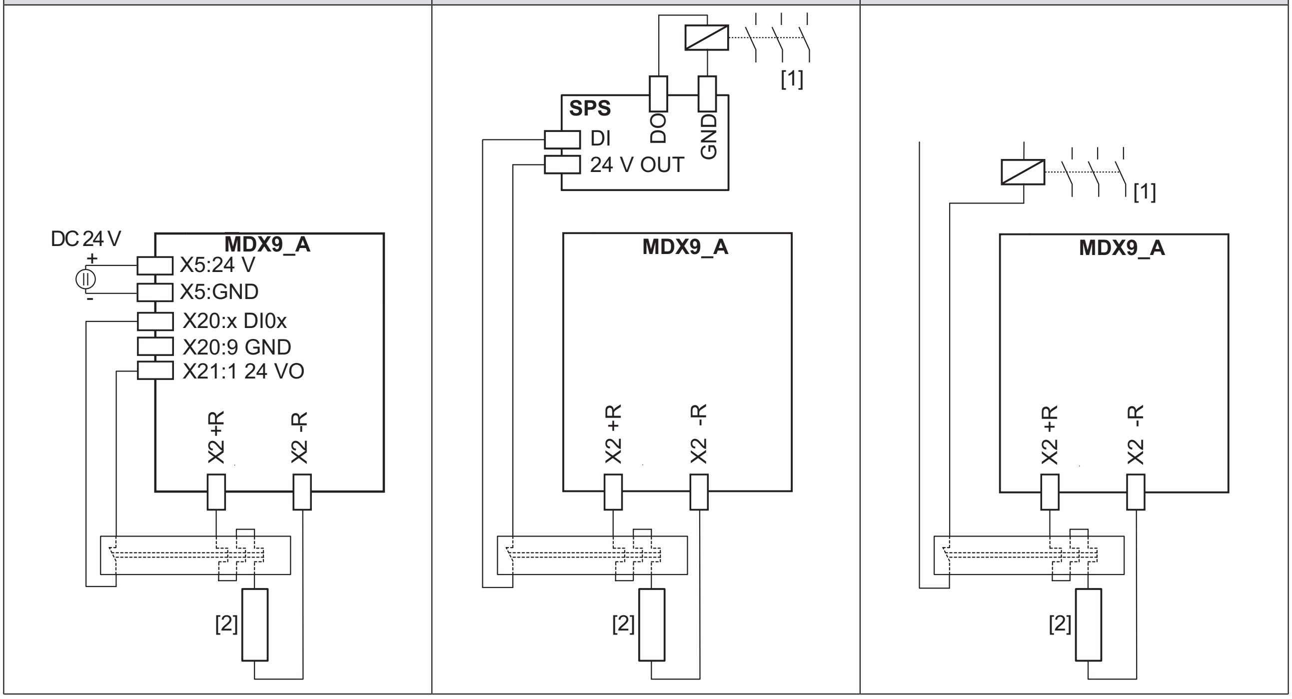
– With connection 2, it is possible that the PLC finishes the current travel cycle although the thermal circuit breaker has tripped. Only then, the power supply is disconnected. In this case, the residual braking energy $W_{Rest} = R_{BRnom} \times 20$ s must not be exceeded.

- Connection 3
  - If the thermal circuit breaker trips, the signal directly affects the line contactor.
  - This does not require a response by the PLC.
  - If the thermal circuit breaker trips, there is no direct response in the application inverter.

Application inverter: MDX90A-0240-5_3-.. and higher, MDX90A-0213-2_3-.. and higher

If an external bimetallic relay is used with the application inverter, there are 3 possible connections.

Connection 1	Connection 2	Connection 3



[1] Line contactor

[2] Braking resistor

- Connection 1

  The digital input of the application inverter connected to the signal contact of the external bimetallic relay must be parameterized to the function "External braking resistor error".

  – If the thermal circuit breaker trips, the signal is evaluated in the application inverter.

  – This does not require a response by the PLC.

  – It is not required to disconnect the supply system connection with an external switching device.

  – If the thermal circuit breaker trips, the application inverter interrupts the power supply by inhibiting the rectifier.

  – If the thermal circuit breaker trips, the application inverter switches to "Output stage inhibit".

INFORMATION

When using connection variant 1 (connection of braking resistor without line contactor), the application inverter must be supplied with external DC 24 V.

- Connection 2

  – If the thermal circuit breaker trips, the signal in the PLC is evaluated.

  – If the thermal circuit breaker trips, the PLC must interrupt the power supply.

- If the thermal circuit breaker trips, there is no direct response in the application inverter.
- With connection 2, it is possible that the PLC finishes the current travel cycle although the thermal circuit breaker has tripped. Only then, the power supply is disconnected. In this case, the residual braking energy $W_{Rest} = R_{BRnom} \times 20$ s must not be exceeded.

• Connection 3
  - If the thermal circuit breaker trips, the signal directly affects the line contactor.
  - This does not require a response by the PLC.
  - If the thermal circuit breaker trips, there is no direct response in the application inverter.

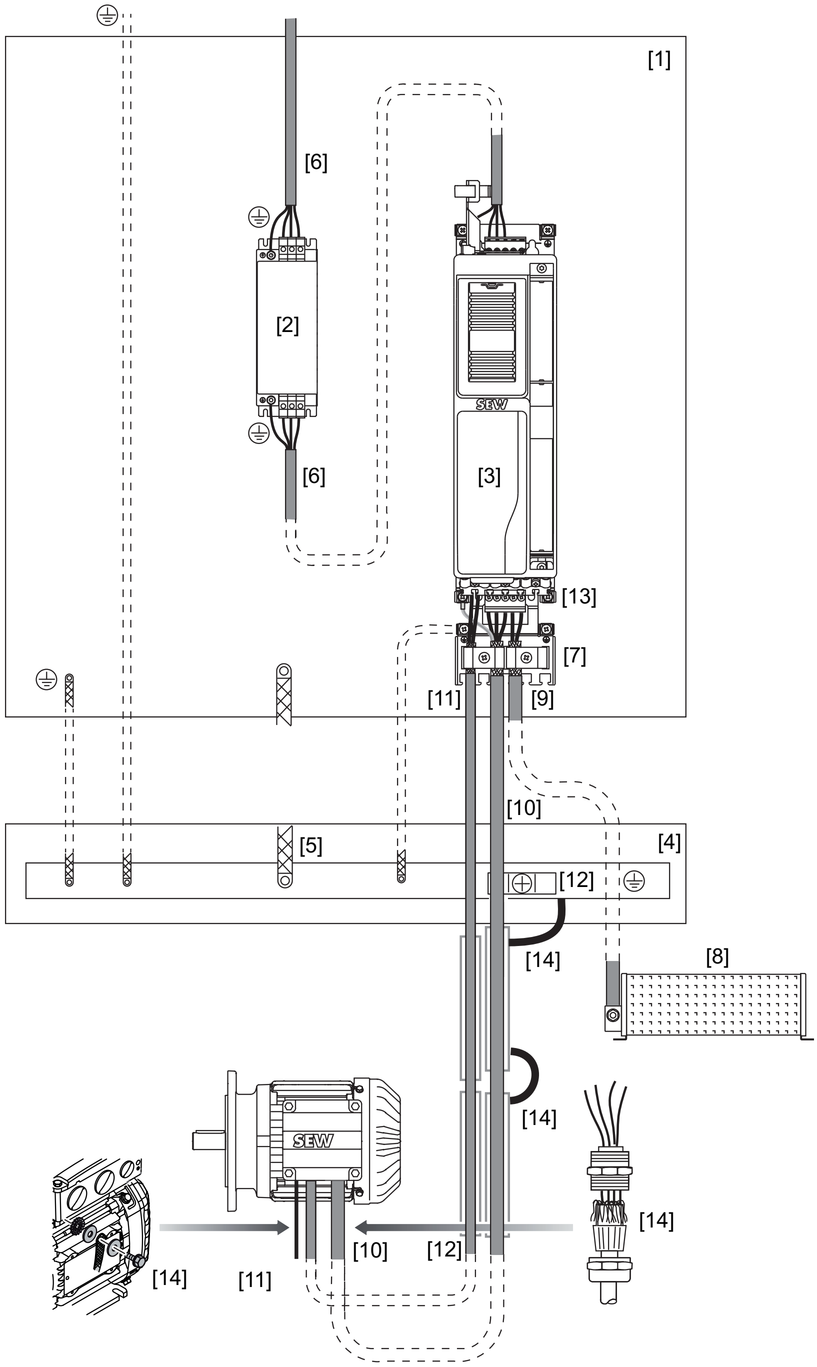
23061715/EN – 03/2017

8.9 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 application inverter.
- The connection cable between line filter and application inverter does not have 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 NF... line filter and inverter.

23061715/EN – 03/2017

8.10 EMC-compliant installation



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[1] Zinc-coated mounting plate
[2] Line filter
[3] Inverter
[4] PE busbar
[5] HF connection of PE busbar/mounting plate
[6] Supply system cable
[7] Power shield plate
[8] Braking resistor
[9] Braking resistor performance
[10] Motor cable
[11] Brake cable
[12] Grounding clamp
[13] Electronics shield plate
[14] HF connection

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

23061715/EN – 03/2017

The notes in this chapter are not legal regulations; they are merely recommendations for improving the electromagnetic compatibility of your plant.

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

8.10.1 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.

8.10.2 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.

8.10.3 Cable installation

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

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.

8.10.4 Supply system cable connection

The supply system cable can be connected to the line choke and/or line filter using twisted unshielded single conductors, or using unshielded cables.

If necessary, shielded cables can increase the EMC.

8.10.5 Line filter connection

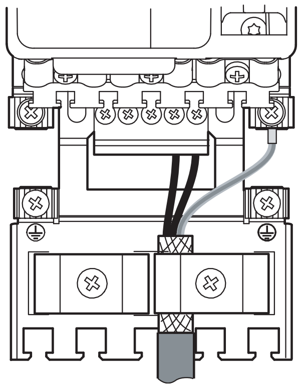
Limit the length of connection cables between line filter and inverter to the absolute minimum needed.

23061715/EN – 03/2017

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

8.10.6 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.



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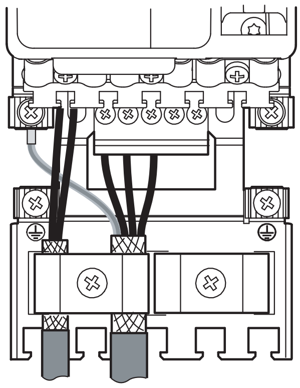
8.10.7 Motor and brake connection

Only use shielded motor cables. Connect the braided shield of the motor cable at both ends over its entire circumference to the power shield plate at the inverter.

Shielded cables must be selected for the brake supply. The shield of the brake cable can be connected to the power shield plate at the inverter.

In case motor cable and brake cable are combined in a shared cable, the cable must have an inner shield separating the brake cable from the motor conductors. In addition, the cables have an overall shield.



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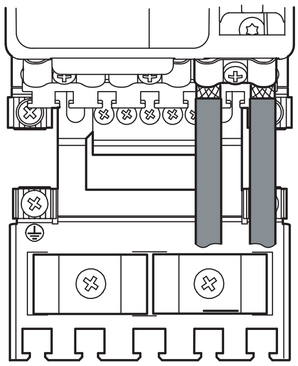
SEW-EURODRIVE recommends to use prefabricated cables.

In case of especially high requirements, an additional connection point for the shield is recommended. To limit the emitted interference the motor shield can additionally be grounded to the control cabinet outlet using commercial installation materials (grounding clamps or EMC screw fittings).

8.10.8 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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8.10.9 Encoder connection

SEW-EURODRIVE recommends to use prefabricated encoder cables.

The shield of prefabricated cables by SEW-EURODRIVE is connected via the connector.

8.10.10 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.

8

8.11 Terminal assignment

INFORMATION

Reference potentials inside the device:

The device internal reference potential is designated as GND in the following table.

All reference potentials GND are internally connected to PE.

INFORMATION

The assignment "reserved" means that no cable must be connected to this connection.

INFORMATION

The technical data for the connection of power electronics and control electronics are listed in chapter "Technical data" (→ 🗎 32).

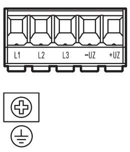
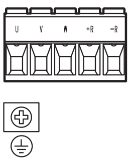
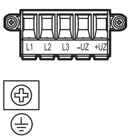
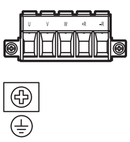
Figure	Terminal	Connection	Brief description
	X1:L1	L1	Line connection - MDX90A-0020 – 0160-5_3-.. - MDX90A-0070 – 0140-2_3-..
	X1:L2	L2	
	X1:L3	L3	
	X1:$-V_{DCL}$	$-V_{DCL}$	DC link connection
	X1:$+V_{DCL}$	$+V_{DCL}$	
	⏚	PE	PE connection at housing
	X2:U	U	Motor connection - MDX90A-0020 – 0160-5_3-.. - MDX90A-0070 – 0140-2_3-..
	X2:V	V	
	X2:W	W	
	X2:+R	+R	Braking resistor connection
	X2:-R	-R	
	⏚	PE	PE connection at housing
	X1:L1	L1	Line connection - MDX90A-0240 – 0320-5_3-.. - MDX90A-0213 – 0290-2_3-..
	X1:L2	L2	
	X1:L3	L3	
	X1:$-V_{DCL}$	$-V_{DCL}$	DC link connection
	X1:$+V_{DCL}$	$+V_{DCL}$	
	⏚	PE	PE connection at housing
	X2:U	U	Motor connection - MDX90A-0240 – 0320-5_3-.. - MDX90A-0213 – 0290-2_3-..
	X2:V	V	
	X2:W	W	
	X2:+R	+R	Braking resistor connection
	X2:-R	-R	
	⏚	PE	PE connection at housing

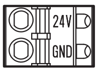
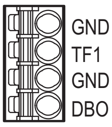
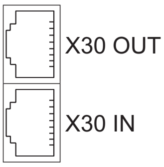
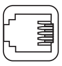
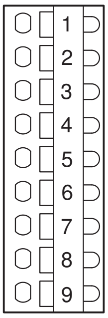
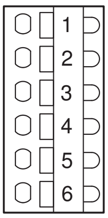
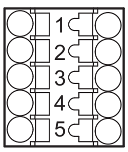
Figure	Terminal	Connection	Brief description
	X5:24 V	V_I24 V	DC 24 V supply voltage
	X5:GND	GND	Reference potential
	X10:DB0	DB00	Brake control
	X10:GND	GND	Reference potential
	X10:TF1	TF1	Sensor input for temperature evaluation of the motor
	X10:GND	GND	Reference potential
	X30 OUT		System bus
	X30 IN		
	X31		SEW Service interface
	X20:1	DI00	Digital input 1, with fixed assignment "Output stage enable"
	X20:2	DI01	Digital input 2, freely programmable
	X20:3	DI02	Digital input 3, freely programmable
	X20:4	DI03	Digital input 4, freely programmable
	X20:5	DI04	Digital input 5, freely programmable
	X20:6	DI05	Digital input 6, freely programmable
	X20:7	Reserved	–
	X20:8	Reserved	–
	X20:9	GND	Reference potential
	X21:1	+24 V	DC 24 V voltage output
	X21:2	DO00	Digital output 1, freely programmable
	X21:3	DO01	Digital output 2, freely programmable
	X21:4	DO02	Digital output 3, freely programmable
	X21:5	DO03	Digital output 4, freely programmable
	X21:6	GND	Reference potential
	X6:1	STO_P1	DC +24 V input STO_P1
	X6:2	STO_M	Reference potential for STO_P1 and STO_P2
	X6:3	STO_P2	DC +24 V input STO_P2
	X6:4	GND	Reference potential
	X6:5	24 V STO_OUT	V_{out} = DC 24 V to supply STO_P1 and STO_P2

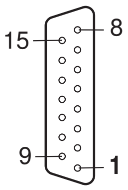
Figure	Terminal	Connection	Brief description motor encoder resolver
	X15:1	S2 (SIN +)	Signal track
	X15:2	S1 (COS +)	Signal track
	X15:3	Reserved	-
	X15:4	Reserved	-
	X15:5	R1 (REF +)	Supply voltage resolver
	X15:6	-TEMP_M	Motor temperature evaluation
	X15:7	Reserved	-
	X15:8	Reserved	-
	X15:9	S4 (SIN -)	Signal track
	X15:10	S3 (COS-)	Signal track
	X15:11	Reserved	-
	X15:12	Reserved	-
	X15:13	R2 (REF -)	Supply voltage resolver
	X15:14	+TEMP_M	Motor temperature evaluation
	X15:15	Reserved	-

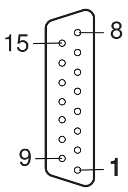
Figure	Terminal	Connection	Brief description motor encoder Sin/Cos encoder, TTL encoder
	X15:1	A (COS +) (K1)	Signal track A (COS+) (K1)
	X15:2	B (SIN +) (K2)	Signal track B (SIN+) (K2)
	X15:3	C (K0)	Signal track C (K0)
	X15:4	Reserved	–
	X15:5	Reserved	–
	X15:6	-TEMP_M	Motor temperature evaluation
	X15:7	Reserved	–
	X15:8	GND	Reference potential
	X15:9	$\overline{A}$ (COS -) ($\overline{K1}$)	Negated signal track $\overline{A}$ (COS-) ($\overline{K1}$)
	X15:10	$\overline{B}$ (SIN -) ($\overline{K2}$)	Negated signal track $\overline{B}$ (SIN-) ($\overline{K2}$)
	X15:11	$\overline{C}$ ($\overline{K0}$)	Negated signal track $\overline{C}$ ($\overline{K0}$)
	X15:12	Reserved	–
	X15:13	V_{S24VG}	24 V encoder supply
	X15:14	+TEMP_M	Motor temperature evaluation
	X15:15	V_{S12VG}	12 V encoder supply

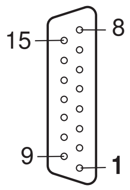
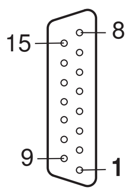
Figure	Terminal	Connection	Brief description motor encoder HTL encoder
	X15:1	A (K1)	Signal track A (K1)
	X15:2	B (K2)	Signal track B (K2)
	X15:3	C (K0)	Signal track C (K0)
	X15:4	Reserved	–
	X15:5	Reserved	–
	X15:6	-TEMP_M	Motor temperature evaluation
	X15:7	Reserved	–
	X15:8	GND	Reference potential
	X15:9	$\overline{A}$ ($\overline{K1}$)	Negated signal track $\overline{A}$ ($\overline{K1}$)
	X15:10	$\overline{B}$ ($\overline{K2}$)	Negated signal track $\overline{B}$ ($\overline{K2}$)
	X15:11	$\overline{C}$ ($\overline{K0}$)	Negated signal track $\overline{C}$ ($\overline{K0}$)
	X15:12	Reserved	–
	X15:13	V_{S24VG}	24 V encoder supply
	X15:14	+TEMP_M	Motor temperature evaluation
	X15:15	V_{S12VG}	12 V encoder supply

Figure	Terminal	Connection	Brief description motor encoder HIPERFACE® and SEW encoder (RS485)
	X15:1	A (COS +) (K1)	Signal track A (COS+) (K1)
	X15:2	B (SIN +) (K2)	Signal track B (SIN+) (K2)
	X15:3	Reserved	–
	X15:4	DATA+	Data line (+) RS485
	X15:5	Reserved	–
	X15:6	-TEMP_M	Motor temperature evaluation
	X15:7	Reserved	–
	X15:8	GND	Reference potential
	X15:9	$\overline{A}$ (COS -) ($\overline{K1}$)	Negated signal track $\overline{A}$ (COS-) ($\overline{K1}$)
	X15:10	$\overline{B}$ (SIN -) ($\overline{K2}$)	Negated signal track $\overline{B}$ (SIN-) ($\overline{K2}$)
	X15:11	Reserved	–
	X15:12	DATA-	Data line
	X15:13	V_{S24VG}	24 V encoder supply
	X15:14	+TEMP_M	Motor temperature evaluation
	X15:15	V_{S12VG}	12 V encoder supply

23061715/EN – 03/2017

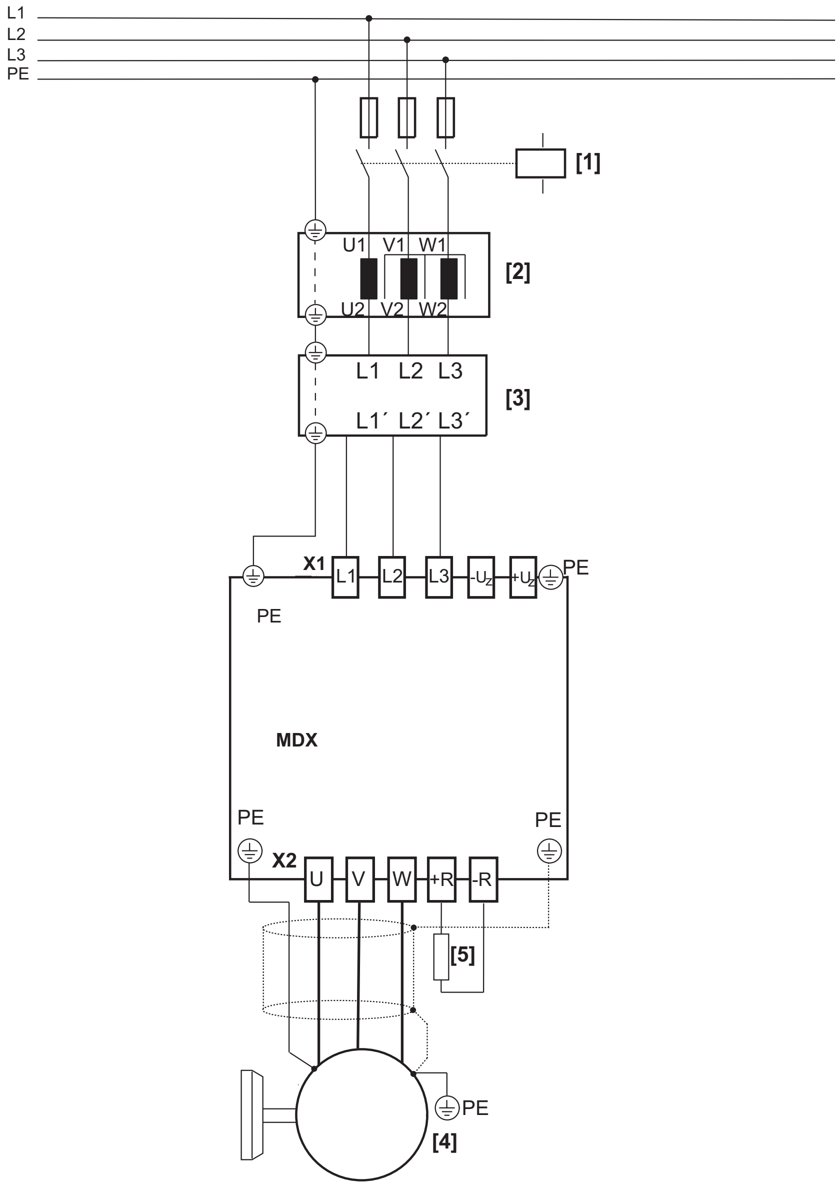
8.12 Wiring diagrams

8.12.1 General information on the wiring diagrams

- For technical data of the power electronics and the control electronics, refer to chapter "Technical data" (→ 🗎 32).
- For the terminal assignment and connections, refer to chapter "Terminal assignment" (→ 🗎 212).

8.12.2 Power connection

Wiring of the power connections with line contactor, line choke, line filter



18014412388387467

[1]	Line contactor	[4]	Motor
[2]	Line choke (optional)	[5]	Braking resistor (optional)
[3]	Line filter (optional)		

23061715/EN – 03/2017

Wiring of the power connections with line choke, line filter without line contactor

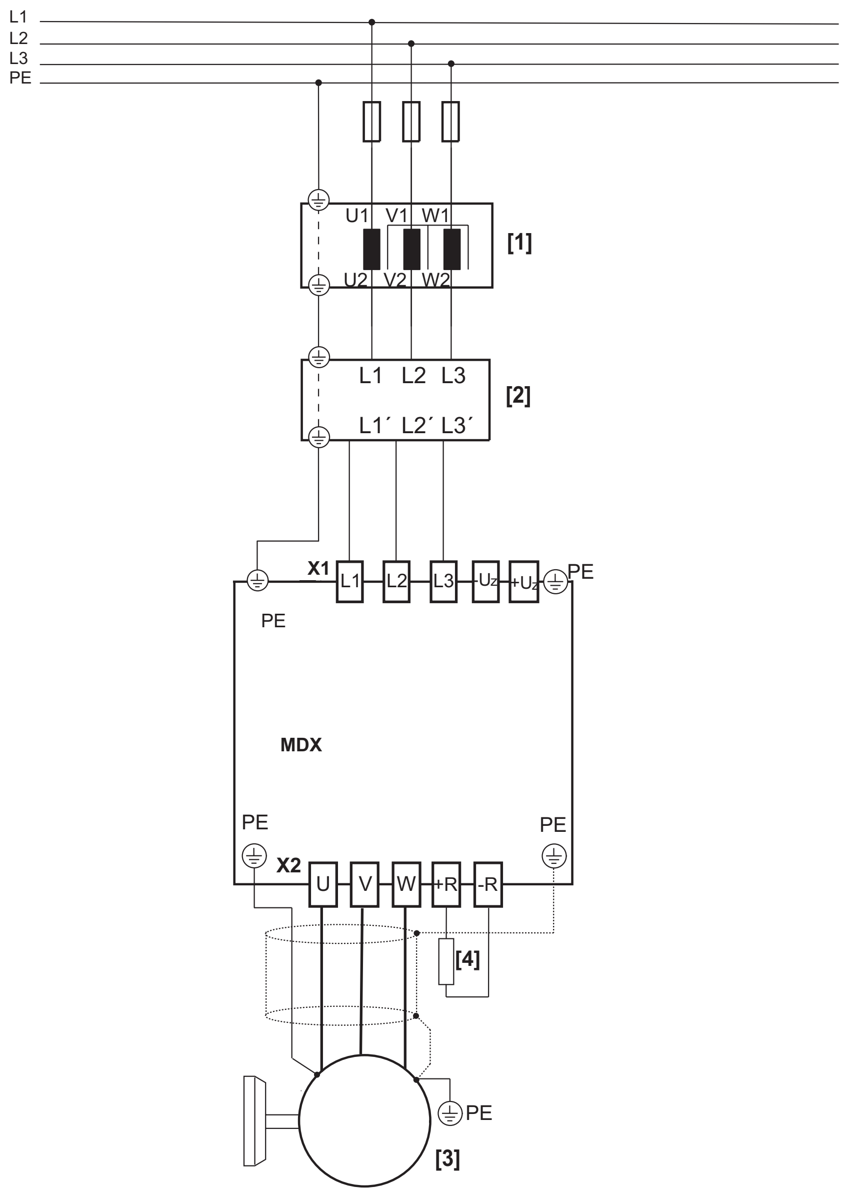
Refer to the table in chapter "Line contactor" (→ 🗎 177) to find out which application inverters can be operated without line contactor.

NOTICE

Operation without line contactor

Operation of an application inverter with connected braking resistor without line contactor may result in heavy damage with the following application inverter:

- MDX90A-0020 – 0240-5_3-..
- MDX90A-0070 – 0420-2_3-..



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[1]	Line choke (optional)	[3]	Motor
[2]	Line filter (optional)	[4]	Braking resistor (optional)

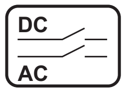
23061715/EN – 03/2017

INFORMATION

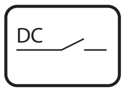
In case of a line connection without line contactor, the temperature evaluation of the braking resistor via a digital input of the application inverter must be ensured. The connected digital input must be parameterized for monitoring the braking resistor temperature evaluation.

8.12.3 Brake control

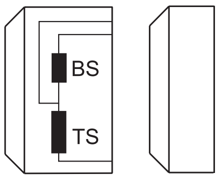
Key:



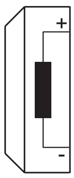
Cut-off in the DC and AC circuits
(Rapid brake application)



Cut-off in the DC circuit



Brake
BS = accelerator coil
TS = coil section



DC brake with one brake coil

Auxiliary terminal strip in terminal box

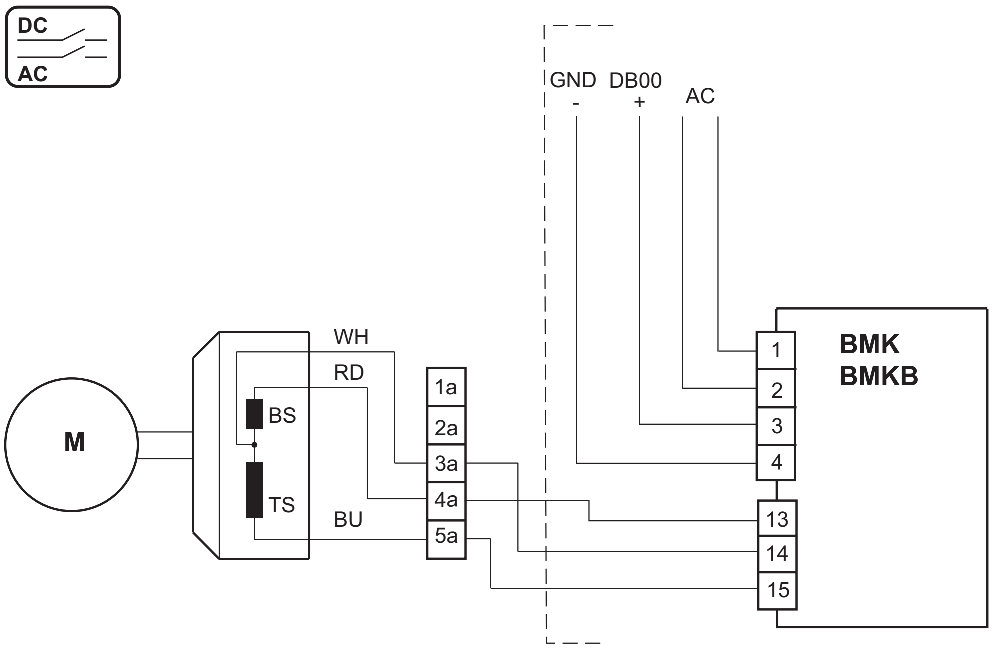
Control cabinet limit

WH	White
RD	Red
BU	Blue

INFORMATION

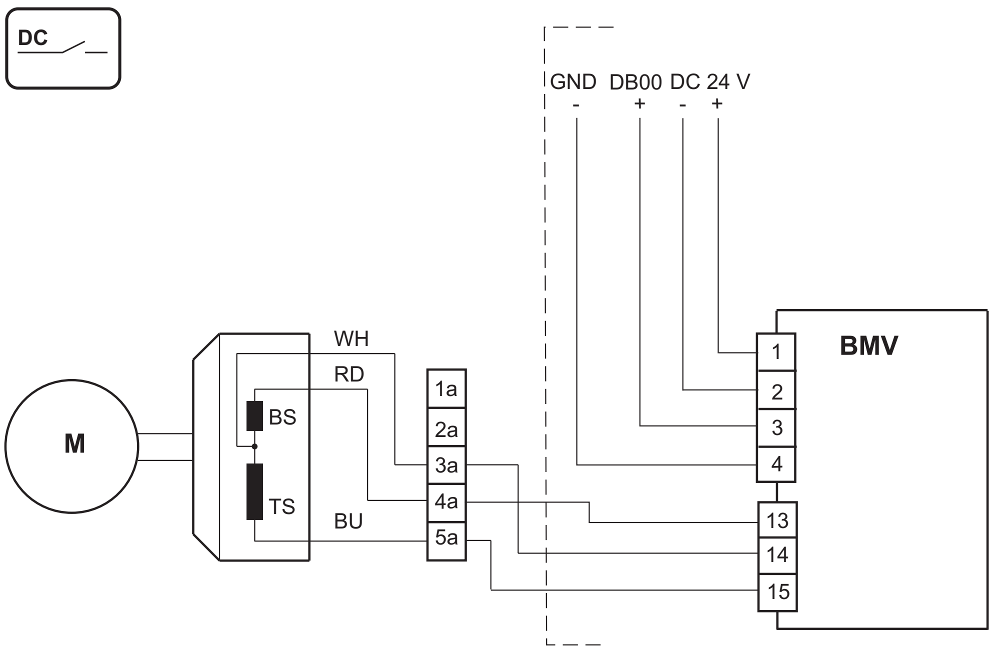
The selection of the brake control and the shown connection diagrams only represent one of the many possibilities. Observe the catalogs and operating instructions of the motors for more information and installation notes.

BMK. brake control



14324495755

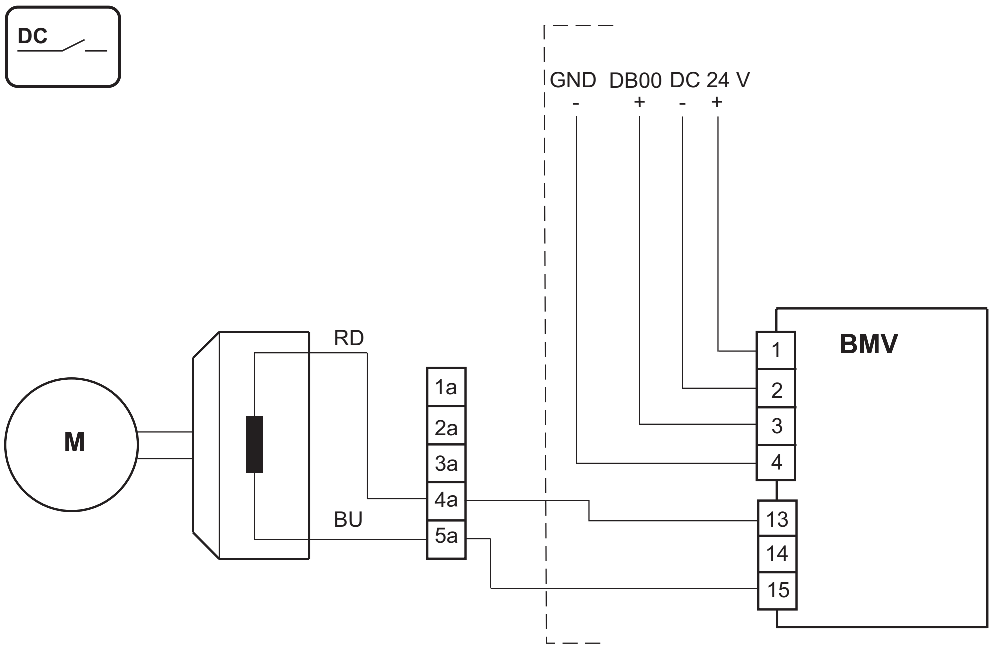
BMV brake control – 2 coils



14373482507

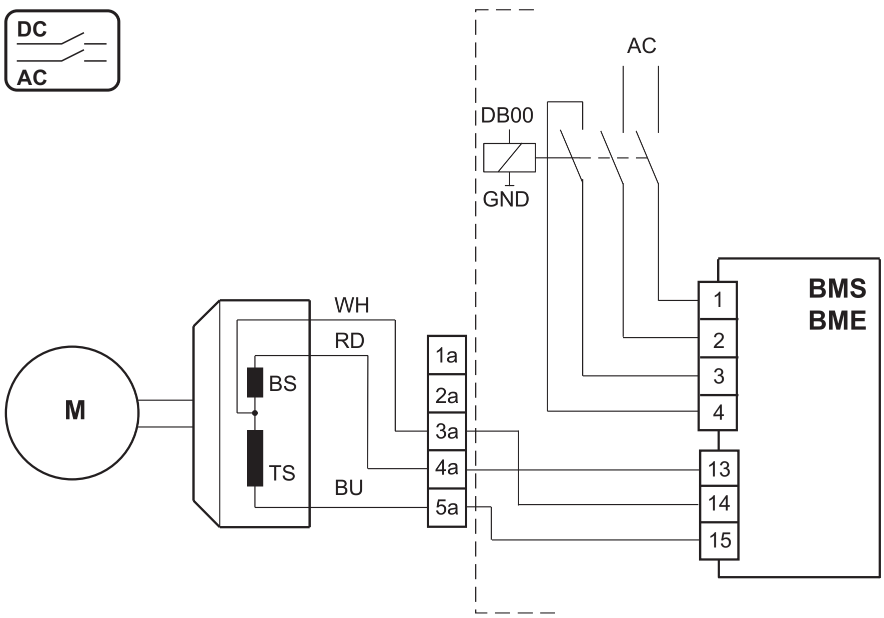
23061715/EN – 03/2017

BMV brake control – 1 coil



14373494923

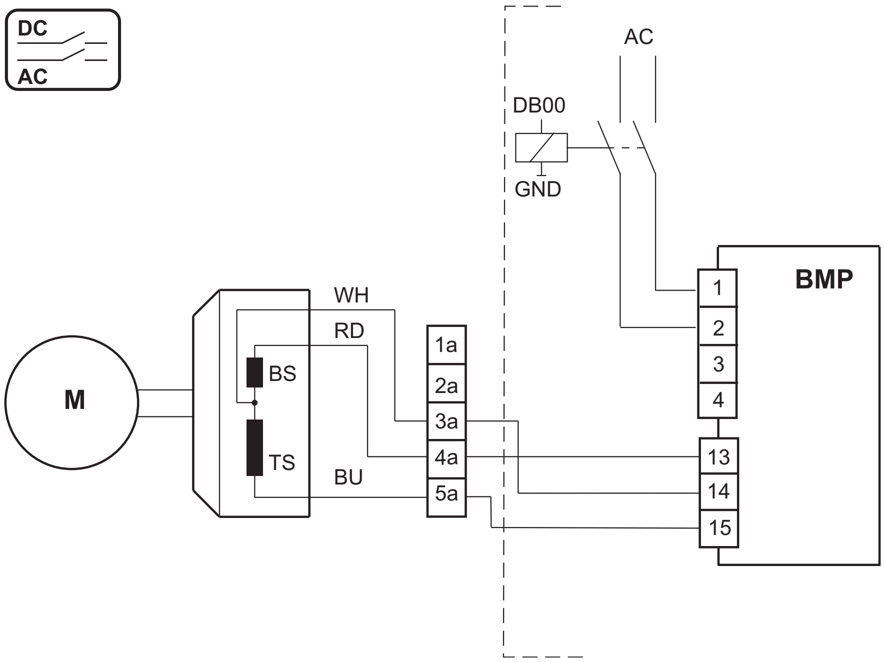
BMS, BME brake control



14324554891

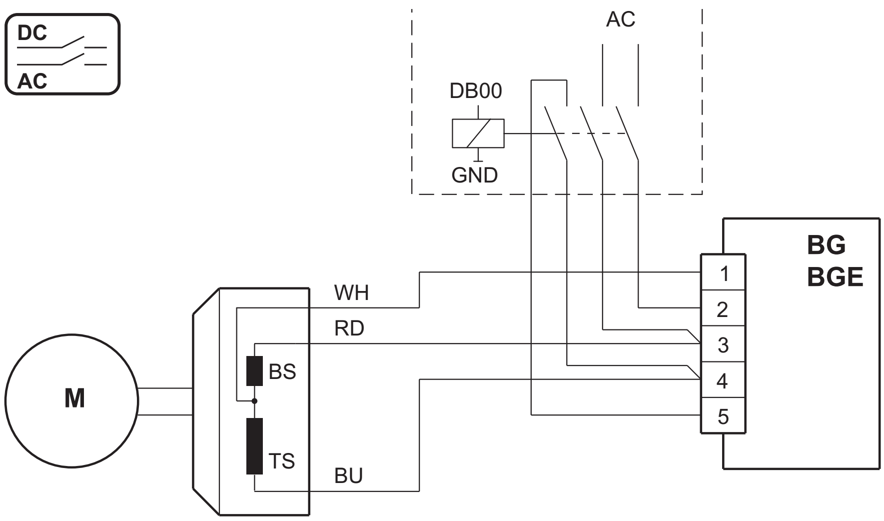
23061715/EN – 03/2017

BMP brake control



14324544523

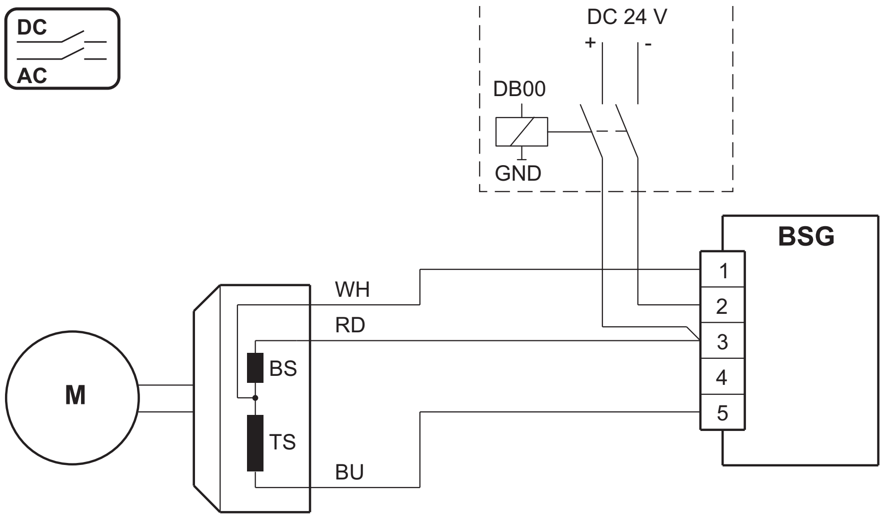
BG, BGE brake control



14324565259

23061715/EN – 03/2017

BSG brake control



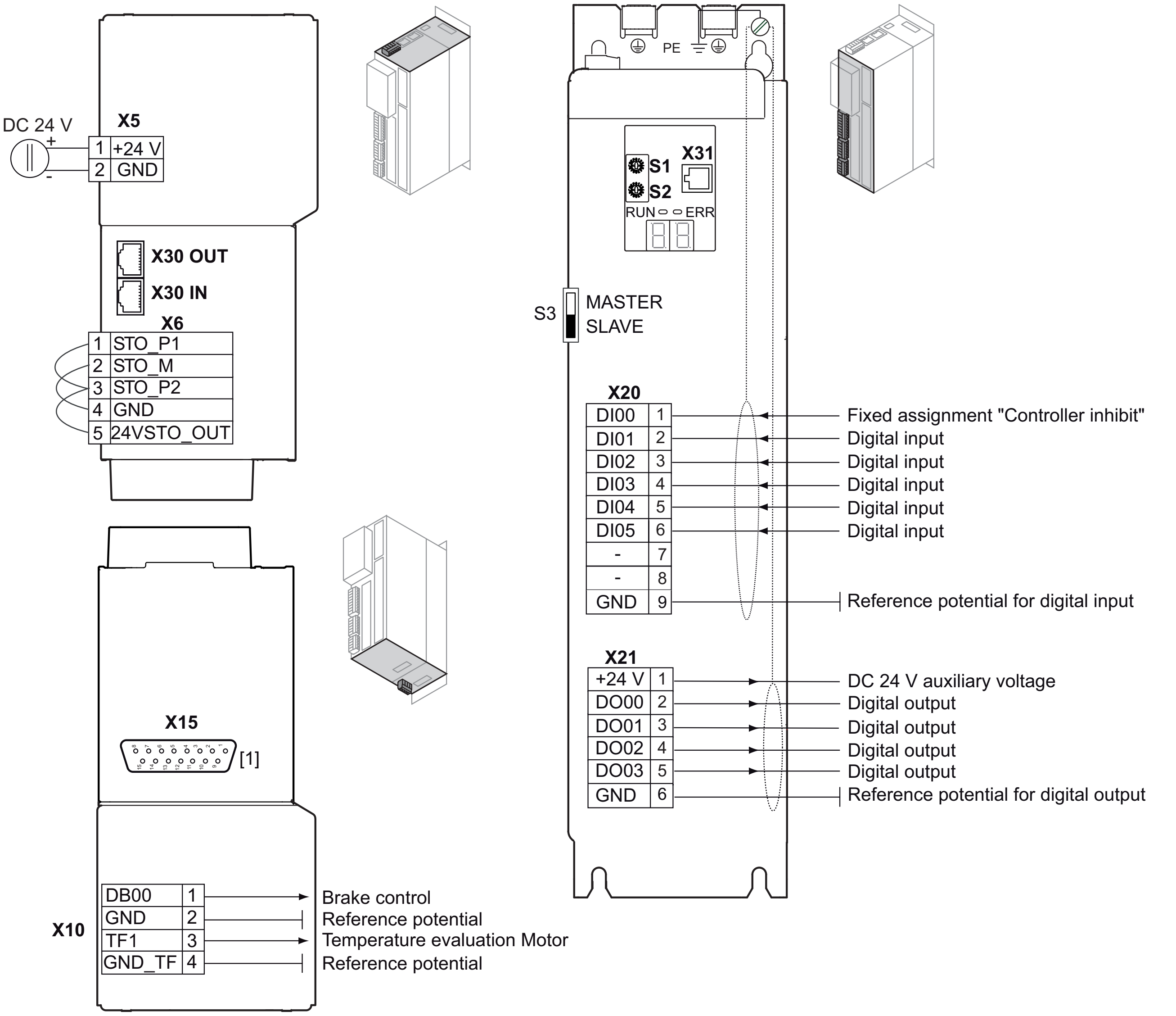
14324597131

23061715/EN – 03/2017

8.12.4 Electronics connection

Wiring the control electronics

For the terminal assignment and connections, refer to chapter "Terminal assignment" (→ 🗎 212).



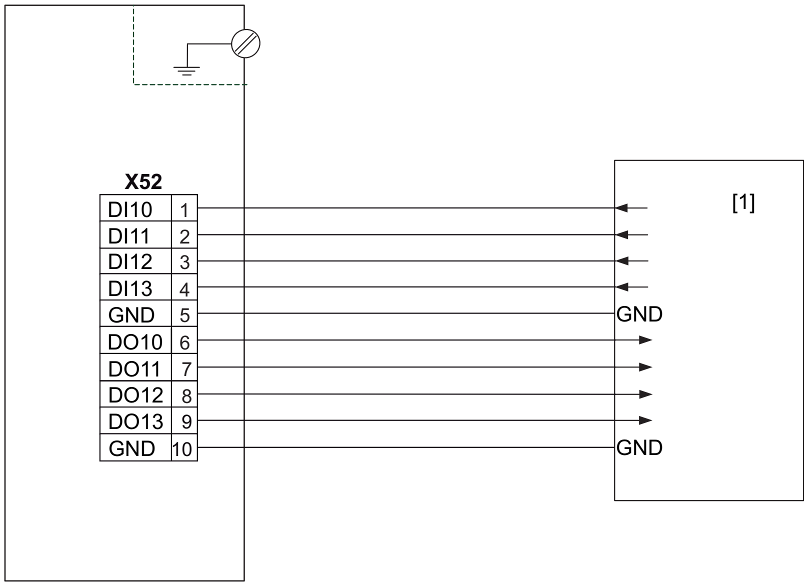
9007214594818315

X5	Connection +24 V supply voltage
X6	Connection for safe disconnection (STO). Cable jumpers are installed at factory.
X10	Brake control and temperature monitoring motor
X15	Motor encoder connection
X20	Digital inputs
X21	Digital outputs
X30	System bus
S1	Operating mode module bus
[1]	Motor encoder connection

23061715/EN – 03/2017

8.12.5 Connection diagram CIO21A and CID21A input/output card

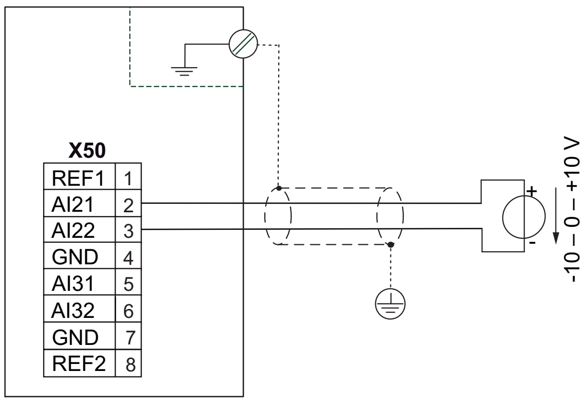
Digital inputs and outputs



18014412829087243

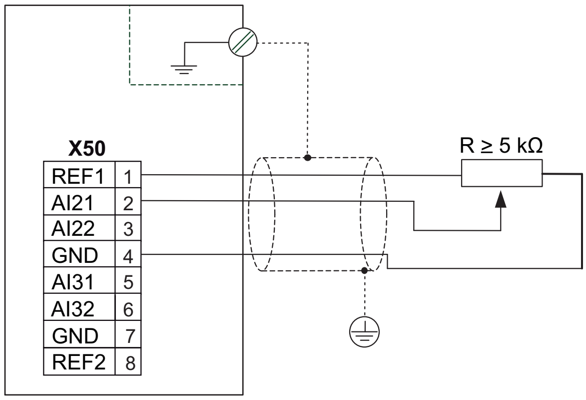
[1] Higher-level controller

Voltage input



9007213575393675

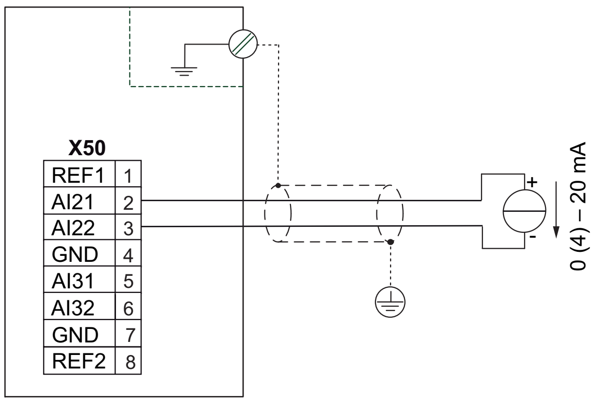
Connection to the terminals AI31 and AI32 is carried out analogously to the connection to the terminals AI21 and AI22 shown in the wiring diagrams.



18014412830137099

Connection to the terminals REF2 and AI31 is carried out analogously to the connection to the terminals REF1 and AI21 shown in the wiring diagrams.

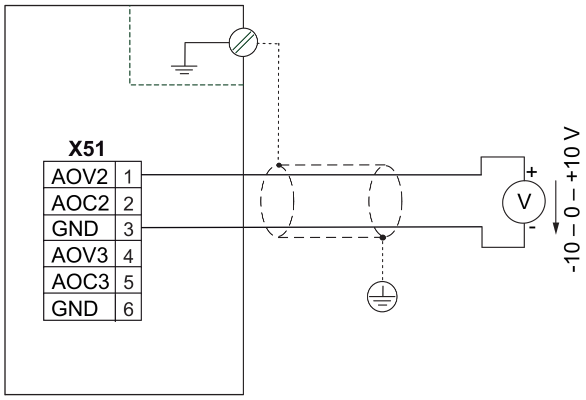
Current input



9007213575398539

Observe the switch position of "DIP switch S50" (→ 🗎 188) when activating the current input.

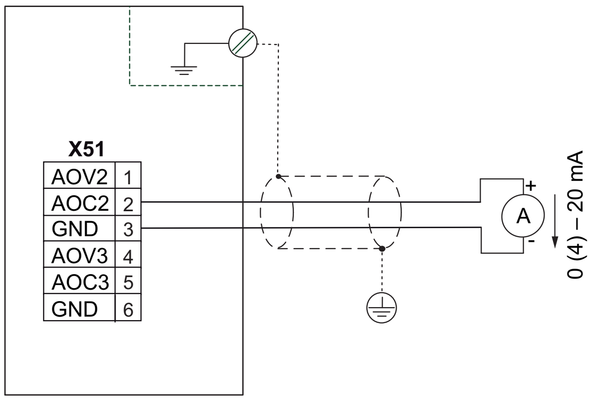
Voltage output



18014412830141963

Connection to the terminals AOV2 and GND is carried out analogously to the connection to the terminals AOV1 and GND shown in the wiring diagram.

Current output



18014412830272395

Connection to the terminals AOC2 and GND is carried out analogously to the connection to the terminals AOC1 and GND shown in the wiring diagram.

23061715/EN – 03/2017

8.13 UL-compliant installation

UL approval of the application inverter is in preparation.

23061715/EN – 03/2017

9 Startup

9.1 General

9.1.1 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.

9.1.2 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.

- After disconnection from the supply system, observe a minimum switch-off time of 10 s.
- Do not turn the power of the supply system on or off **more** than **once per minute**.

9.1.3 Connecting cables

NOTICE

Cables may only be connected and plugged in a de-energized state.

Irreparable damage to the application inverter or unforeseeable malfunctions.

- De-energize the application inverter.

23061715/EN – 03/2017

9.2 Setting the EtherCAT®/SBus^{PLUS} ID

The hexadecimal switches S1 and S2 must be set to "0".

9.3 Startup requirements

The following conditions apply to startup:

- You installed the application inverter correctly both mechanically and electrically.
- You 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.

Required software:

- Engineering software MOVISUITE® standard from SEW-EURODRIVE.

23061715/EN – 03/2017

9.4 Startup procedure

The application inverters are taken into operation using the engineering software MOVISUITE® from SEW-EURODRIVE.

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The startup is functionally divided into segments. The following steps illustrate an example of the startup procedure for an application inverter.

Drive train segment

Drive train		Configuring drive trains.

Interfaces segment

Built-in interfaces		Basic settings of the installed interfaces • EtherCAT® • Standard I/O • Encoder 1
Options		Basic settings of the options • Fieldbus • I/O card • Encoder 2 • DriveSafety®

Functions segment

I/O configuration		• Standard I/O • I/O card DI/DO • I/O card AI/AO
PO configuration		• Basic settings • PO data • Setpoint buffer • Fixed setpoints • Control word 1 – 3

23061715/EN – 03/2017

PI configuration	• PI data • Status word 1 – 3
Drive functions	• FCB05 Speed control • FCB06 Interpolated speed control • FCB08 Interpolated torque control • FCB09 Positioning • FCB10 Interpolated position control • FCB12 Reference travel
Advanced drive functions	• FCB01 Output stage inhibit • FCB20 Jog mode • FCB21 Brake test • FCB26 Stop at user limit
Event-driven functions	• Touchprobe 1 • Touchprobe 2 • Cam switch
Monitoring functions	• Reference signals • Limit values 1 • Limit values 2 • Monitoring functions 1 • Control functions 2 • Energy-saving function
User units	Converting system units into user units.

Information on the application inverter

Device data is available via the project nodes.

Device data	• Device identification • Main component • Subcomponent • Production label
Overview of fault responses	• Axis module • Power supply monitoring • Functions
Setup	• Parameter set selection • Access rights • Resetting device parameters.

9.4.1 Check list for startup

The following checklist lists the necessary steps for complete startup.

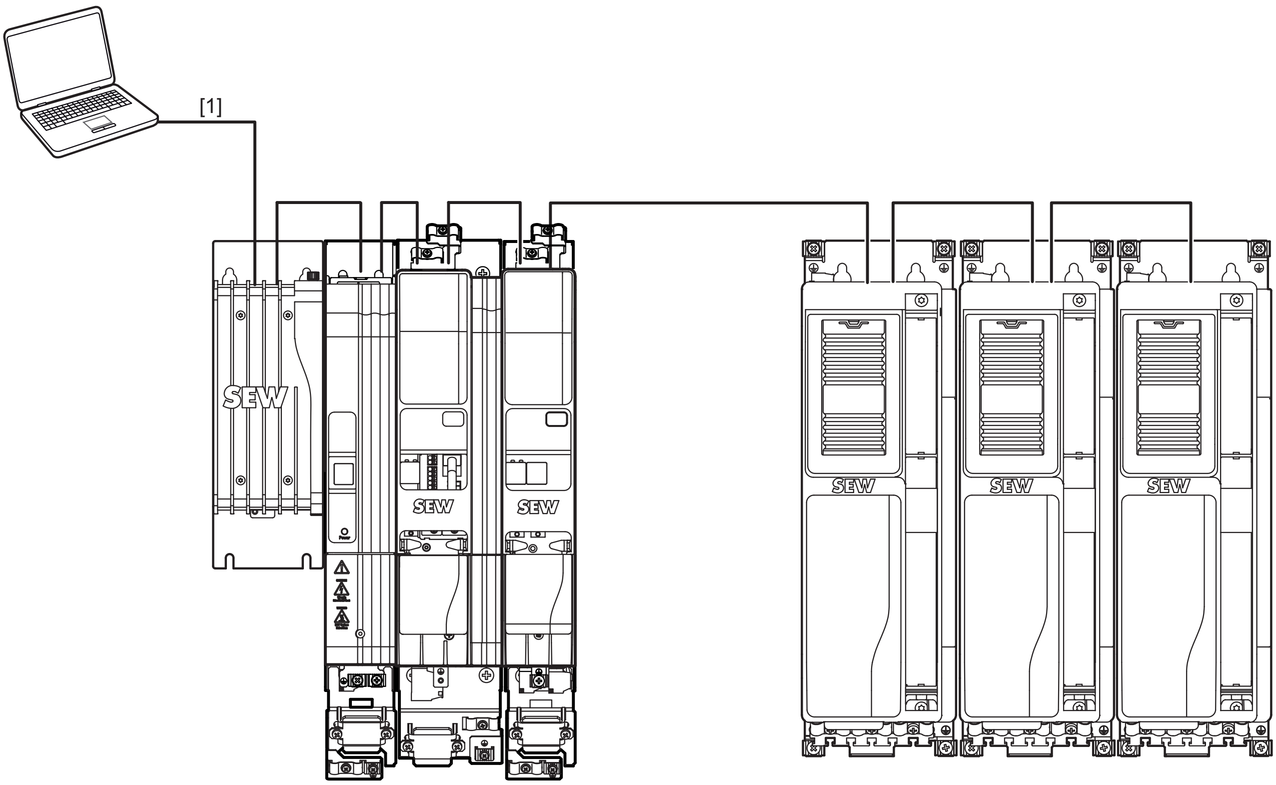
Step	Startup step	Done
1	Motor installation	

Step	Startup step	Done
2	Install MOVI-C® component	
3	Start MOVISUITE®	
4	Start up the drive train	
5	Parameterize setpoints and FCBs	
6	Configure digital inputs and outputs	
7	Configure PD	
8	Configure software module (MOVIKIT®)	
9	Test drives/application	

23061715/EN – 03/2017

9.5 Connection to the engineering software

The following figure shows the connection of the application inverter to the MOVISUITE® engineering software using a PC.



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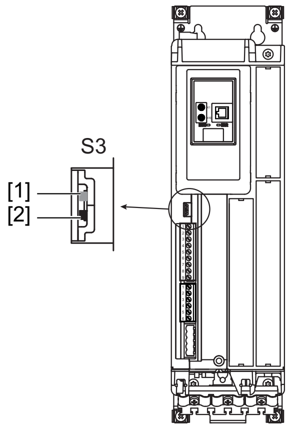
[1] Ethernet

9.6 Setting the module bus operating mode

If 2 MOVIDRIVE® system application inverters are connected via a DC link connection, the require the information whether they are module bus master or module bus slave in the network. This is set with switch S3 "Module bus operating mode".

In the following chapter "Connection types" and the table "Setting options" (→ 🗎 236), the setting of the S3 switch for the respective modules is specified.



15687969931

[1] Switch setting "Master"

[2] Switch setting "Slave"

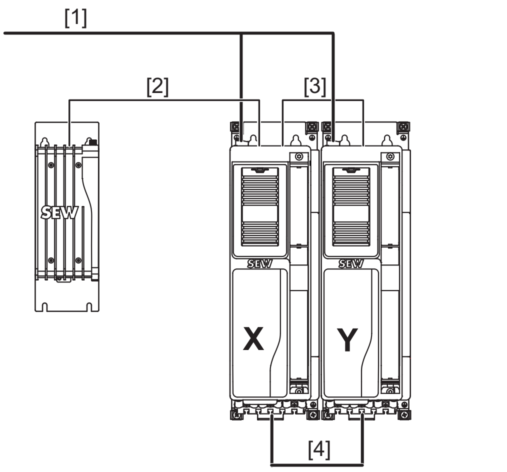
23061715/EN – 03/2017

9.6.1 Connection types

When connecting several devices without DC link connection, the S3 switch must always be set to "Master".

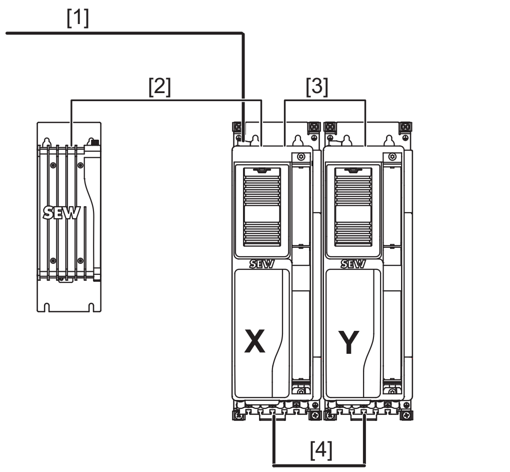
When connecting several MOVIDRIVE® system application inverters with DC link connection, the switch must be set as follows:

Connection type A



16081023627

Connection type B



16081026059

[1] Line cable

[2] System bus cable

[3] Module bus cable

[4] DC link connection

9.6.2 Setting options

The following settings are possible:

	Operating mode module bus	
	Module X	Module Y
Connection type A	Master	Master
Connection type B	Master	Slave

23061715/EN – 03/2017

10 Operation

10.1 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.
- The fact that the operation LED is no longer illuminated does not indicate that the application inverter has been disconnected from the power supply and no longer carries any voltage.
- Before you touch the power terminals, check to see that the application inverter has been disconnected from the supply system.
- Observe the general safety notes in chapter "Safety notes" (→ 🗎 151) and the notes in chapter "Electrical installation" (→ 🗎 173).

⚠ 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 people and damage to machinery.

NOTICE

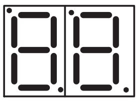
Switching the motor output at the application inverter with enabled output stage.

Damage to the application inverter.

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

10.2 7-segment display

10.2.1 Operating displays



- The two 7-segment displays indicate the operating state of the application inverter.

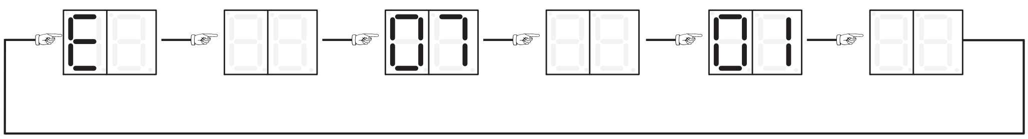
10.2.2 Fault display

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 displayed as flashing numeric values in the application inverter.

The fault code is displayed in the following display sequence:



12082058123

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

10.3 Operating displays

Display	Description	State	Comment/action
Displays during boot process			
b0 b1 b3 br	Unit passes through several states when loading the firmware (boot) to get 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 defective.

Display	Description	State	Comment/action
Displays of different device statuses			
.	Energy-saving mode		Energy-saving mode active
00	DC link voltage missing.	• Status: Not ready. • Output stage is inhibited. • Communication is possible.	Check supply system.
C2 Flashing	STO active.	• Status: Not ready. • Output stage is inhibited. • Communication is possible.	The function Safe Torque Off is active.
C3 Flashing	Incorrect synchronization with bus. Process data processing not available.		• Check bus connection. • Check synchronization setting at device and controller. • Check process data settings at device and controller.
C4 Flashing	Encoder evaluation is not ready.		• Encoders are being initialized. • Device stays in this condition: – No encoder selected. – "Source actual speed" or "Actual position" parameter shows an encoder that does not exist.
C5 Flashing	Motor management is not ready.		
C6 Flashing	Internal device supply incomplete.		
C7 Flashing	Power section not ready.		
C8 Flashing	External device not ready.		
C9 Flashing	Data flexibility level is not ready.		
Cd Flashing	Parameter download running.		

Display	Description	State	Comment/action
Displays during initialization processes (parameters will be reset to default values)			
d0 Flashing	Basic initialization.	• Status: Not ready. • Output stage is inhibited. • Communication is possible.	Waiting for initialization to finish.
d1 Flashing	Initialization of delivery state.		

Display	Description	State	Comment/action
Displays during normal operation			
01	Output stage inhibit	• Output stage is inhibited.	The drive is not actuated by the output stage. The brake is closed, motor coasts without brake. FCB 01 is permanently selected with terminal DI00. However, it can be selected by additional sources.

23061715/EN – 03/2017

Display	Description	State	Comment/action
02	Default stop	For further information refer to the "FCB" (→ 🗎 15) description.	Drive function (FCB) "Default stop" active, if not other FCB is selected and the system is ready.
04	Manual mode		Manual mode active
05	Speed control		Speed control with internal ramp generator.
06	Interpolated speed control		Speed control with setpoints cyclically via bus. The ramp generator is located externally, e.g. in the higher-level controller.
07	Torque control		Torque control
08	Interpolated torque control		Torque control with setpoints cyclically via bus.
09	Position control		Position mode with internal ramp generator.
10	Interpolated position control		Positioning mode with setpoints cyclically via bus. The ramp generator is located externally, e.g. in the higher-level controller.
12	Reference travel		The drive performs reference travel.
13	Stop at application limits		Deceleration at the application limit. FCB 13 is active if no other FCB is selected with the de-fault FCB 02.
14	Emergency stop		Deceleration at the emergency stop limit.
18	Rotor position identification		Encoder commutation for synchronous motors.
19	Position hold control		Position control on current position.
20	Jog		Jog mode active.
21	Brake test		Brake is tested by applying a torque in close state of the brake.
25	Motor parameter measurement		Motor parameter measurement active
26	Stop at user limits		Serves to stop at user limits.

23061715/EN – 03/2017

10.4 Fault description

10.4.1 Fault 1 Output stage monitoring

Subfault: 1.1
Description: Short circuit in motor output terminals

Response: Inhibit output stage

Cause	Measure
Overcurrent in output stage or faulty output stage control detected, and output stage inhibited by the hardware.	Possible causes for overcurrent are short circuit at the output, excessive motor current, or a defective power output stage.

Subfault: 1.2
Description: Overcurrent in output stage

Response: Inhibit output stage

Cause	Measure
Motor current too high.	Connect a smaller motor.
Current supply.	Check current supply.
Current transformer.	Check current transformer.
Ramp limit is deactivated and set ramp time is too short.	Increase ramp time.
Phase module defective.	Check phase module.
Supply voltage 24 V or 24 V generated from it is instable.	Check 24 V supply voltage.
Interruption or short circuit on the signal lines of the phase modules.	Check signal lines.

10.4.2 Fault 3 Ground fault

Subfault: 3.1
Description: Ground fault

Response: Inhibit output stage

Cause	Measure
Ground fault in motor lead.	Eliminate ground fault in motor lead.
Ground fault in inverter.	Eliminate ground fault in inverter.
Ground fault in motor.	Eliminate ground fault in motor.

10.4.3 Fault 4 Brake chopper

Subfault: 4.1
Description: Brake chopper overcurrent

Response: Inhibit output stage

Cause	Measure
Too much regenerative power.	Extend deceleration ramps.
Short circuit in the braking resistor circuit.	Check supply cable to braking resistor.
Braking resistance too high.	Check technical data of braking resistor.

Subfault: 4.2
Description: Brake chopper defective

Response: Inhibit output stage

Cause	Measure
Output stage of brake chopper defective.	Replace defective brake chopper.

10.4.4 Fault 6 Line fault

Subfault: 6.1
Description: Line phase failure

Response: Line phase failure

Cause	Measure
A missing line phase was detected.	Check supply system cable.
DC link voltage periodically too low.	Check the configuration of the supply system.
Inadequate line voltage quality.	Check supply (fuses, contactor).

10.4.5 Fault 7 DC link fault

Subfault: 7.1
Description: DC link overvoltage

Response: Inhibit output stage

Cause	Measure
The maximum permitted DC link voltage limit was exceeded, and the output stage was inhibited by the hardware.	– Extend deceleration ramps. – Check supply cable to the braking resistor. – Check technical data of braking resistor.

10.4.6 Fault 8 Speed monitoring fault

Subfault: 8.1
Description: Speed monitoring – motor mode

Response: Inhibit output stage

Cause	Measure
The speed controller operates at setting limit (mechanical overload or phase failure in the supply system or the motor).	Increase set delay time of speed monitoring or reduce load.
The encoder is not connected correctly.	Check encoder connection and direction of rotation. If necessary, increase current limiting or reduce acceleration values.
Encoder has incorrect direction of rotation.	– Check encoder connection and direction of rotation. If necessary, increase current limiting. If necessary, reduce acceleration values. – Check motor lead and motor, check line phases.

Subfault: 8.2
Description: Speed monitoring – generator mode

Response: Inhibit output stage

Cause	Measure
The speed controller operates at setting limit (mechanical overload or phase failure in the supply system or the motor).	Increase set delay time of speed monitoring or reduce regenerative load.
The encoder is not connected correctly.	Check encoder connection and direction of rotation. If necessary, increase current limiting or reduce deceleration values.
Encoder has incorrect direction of rotation.	– Check encoder connection and direction of rotation. If necessary, increase current limiting. If necessary, reduce deceleration values. – Check motor lead and motor, check line phases.

Subfault: 8.3
Description: Motor limit speed exceeded

Response: Inhibit output stage

Cause	Measure
The maximum permitted motor speed was exceeded.	Reduce the maximum speed.

10.4.7 Fault 9 control mode

Subfault: 9.1
Description: Magnetization of motor not possible

Response: Inhibit output stage

Cause	Measure
The user current limit or output stage monitoring has reduced the possible maximum current to such a degree that the required magnetizing current cannot be set.	– Reduce output stage utilization (e.g. by reducing the PWM frequency or by reducing the load). – Increase the user current limit.

Subfault: 9.2
Description: The requested operating mode is not possible with the active control mode

Response: Inhibit output stage

Cause	Measure
The current FCB has activated an operating mode. The active control mode does not support this operating mode, for example "position control" or "torque control" with V/f control mode.	Start up control mode that supports the required operating mode. Connect encoder is necessary. Select an operating mode that is supported by the current control mode.

23061715/EN – 03/2017

Subfault: 9.3 **Description: Absolute rotor position not available**		
	Response: Inhibit output stage	
	Cause	Measure
	The current control mode requires an absolute rotor position. The encoder selected for "Source is actual speed" does not provide an absolute rotor position.	Use absolute encoder, or identify the rotor position using FCB 18.

Subfault: 9.4 **Description: Correct current supply of motor not possible**		
	Response: Inhibit output stage	
	Cause	Measure
	Failure to set the required current during premagnetization.	Check the cabling, or disable the function "current monitoring during premagnetization".

Subfault: 9.5 **Description: Maximum output frequency exceeded**		
	Response: Inhibit output stage	
	Cause	Measure
	Maximum output frequency exceeded.	Reduce maximum speed.

Subfault: 9.6 **Description: Maximum model speed exceeded**		
	Response: Inhibit output stage	
	Cause	Measure
	The speed of the drive calculated in ELSM® control mode is too high for motor control.	If possible minimize the "Speed/position controller sampling cycle", or reduce the speed.

Subfault: 9.8 **Description: Flux model error**		
	Response: Inhibit output stage	
	Cause	Measure
	The rotor flux calculated by the motor model is not plausible, or the calculated internal voltage is too small.	– Check configuration data. – Check motor data. – Check machines: Idle state or too low speed. – Contact SEW-EURODRIVE Service.

Subfault: 9.9 **Description: Parameter measurement not possible with active motor type**		
	Response: Inhibit output stage	
	Cause	Measure
	Parameter measurement is only possible with "asynchronous" and "synchronous" motor types. No magnetic reluctance and LSPM motors.	Select the correct motor type.

10.4.8 Fault 10 Data flexibilization layer

Subfault: 10.1 **Description: initialization**		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	Error during init task.	Contact SEW-EURODRIVE Service.

Subfault: 10.2 **Description: Illegal operation code**		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	Illegal opcode in the data flexibilization layer program.	Contact SEW-EURODRIVE Service.

Subfault: 10.3 **Description: Memory access**		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	Memory area violated while accessing array.	Contact SEW-EURODRIVE Service.

Subfault: 10.4 Description: Stack		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	Data flexibilization layer stack overflow.	Contact SEW-EURODRIVE Service.

Subfault: 10.5 Description: Division by 0		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	Division by 0.	Contact SEW-EURODRIVE Service.

Subfault: 10.6 Description: Runtime		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	Runtime error/watchdog.	Contact SEW-EURODRIVE Service.
	PDI or PDO tasks.	Contact SEW-EURODRIVE Service.

Subfault: 10.7 Description: Calculation result of multiplication/division command too large		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	The calculation result of a multiplication/division command in the data flexibilization layer program exceeds 32 bits.	Contact SEW-EURODRIVE Service.
	The result cannot be written into the result variable.	Contact SEW-EURODRIVE Service.

Subfault: 10.8 Description: Illegal connection		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	The index used in connect is not allowed.	Contact SEW-EURODRIVE Service.

Subfault: 10.9 Description: CRC code		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	The CRC checksum of the code is wrong.	Contact SEW-EURODRIVE Service.

Subfault: 10.10 Description: Setpoint cycle time not supported		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	Non-supported setpoint cycle time parameterized.	Set the setpoint cycle time to the default value 1 ms.

Subfault: 10.11 Description: No application program loaded		
	Response: Inhibit output stage	
	Cause	Measure
	No data flexibilization layer application program loaded.	Contact SEW-EURODRIVE Service.

Subfault: 10.99 Description: Unknown error		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	Unknown data flexibilization layer error.	Contact SEW-EURODRIVE Service.

23061715/EN – 03/2017

10.4.9 Fault 11 Temperature monitoring

Subfault: 11.1 Description: Heat sink overtemperature	
Response: Inhibit output stage	
Cause	Measure
The maximum permitted heat sink temperature was exceeded. The capacity utilization is possibly too high.	– Reduce load. – Reduce rms value of current. – Reduce PWM frequency. – Ensure sufficient cooling. – Reduce ambient temperature.

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

Subfault: 11.3 Description: Device utilization	
Response: Inhibit output stage	
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 PWM frequency.
Ambient temperature too high.	Ensure sufficient cooling.
Unfavorable air convection.	Check air convection.
Fan defective.	Check fan and replace if necessary.

Subfault: 11.5 Description: Electromechanical utilization	
Response: Inhibit output stage	
Cause	Measure
The electromechanical components of the device are over-loaded by excessive continuous current.	Reduce the load: if necessary, reduce the rms value of the cur-rent.

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

Subfault: 11.7 Description: Wire break of the temperature sensor of the heat sink	
Response: Inhibit output stage	
Cause	Measure
Wire break on the temperature sensor of the heat sink.	Contact SEW-EURODRIVE Service.

Subfault: 11.8 Description: Short circuit on the temperature sensor of the heat sink.	
Response: Inhibit output stage	
Cause	Measure
Short circuit on the temperature sensor of the heat sink.	Contact SEW-EURODRIVE Service.

10.4.10 Fault 12 Brake

Subfault: 12.1
Description: Brake output

Response: Application stop (with output stage inhibit)

Cause	Measure
No brake connected.	Check brake connection.
Brake cable disconnected in "ON" status.	Check brake connection.
Overload due to overcurrent > 2 A.	Check sequential profile of brake control.
Overload due to excessive connection (approx. > 0.5 Hz).	Check sequential profile of brake control.
Monitoring is only active with parameter settings "Brake installed" and "Brake applied".	Check whether the connected brake is permitted.

Subfault: 12.2
Description: 24 V brake voltage

Response: Application stop (with output stage inhibit)

Cause	Measure
24 V supply not within permitted tolerance of ±10%.	Check 24 V supply voltage.
Monitoring is only active with parameter settings “Brake installed” and “Brake applied”.	Check parameter setting.

10.4.11 Error 13 Encoder 1

Subfault: 13.1
Description: Position comparison check

Response: Encoder 1 – latest critical fault

Cause	Measure
Faulty comparison between raw position and track counter of absolute encoders.	– Check the track signal wiring. – Check interference source (e.g. from EMC). – Replace encoder. – Replace card. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.2
Description: Unknown encoder type

Response: Encoder 1 – latest critical fault

Cause	Measure
Encoder type is not known and not supported by the inverter.	– Check encoder type. – Contact SEW-EURODRIVE Service. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.3
Description: Invalid data

Response: Encoder 1 – latest critical fault

Cause	Measure
Invalid encoder nameplate data (measuring steps/pulses per revolution/multi-turn).	– Check startup parameters. – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.4
Description: Track measurement

Response: Encoder 1 – latest critical fault

Cause	Measure
Faulty track measurement.	– Switch off the device and on again. – Check wiring. – Check interference source (e.g. from EMC). – Check/replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

23061715/EN – 03/2017

Subfault: 13.5 **Description: Internal warning**		
	Response: Encoder – warning	
	Cause	Measure
	Encoder signals warning status.	– Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). - Clean sensor.

Subfault: 13.6 **Description: Signal level too low**		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Error while monitoring signal level. Vector below permitted limit.	– Check wiring. – Check interference source (e.g. from EMC). – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.7 **Description: Signal level too high**		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Error while monitoring signal level. Vector exceeds permitted limit.	Check the gear ratio of the resolver in use. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.8 **Description: Signal level monitoring**		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Error while monitoring signal level. Vector exceeds permitted limit.	Check the encoder mounting position. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.9 **Description: Quadrant check**		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Error while checking quadrants (sine encoder).	– Switch off the device and on again. – Check wiring. – Check interference source (e.g. from EMC). – Check/replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.10 **Description: Position tolerance band monitoring**		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Position outside tolerance band.	– Check startup parameters. – Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.11 **Description: Data timeout**		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Encoder process data timeout	– Check interference source (e.g. from EMC). – Check startup parameters. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.12 Description: Emergency		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Encoder sends emergency error message.	– Check interference source (e.g. from EMC). – Check startup parameters. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.13 Description: Initialization		
	Response: Encoder 1 – latest fault	
	Cause	Measure
	Communication error during initialization.	– Check parameterization. – Check baud rate. – CANopen interface at encoder (node ID) not set correctly. – Check wiring. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.14 Description: Communication		
	Response: Encoder 1 – latest fault	
	Cause	Measure
	Faulty communication with the encoder.	– Check voltage supply. – Check interference source (e.g. from EMC). – Check wiring. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.15 Description: System error		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Encoder evaluation signals a system error.	– Multi-turn encoder is outside the configured track are. – Check limits. – Check correct settings of encoder numerator/denominator factors. – Check interference source (e.g. from EMC). – Check startup parameters. – Switch off the device and on again. – Contact SEW-EURODRIVE service if the error is still present. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.16 Description: Permanent high level in data line – critical		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Permanent high level of data signal.	– Check wiring. – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.17 Description: Permanent high level in data line.		
	Response: Encoder 1 – latest fault	
	Cause	Measure
	Permanent high level of data signal.	– Check wiring. – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

23061715/EN – 03/2017

Subfault: 13.18 Description: Permanent low level in data line – critical		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Permanent low level of data signal.	– Check wiring. – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.19 Description: Permanent low level in data line		
	Response: Encoder 1 – latest fault	
	Cause	Measure
	Permanent low level of data signal.	– Check wiring. – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.20 Description: SSI error bit – critical		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Error bit set in SSI protocol.	– Check startup parameters. – Check settings at SSI encoder (error bit). – Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.21 Description: SSI error bit		
	Response: Encoder 1 – latest fault	
	Cause	Measure
	Error bit set in SSI protocol.	– Check startup parameters. – Check settings at SSI encoder (error bit). – Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.22 Description: Internal fault – critical		
	Response: Encoder 1 – latest critical fault	
	Cause	Measure
	Encoder signals internal fault status.	– Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.23 Description: Internal fault		
	Response: Encoder 1 – latest fault	
	Cause	Measure
	Encoder signals internal fault status.	– Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.24 Description: Travel range exceeded	
Response: Encoder 1 – latest fault	
Cause	Measure
The current position mode (8381.10) does not allow for a larger travel range.	Check travel range. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 13.25 Description: Encoder startup	
Response: Inhibit output stage	
Cause	Measure
Fatal error during startup	Switch the device off/on. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

10.4.12 Fault 14 Encoder 2

Subfault: 14.1 Description: Position comparison check	
Response: Encoder 2 – latest critical fault	
Cause	Measure
Faulty comparison between raw position and track counter of absolute encoders.	– Check the track signal wiring. – Check interference source (e.g. from EMC). – Replace encoder. – Replace card. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.2 Description: Unknown encoder type	
Response: Encoder 2 – latest critical fault	
Cause	Measure
Encoder type is not known and not supported by the inverter.	– Check encoder type. – Contact SEW-EURODRIVE Service. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.3 Description: Invalid data	
Response: Encoder 2 – latest critical fault	
Cause	Measure
Invalid encoder nameplate data (measuring steps/pulses per revolution/multi-turn).	– Check startup parameters. – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.4 Description: Track measurement	
Response: Encoder 2 – latest critical fault	
Cause	Measure
Faulty track measurement.	– Switch off the device and on again. – Check wiring. – Check interference source (e.g. from EMC). – Check/replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.5 Description: Internal warning	
Response: Encoder – warning	
Cause	Measure
Encoder signals warning status.	– Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). - Clean sensor.

Subfault: 14.6 Description: Signal level too low		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Error while monitoring signal level. Vector below permitted limit.	– Check wiring. – Check interference source (e.g. from EMC). – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.7 Description: Signal level too high		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Error while monitoring signal level.Vector exceeds permitted limit.	Check the gear ratio of the resolver in use. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.8 Description: Signal level monitoring		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Error while monitoring signal level.Vector exceeds permitted limit.	Check the encoder mounting position. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.9 Description: Quadrant check		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Error while checking quadrants (sine encoder).	– Switch off the device and on again. – Check wiring. – Check interference source (e.g. from EMC). – Check/replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.10 Description: Position tolerance band monitoring		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Position outside tolerance band.	– Check startup parameters. – Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.11 Description: Data timeout		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Encoder process data timeout.	– Check interference source (e.g. from EMC). – Check startup parameters. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.12 Description: Emergency		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Encoder sends emergency error message.	– Check interference source (e.g. from EMC). – Check startup parameters. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.13 Description: initialization		
	Response: Encoder 2 – latest fault	
	Cause	Measure
	Communication error during initialization.	– Check parameterization. – Check baud rate. – CANopen interface at encoder (node ID) not set correctly. – Check wiring. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.14 Description: Communication		
	Response: Encoder 2 – latest fault	
	Cause	Measure
	Faulty communication with the encoder.	– Check voltage supply. – Check interference source (e.g. from EMC). – Check wiring. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.15 Description: System error		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Encoder evaluation signals a system error.	– Multi-turn encoder is outside the configured track are. – Check limits. – Check correct settings of encoder numerator/denominator factors. – Check interference source (e.g. from EMC). – Check startup parameters. – Switch off the device and on again. – Contact SEW-EURODRIVE service if the error is still present. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.16 Description: Permanent high level in data line – critical		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Permanent high level of data signal.	– Check wiring. – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.17 Description: Permanent high level in data line		
	Response: Encoder 2 – latest fault	
	Cause	Measure
	Permanent high level of data signal.	– Check wiring. – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.18 Description: Permanent low level in data line – critical		
	Response: Encoder 2 – latest critical fault	
	Cause	Measure
	Permanent low level of data signal.	– Check wiring. – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

23061715/EN – 03/2017

Subfault: 14.19 Description: Permanent low level in data line	
Response: Encoder 2 – latest fault	
Cause	Measure
Permanent low level of data signal.	– Check wiring. – Check encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.20 Description: SSI error bit – critical	
Response: Encoder 2 – latest critical fault	
Cause	Measure
Error bit set in SSI protocol.	– Check startup parameters. – Check settings at SSI encoder (error bit). – Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.21 Description: SSI error bit	
Response: Encoder 2 – latest fault	
Cause	Measure
Error bit set in SSI protocol.	– Check startup parameters. – Check settings at SSI encoder (error bit). – Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.22 Description: Internal fault – critical	
Response: Encoder 2 – latest critical fault	
Cause	Measure
Encoder signals internal fault status.	– Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.23 Description: Internal fault	
Response: Encoder 2 – latest fault	
Cause	Measure
Encoder signals internal fault status.	– Check wiring. – Check interference source (light beam interrupted, reflector, data cable, etc.). – Replace encoder. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

Subfault: 14.24 Description: Travel range exceeded	
Response: Encoder 2 – latest fault	
Cause	Measure
The current position mode (8382.10) does not allow for a larger travel range.	Check travel range. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

23061715/EN – 03/2017

Subfault: 14.25 Description: Encoder startup	
Response: Inhibit output stage	
Cause	Measure
Fatal error during startup.	Switch the device off/on. Note: In the "emergency mode" manual mode, you can move the drive even with a fault in the external position encoder.

10.4.13 Error 16 Startup

Subfault: 16.1 Description: Motor not started up yet	
Response: Inhibit output stage	
Cause	Measure
Motor not yet started up completely.	Perform complete motor startup.

Subfault: 16.2 Description: Cannot calculate controller parameters	
Response: Inhibit output stage	
Cause	Measure
The delay of the encoder in use is too long to calculate the required filter coefficients.	Use an encoder with shorter delay, or contact the SEW-EURODRIVE Service.

Subfault: 16.3 Description: Thermal motor model not possible	
Response: Inhibit output stage	
Cause	Measure
Invalid parameters for the thermal motor model or for drive enable although starting up the thermal model has not been completed yet.	Check the parameters of the thermal motor model, and perform startup.

Subfault: 16.4 Description: Current limit too high	
Response: Inhibit output stage	
Cause	Measure
The current limit value is greater than the maximum current of the inverter.	Set the current limit to a smaller value than the maximum current of the inverter.

Subfault: 16.5 Description: Current limit smaller than magnetizing current of motor	
Response: Inhibit output stage	
Cause	Measure
The current limit is smaller than the magnetizing current of the motor calculated by the active control mode.	Increase current limit. Required magnetizing current: See diagnostics parameters of control mode.

Subfault: 16.6 Description: Control mode not possible	
Response: Inhibit output stage	
Cause	Measure
Wrong control mode selected for the motor.	Choose a control mode that matches the selected motor.

Subfault: 16.7 Description: PWM frequency not possible	
Response: Inhibit output stage	
Cause	Measure
The specified PWM frequency is not allowed for this power output stage.	Select different PWM frequency. Possible PWM frequencies; see device configuration data.

Subfault: 16.8 Description: Temperature sensor motor 1	
Response: Inhibit output stage	
Cause	Measure
Faulty startup of temperature sensor of motor 1.	Perform startup again.

23061715/EN – 03/2017

Subfault: 16.9 Description: Temperature sensor motor 2	
Response: Inhibit output stage	
Cause	Measure
Faulty startup of temperature sensor of motor 2.	Perform startup again.

Subfault: 16.10 Description: Actual position source not assigned	
Response: Application stop (with output stage inhibit)	
Cause	Measure
The active control mode requires an encoder for position mode.	Assign actual position source in encoder assignment of the active parameter set: 8565.3 or 8566.3. If no encoder is installed, activate the FCBs only using "torque control" or "speed control" mode.

Subfault: 16.11 Description: Motor data calculation error	
Response: Inhibit output stage	
Cause	Measure
Motor startup is not possible because of inconsistent motor data or wrong device configuration data.	Motor data and device configuration data are checked for plausibility. Or contact SEW-EURODRIVE Service.

Subfault: 16.12 Description: Motor data write sequence	
Response: Inhibit output stage	
Cause	Measure
Subindex 1 not written to zero before writing the electrical startup parameters 8357, 8360, 8394, 8420 or 8358, 8361, 8395, 8421.	Reset error. Set parameters 8360/1 or 8361/1 to 0 before writing additional parameters.

Subfault: 16.20 Description: Nominal speed too high or nominal frequency too low	
Response: Inhibit output stage	
Cause	Measure
During startup using nameplate data: Nominal speed too high or nominal frequency too low. The resulting number of pole pairs is 0.	Enter plausible motor data (nominal speed and nominal frequency).

Subfault: 16.21 Description: Nominal slip negative	
Response: Inhibit output stage	
Cause	Measure
During startup using nameplate data, the calculated nominal slip is negative: Nominal frequency too low or nominal speed too high or number of pole pairs too high.	Enter plausible motor data (nominal frequency, nominal speed, number of pole pairs).

Subfault: 16.22 Description: Specify the number of pole pairs	
Response: Inhibit output stage	
Cause	Measure
During startup using nameplate data: It is not possible to calculate the number of pole pairs accurately from nominal frequency and nominal speed.	Enter the number of pole pairs.

Subfault: 16.23 Description: Plausibility check failed.	
Response: Inhibit output stage	
Cause	Measure
During startup using nameplate data: the estimated nominal power does not match the entered nominal power.	Check entered nameplate data for plausibility.

Subfault: 16.24
Description: Speed controller sampling cycle not possible with current PWM frequency or current control mode

Response: Application stop (with output stage inhibit)

Cause	Measure
At PWM frequency "2.5 kHz", only the speed controller sampling cycle of 2 ms is permitted. For the ELSM® control mode, only the speed controller sampling times 1 ms and 2 ms are permitted.	Increase PWM frequency or increase sampling cycle of speed controller to 2 ms. Set the sampling cycle to 1 ms or 2 ms for ELSM® control mode.

Subfault: 16.25
Description: User current limit too low for standstill current

Response: Inhibit output stage

Cause	Measure
The user current limit value is too small for the minimum standstill current.	Increase the user current limit, or disable the standstill current function.

Subfault: 16.26
Description: Nominal values incomplete

Response: Inhibit output stage

Cause	Measure
During startup using nameplate data: Nominal voltage, nominal current, nominal speed, or nominal torque not entered.	Enter nominal voltage, nominal current, nominal speed, and nominal torque.

Subfault: 16.27
Description: Maximum current or maximum torque not plausible

Response: Inhibit output stage

Cause	Measure
During startup using nameplate data: Maximum current or maximum torque not entered, or maximum current and maximum torque not plausible.	Check maximum current and maximum torque.

Subfault: 16.30
Description: Faulty EtherCAT® EEPROM configuration status.

Response: Warning

Cause	Measure
Faulty EtherCAT®/SBusPLUS EEPROM configuration status. EEPROM not loaded, binary file not loaded.	Contact SEW-EURODRIVE Service.
Faulty EEPROM loading procedure.	Contact SEW-EURODRIVE Service.
Faulty EEPROM checksum.	Contact SEW-EURODRIVE Service.

10.4.14 Error 17 Internal processor error

Subfault: 17.7
Description: Exception error

Response: Inhibit output stage

Cause	Measure
An exception trap has occurred in the CPU.	Contact SEW-EURODRIVE Service.

10.4.15 Error 18 Software error

Subfault: 18.1
Description: Motor management

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
An error was detected at the motor management interface.	Switch the device off/on. Contact SEW-EURODRIVE service if the error is still present.

Subfault: 18.4 Description: Task system		
	Response: Inhibit output stage System state: Fault acknowledgement with CPU reset	
	Cause	Measure
	An error was detected during processing the internal task system. This can for example be a timeout for cyclic tasks.	Switch the device off/on. Contact SEW-EURODRIVE service if the error is still present.

Subfault: 18.7 Description: Fatal error		
	Response: Inhibit output stage System state: Fault acknowledgement with CPU reset	
	Cause	Measure
	A fatal software error occurred.	Switch the device off/on. Contact SEW-EURODRIVE service if the error is still present.

Subfault: 18.8 Description: Invalid error code		
	Response: Inhibit output stage	
	Cause	Measure
	Invalid error code requested.	Switch the device off/on. Contact SEW-EURODRIVE service if the error is still present.

Subfault: 18.9 Description: Internal software error		
	Response: Inhibit output stage System state: Fault acknowledgement with CPU reset	
	Cause	Measure
	A group software error occurred.	Switch the device off/on. Contact SEW-EURODRIVE service if the error is still present.

Subfault: 18.10 Description: Watchdog		
	Response: Inhibit output stage	
	Cause	Measure
	The software no longer works within the intended cycle time.	Switch the device off/on. Contact SEW-EURODRIVE service if the error is still present.

Subfault: 18.12 Description: Configuration data		
	Response: Inhibit output stage System state: Fault acknowledgement with CPU reset	
	Cause	Measure
	Configuration data not plausible or cannot be interpreted by the active firmware version.	Load firmware update or valid configuration data.

10.4.16 Error 19 Process data

Subfault: 19.1 Description: Torque violation		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	The specified torque values are not plausible.	Adjust torque values.

Subfault: 19.2 Description: Position setpoint violation		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	The position setpoint is outside the software limit switches.	Check position setpoint.
	The position setpoint is outside the modulo range.	Check position setpoint.
	Position in user unit generates number overflow in system units	Check position in user unit.

23061715/EN – 03/2017

Subfault: 19.3 Description: Speed setpoint violation	
Response: Application stop (with output stage inhibit)	
Cause	Measure
The specified speed setpoints are not plausible.	Adjust speed setpoints.

Subfault: 19.4 Description: Acceleration setpoint violation	
Response: Emergency stop (with output stage inhibit)	
Cause	Measure
The specified acceleration setpoints are not plausible.	Adjust acceleration setpoints.

Subfault: 19.5 Description: Drive function does not exist	
Response: Application stop (with output stage inhibit)	
Cause	Measure
Non-existing drive function (FCB) selected via process data.	Specify an existing FCB number for FCB activation via process data.

Subfault: 19.7 Description: Referencing missing	
Response: Application stop (with output stage inhibit)	
Cause	Measure
The activated function is only permitted with referenced encoder.	Reference the encoder first, then activate the function.

Subfault: 19.8 Description: Data set changeover not allowed	
Response: Application stop (with output stage inhibit)	
Cause	Measure
You have requested data set changeover while the output stage is enabled.	Before changing to another data set, inhibit the output stage.

Subfault: 19.9 Description: Jerk setpoint violation	
Response: Application stop (with output stage inhibit)	
Cause	Measure
Jerk values not plausible.	Adjust jerk setpoints.

10.4.17 Fault 20 Device monitoring

Subfault: 20.1 Description: Supply voltage – fault	
Response: Inhibit output stage System state: Fault acknowledgement with CPU reset	
Cause	Measure
The internal electronics supply voltage or the externally connected 24 V standby supply voltage are outside the permitted voltage range.	Check the voltage level of the external 24 V standby supply voltage and check for correct connection. If required, correct. – Acknowledge the error. If this does not help and the error message is displayed again, the device must be replaced.

Subfault: 20.2 Description: Supply voltage – overload fault		
	Response: Inhibit output stage	
	Cause	Measure
	For MOVIDRIVE® system, the current load of the current paths of the 24 V standby supply voltage in the device is too high. The device signal output of the device was de-energized because of the fault message.	Remove all external consumers: - from the digital output terminals of the basic device. - from other installed options. - from all encoder connections. - from all other consumers at the 24 V output voltage terminals. – Acknowledge error. – If the fault is no longer displayed, reconnect the removed consumers one after the other until the fault message is displayed again. The consumer connected last is the one that caused the internal supply voltage overload. – To eliminate the fault, use a consumer with a lower current consumption or eliminate possible short circuit.

Subfault: 20.7 Description: Internal hardware fault		
	Response: Inhibit output stage	
	Cause	Measure
	An error occurred in the device hardware.	Acknowledge fault. If this does not help and the error message is displayed again, the device must be replaced.

Subfault: 20.8 Description: Fan function – warning		
	Response: Warning with self-reset	
	Cause	Measure
	Impaired fan function.	Check fan for proper functioning.

Subfault: 20.9 Description: Fan function – fault		
	Response: Application stop (with output stage inhibit)	
	Cause	Measure
	Fan defective.	Replace the fan.

Subfault: 20.10 Description: Fan supply voltage – fault		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	Supply voltage of fan missing.	Check the connection or establish a connection.

Subfault: 20.11 Description: STO – switching delay		
	Response: Inhibit output stage	
	Cause	Measure
	A switching delay occurred between the two STO channels.	Check STO channels.

10.4.18 Fault 23 Power section

Subfault: 23.1 Description: Warning		
	Response: Warning with self-reset	
	Cause	Measure
	Power section fault with fault response of the type "warning".	See also "power section subcomponent" fault status.

Subfault: 23.2 Description: Fault		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	Power section fault with fault response of the type "standard".	See also "power section subcomponent" fault status.

23061715/EN – 03/2017

Subfault: 23.3 Description: Critical fault		
	Response: Inhibit output stage	
	Cause	Measure
	Power section fault with fault response of the type "critical fault".	See also "power section subcomponent" fault status.

Subfault: 23.4 Description: Hardware fault		
	Response: Inhibit output stage	
	Cause	Measure
	A fault occurred in a hardware component of the power section, e.g.: – Overcurrent hardware comparator.	– Check current supply. – Check current transformer. – Increase ramp time. – Check phase modules. – Check for correct motor size (the motor current is too high). – Perform power section update.
	SMPS fault, hardware fault.	– Check current supply. – Check 24 V supply voltage.
	Fault at the gate driver of an IGBT.	Defect in the power output stage. Contact SEW-EURODRIVE Service.
	Invalid process data configuration. Status of control section and power section are not compatible.	Perform power section update.

Subfault: 23.5 Description: Invalid process data configuration		
	Response: Inhibit output stage	
	Cause	Measure
	Invalid process data configuration.	Perform power section update.

10.4.19 Error 24 Cam switch

Subfault: 24.1 Description: Cam window limits interchanged		
	Response: Warning	
	Cause	Measure
	Left cam window limit larger than right limit.	Check cam windows limits and adjust.

Subfault: 24.2 Description: Cam window limit not within modulo range		
	Response: Warning	
	Cause	Measure
	Cam window limit not within modulo range.	Check cam windows limits and adjust.

10.4.20 Error 25 Parameter memory monitoring

Subfault: 25.2 Description: NV memory — runtime error		
	Response: Inhibit output stage	
	Cause	Measure
	Runtime error of the non-volatile memory system.	– Reset device. If this occurs repeatedly, replace device. Contact SEW-EURODRIVE Service.

Subfault: 25.3 Description: NV data import – error		
	Response: Inhibit output stage	
	Cause	Measure
	– Error while importing non-volatile memory data from non-volatile memory.	

Subfault: 25.4 Description: NV setup – error	
Response: Inhibit output stage	
Cause	Measure
Error while performing delivery state or during basic initialization of the parameters.	– Reset device. If this occurs repeatedly, replace device. Contact SEW-EURODRIVE Service.

Subfault: 25.5 Description: NV data error	
Response: Inhibit output stage	
Cause	Measure
Faulty data detected in non-volatile memory system.	The data on the (mobile) non-volatile memory might have been formatted for another device. You can rectify the error by re-formatting the data (basic initialization).

Subfault: 25.6 Description: NV memory – incompatible data	
Response: Inhibit output stage	
Cause	Measure
Incompatible data detected while reading non-volatile memory.	The data on the (mobile) non-volatile memory might have been formatted for another device. You can rectify the error by re-formatting the data (basic initialization).

Subfault: 25.7 Description: NV memory initialization – error	
Response: Inhibit output stage System state: Fault acknowledgement with CPU reset	
Cause	Measure
Error while initializing non-volatile memory system.	– Reset device. If this occurs repeatedly, replace device. Contact SEW-EURODRIVE Service.

Subfault: 25.9 Description: NV memory hardware – error	
Response: Inhibit output stage System state: Fault acknowledgement with CPU reset	
Cause	Measure
Faulty access to non-volatile memory hardware.	– Reset device. If this occurs repeatedly, replace device. Contact SEW-EURODRIVE Service.

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

Subfault: 25.11 Description: Control electronics configuration data – version conflict	
Response: Inhibit output stage	
Cause	Measure
Wrong version of configuration data of control electronics.	Contact SEW-EURODRIVE Service.

Subfault: 25.12 Description: Power section configuration data – CRC error	
Response: Inhibit output stage	
Cause	Measure
Faulty configuration data of the power section.	Contact SEW-EURODRIVE Service.

Subfault: 25.13 Description: Configuration data of control electronics – CRC error	
Response: Inhibit output stage	
Cause	Measure
Faulty configuration data of the control electronics.	Contact SEW-EURODRIVE Service.

Subfault: 25.20 Description: Initialization error – basic unit memory	
Response: Emergency stop (with output stage inhibit) System state: Fault acknowledgement with CPU reset	
Cause	Measure
Initialization error of the basic unit memory.	Contact SEW-EURODRIVE Service.

Subfault: 25.21 Description: Runtime error – basic unit memory	
Response: Emergency stop (with output stage inhibit)	
Cause	Measure
Runtime error in the memory of the basic unit.	Contact SEW-EURODRIVE Service.

Subfault: 25.30 Description: Initialization error – replaceable memory module	
Response: Emergency stop (with output stage inhibit) System state: Fault acknowledgement with CPU reset	
Cause	Measure
Initialization error of the replaceable memory module.	Contact SEW-EURODRIVE Service.

Subfault: 25.31 Description: Runtime error – replaceable memory module	
Response: Emergency stop (with output stage inhibit) System state: Fault acknowledgement with CPU reset	
Cause	Measure
Runtime error of the replaceable memory module.	Contact SEW-EURODRIVE Service.

Subfault: 25.40 Description: Initialization error – safety device memory	
Response: Emergency stop (with output stage inhibit) System state: Fault acknowledgement with CPU reset	
Cause	Measure
Initialization error of the Safety unit memory.	Contact SEW-EURODRIVE Service.

Subfault: 25.41 Description: Runtime error – Safety device memory	
Response: Emergency stop (with output stage inhibit) System state: Fault acknowledgement with CPU reset	
Cause	Measure
Runtime error of the Safety unit memory.	Contact SEW-EURODRIVE Service.

Subfault: 25.50 Description: Runtime error – replaceable safety memory module	
Response: Emergency stop (with output stage inhibit) System state: Fault acknowledgement with CPU reset	
Cause	Measure
Runtime error of the replaceable safety memory module.	Contact SEW-EURODRIVE Service.

Subfault: 25.60 Description: Compatibility fault – replaceable memory module	
Response: Emergency stop (with output stage inhibit) System state: Fault acknowledgement with CPU reset	
Cause	Measure
Data on replaceable memory module does not match device.	Establish compatibility with the device, e.g. by installing missing options, etc.

Subfault: 25.61 Description: Error – restore point basic unit memory	
Response: Emergency stop (with output stage inhibit) System state: Fault acknowledgement with CPU reset	
Cause	Measure
The restore point could not be created.	Delete restore point.

23061715/EN – 03/2017

Subfault: 25.70 Description: NV memory – incompatible option card configuration		
	Response: Inhibit output stage	
	Cause	Measure
	Incompatible option card configuration detected. The current configuration of the option card does not match the state of the stored startup. An option card that was installed during startup has been removed, for example.	– Restore the initial option setup. Acknowledge the changed configuration in MOVISUITE®: Diagnostics/Status/Error status/Reset = "with parameter acceptance". Reset the device to delivery state in MOVISUITE®: Reset setup/reset device parameter/reset delivery state.

10.4.21 Fault 26 External fault

Subfault: 26.1 Description: Terminal		
	Response: External fault	
	Cause	Measure
	Error message about external error source.	Programmable via 8622.5 (default: Application stop (+output stage inhibit)).

Subfault: 26.2 Description: Emergency shutdown		
	Response: Inhibit output stage	
	Cause	Measure
	Another module bus station has requested external emergency shutdown.	Check the other module bus stations for errors.

Subfault: 26.3 Description: Power section emergency shutdown		
	Response: Inhibit output stage	
	Cause	Measure
	Power section has requested external emergency shutdown.	Power section has detected a critical fault.

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

10.4.22 Error 28 FCB drive functions

Subfault: 28.1 Description: FCB 12 – timeout while searching zero pulse		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	Failed to find the zero pulse of the encoder's C track within the specified search time during reference travel.	Check encoder wiring.

Subfault: 28.2 Description: FCB 12 – Hardware limit switch before reference cam		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	The hardware limit switch was reached during reference travel. The reference cam was not detected.	Make sure that the reference cam is not installed behind the hardware limit switch.

Subfault: 28.3 Description: FCB 12 – Hardware limit switch and reference cam not flush	
Response: Emergency stop (with output stage inhibit)	
Cause	Measure
Hardware limit switch and reference cam are not mounted properly.	Make sure that reference cam and hardware limit switch are installed so they overlap.

Subfault: 28.4 Description: FCB 12 – reference offset error	
Response: Emergency stop (with output stage inhibit)	
Cause	Measure
An error occurred while determining the reference offset.	– Make sure that the reference offset is not set to a larger value than the "Modulo max." limit value. When using a single-turn absolute encoder, make sure that the reference offset is not set to a larger value than one encoder revolution.

Subfault: 28.6 Description: FCB 12 – limit switch/reference cam not flush/overlapping with fixed stop	
Response: Emergency stop (with output stage inhibit)	
Cause	Measure
A hardware limit switch or reference cam that was not selected was hit during reference travel to fixed stop.	Check whether the parameters set for reference travel are correct.
During reference travel to fixed stop with selected hardware limit switch or reference cam, the fixed stop was reached without hitting the hardware limit switch or reference cam.	Check whether the parameters set for reference travel are correct.

Subfault: 28.7 Description: FCB 21 – test torque greater than maximum torque at motor shaft	
Response: Inhibit output stage	
Cause	Measure
The required test torque for the brake test is higher than the maximum torque. It cannot be generated by the motor/inverter combination.	Reduce the test torque.

Subfault: 28.8 Description: FCB 21 – test torque not reached	
Response: Inhibit output stage	
Cause	Measure
The required test torque for the brake test exceeds the valid limit values.	– Reduce the test torque. – Check limit values.

Subfault: 28.9 Description: FCB 18 – rotor position identification not possible	
Response: Inhibit output stage	
Cause	Measure
Rotor position identification was started with an incremental encoder but was aborted prematurely.	– Restart the rotor position identification. – Check whether the encoder is connected correctly. – Check whether encoder is defective.
The result of rotor position identification cannot be stored in the encoder.	Select "inverter" as storage location.
The combination of "Automatic" mode and "Encoder" storage location is not permitted.	Set the operating mode to "Manual" or the storage location to "Inverter".

Subfault: 28.10 Description: FCB 25 – unbalanced motor phases	
Response: Inhibit output stage	
Cause	Measure
When measuring stator resistances, significantly different values were determined in the 3 phases.	– Check whether the motor is connected correctly. – Check all contact points on the motor and inverter. – Check the motor and motor cable for damage.

Subfault: 28.11 **Description: FCB 25 – at least one phase with high resistance**		
	Response: Inhibit output stage	
	Cause	Measure
	At least one motor phase could not be measured during motor parameter measurement.	– Check whether the motor is connected correctly. – Check all contact points on the motor and inverter. – Check the motor and motor cable for damage.

Subfault: 28.12 **Description: FCB 25 – timeout during stator resistance measurement**		
	Response: Inhibit output stage	
	Cause	Measure
	Motor parameter measurement was activated while motor is rotating.	– Stop motor. – Start motor parameter measurement when the motor is at standstill.

Subfault: 28.13 **Description: FCB 25 – characteristic curve identification not possible**		
	Response: Inhibit output stage	
	Cause	Measure
	Motor parameter measurement does not allow for unique identification of the characteristic curve.	Contact SEW-EURODRIVE Service.

10.4.23 Error 29 Hardware limit switch

Subfault: 29.1 **Description: Positive limit switch hit**		
	Response: HW limit switches – current parameter set	
	Cause	Measure
	Positive hardware limit switch hit.	– Check hardware limit switch wiring. – Check target position. – Move clear with negative speed.

Subfault: 29.2 **Description: Negative limit switch hit**		
	Response: HW limit switches – current parameter set	
	Cause	Measure
	Negative hardware limit switch hit.	– Check hardware limit switch wiring. – Check target position. – Move clear with positive speed.

Subfault: 29.3 **Description: Limit switch missing**		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	Both limit switches (positive and negative) were hit at the same time.	– Check hardware limit switch wiring. – Check the parameter setting of digital inputs. – Check the parameter setting of PO data.

Subfault: 29.4 **Description: Limit switches reversed**		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	The positive hardware limit switch was hit at negative speed, or the negative hardware limit switch was hit at positive speed.	Check whether hardware limit switch connections are swapped.

10.4.24 Error 30 Software limit switch

Subfault: 30.1 Description: Positive limit switch hit	
Response: SW limit switches – current parameter set	
Cause	Measure
The positive software limit switch was hit.	– Check software limit switch position. – Check target position. – Move clear with negative speed.

Subfault: 30.2 Description: Negative limit switch hit	
Response: SW limit switches – current parameter set	
Cause	Measure
Negative software limit switch hit.	– Check software limit switch position. – Check target position. – Move clear with positive speed.

Subfault: 30.3 Description: Limit switches reversed	
Response: Emergency stop (with output stage inhibit)	
Cause	Measure
The position value of the negative software limit switch is greater than the position value of the positive software limit switch.	Check software limit switch positions.

10.4.25 Error 31 Thermal motor protection

Subfault: 31.1 Description: Wire break temperature sensor – motor 1	
Response: Application stop (with output stage inhibit)	
Cause	Measure
The connection to the temperature sensor of motor 1 is interrupted.	Check temperature sensor wiring.

Subfault: 31.2 Description: Temperature sensor short circuit – motor 1	
Response: Application stop (with output stage inhibit)	
Cause	Measure
Short circuit in the connection to the temperature sensor of motor 1.	Check temperature sensor wiring.

Subfault: 31.3 Description: Temperature sensor overtemperature – motor 1	
Response: Inhibit output stage	
Cause	Measure
Temperature sensor of motor 1 signals overtemperature.	– Let motor cool down. – Check for motor overload.

Subfault: 31.4 Description: Temperature model overtemperature – motor 1	
Response: Inhibit output stage	
Cause	Measure
Temperature model of motor 1 signals overtemperature.	– Let motor cool down. – Check for motor overload.

Subfault: 31.5 Description: Temperature sensor prewarning – motor 1	
Response: Motor temperature prewarning – current parameter set	
Cause	Measure
Temperature signaled by temperature sensor of motor 1 exceeds prewarning threshold.	Check for motor overload.

23061715/EN – 03/2017

Subfault: 31.6 Description: Temperature model prewarning – motor 1	
Response: Motor temperature prewarning – current parameter set	
Cause	Measure
The temperature signaled by the temperature sensor of motor 1 exceeds the prewarning threshold.	Check for motor overload.

Subfault: 31.7 Description: UL temperature monitoring	
Response: Inhibit output stage	
Cause	Measure
Temperature model of the active motor signals overtemperature.	Check for motor overload.

Subfault: 31.9 Description: Temperature too low – temperature sensor – motor 1	
Response: Warning with self-reset	
Cause	Measure
The temperature signaled by the temperature sensor of motor 1 is below -50 °C.	– Check if a KTY temperature sensor is installed in the motor but the parameterization is carried out for a PT1000 temperature sensor. – Heat the motor.

Subfault: 31.11 Description: Wire break temperature sensor – motor 2	
Response: Application stop (with output stage inhibit)	
Cause	Measure
The connection to the temperature sensor of motor 2 is interrupted.	Check temperature sensor wiring.

Subfault: 31.12 Description: Temperature sensor short circuit – motor 2	
Response: Application stop (with output stage inhibit)	
Cause	Measure
Short circuit in the connection to the temperature sensor of motor 2.	Check temperature sensor wiring.

Subfault: 31.13 Description: Temperature sensor overtemperature – motor 2	
Response: Inhibit output stage	
Cause	Measure
Temperature sensor of motor 2 signals overtemperature.	– Let motor cool down. – Check for motor overload.

Subfault: 31.14 Description: Temperature model overtemperature – motor 2	
Response: Inhibit output stage	
Cause	Measure
Temperature model of motor 2 signals overtemperature.	– Let motor cool down. – Check for motor overload.

Subfault: 31.15 Description: Temperature sensor prewarning – motor 2	
Response: Motor temperature prewarning – current parameter set	
Cause	Measure
Temperature signaled by temperature sensor of motor 2 exceeds prewarning threshold.	Check for motor overload.

Subfault: 31.16 Description: Temperature model prewarning – motor 2	
Response: Motor temperature prewarning – current parameter set	
Cause	Measure
The temperature signaled by the temperature sensor of motor 2 exceeds the prewarning threshold.	Check for motor overload.

Subfault: 31.19 Description: Temperature too low – temperature sensor – motor 2	
Response: Warning with self-reset	
Cause	Measure
The temperature signaled by the temperature sensor of motor 2 is below -50 °C.	– Check if a KTY temperature sensor is installed in the motor but the parameterization is carried out for a PT1000 temperature sensor. – Heat the motor.

10.4.26 Error 32 Communication

Subfault: 32.2 Description: EtherCAT®/SBusPLUS timeout	
Response: Fieldbus – timeout	
Cause	Measure
Timeout during EtherCAT®/SBus^{PLUS} communication.	– Check the wiring of system bus and module bus. Check for correct setting of the EtherCAT®/SBusPLUS configuration in the MOVI-C® CONTROLLER. – Check EtherCAT®/SBus^{PLUS} timeout configuration in the device.

Subfault: 32.3 Description: Faulty synchronization signal	
Response: External synchronization	
Cause	Measure
Faulty synchronization signal period.	Check for correct setting of the EtherCAT®/SBus^{PLUS} configuration in the MOVI-C® CONTROLLER.

Subfault: 32.4 Description: No synchronization signal	
Response: External synchronization	
Cause	Measure
No synchronization signal present.	Check for correct setting of the EtherCAT®/SBus^{PLUS} configuration in the MOVI-C® CONTROLLER.

Subfault: 32.5 Description: Synchronization timeout	
Response: External synchronization	
Cause	Measure
A timeout occurred while synchronizing to the synchronization signal.	Check for correct setting of the EtherCAT®/SBus^{PLUS} configuration in the MOVI-C® CONTROLLER.

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

Subfault: 32.7 Description: Application heartbeat timeout	
Response: Application heartbeat timeout	
Cause	Measure
Communication interrupted between IE program in MOVI-C® CONTROLLER and device.	– Check status of IEC program. – Restart IEC program.

Subfault: 32.12 Description: Manual mode timeout	
Response: Manual mode – timeout response	
Cause	Measure
Communication connection to the device interrupted in manual mode.	– Check whether too many programs are open on the operator PC. Increase the timeout time in manual mode.

23061715/EN – 03/2017

10.4.27 Error 33 System initialization

Subfault: 33.1
Description: Motor current measurement

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
Motor current measurement has detected an error.	Contact SEW-EURODRIVE Service.

Subfault: 33.2
Description: Firmware CRC check

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
Error detected while checking the firmware.	Contact SEW-EURODRIVE Service.

Subfault: 33.3
Description: RAM error

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
Error detected while checking RAM.	Contact SEW-EURODRIVE Service.

Subfault: 33.4
Description: Bootloader CRC check

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
The bootloader check has detected a fault.	Contact SEW-EURODRIVE Service.

Subfault: 33.5
Description: RAM code CRC check

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
Error detected while checking RAM code.	Contact SEW-EURODRIVE Service.

Subfault: 33.6
Description: FPGA configuration

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
Error detected while checking the FPGA configuration.	Contact SEW-EURODRIVE Service.

Subfault: 33.7
Description: Function block compatibility error

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
The compatibility test of the function block has detected an error.	Contact SEW-EURODRIVE Service.

Subfault: 33.8
Description: SW function block configuration

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
Error detected while checking the configuration of the software function block.	Contact SEW-EURODRIVE Service.

Subfault: 33.10
Description: Boot timeout

Response: Inhibit output stage
System state: Fault acknowledgement with CPU reset

Cause	Measure
Timeout during system boot.	Contact SEW-EURODRIVE Service.

Subfault: 33.11 Description: Hardware compatibility error		
	Response: Inhibit output stage System state: Fault acknowledgement with CPU reset	
	Cause	Measure
	The firmware does not match the device.	Contact SEW-EURODRIVE Service.

Subfault: 33.12 Description: Memory module plugged		
	Response: Inhibit output stage	
	Cause	Measure
	A plugged in memory module was detected during device start. The setting for the device parameter source is set to "Internal memory".	– Switch off device. Remove the memory module and restart the device. Change the parameter "Non-volatile memory source" to "Arbitrary" or "Replaceable memory module". Switch device off and on again.

Subfault: 33.13 Description: Memory module removed		
	Response: Inhibit output stage	
	Cause	Measure
	The device was started without memory module. The setting for the device parameter source is set to "Replaceable memory module".	Switch off device. Insert the memory module and restart the device.
	The replaceable memory module was removed during ongoing operation.	Change parameter "Non-volatile memory source" to "Internal memory". Switch the device off and on again.

10.4.28 Error 34 Process data configuration

Subfault: 34.1 Description: Changed process data configuration		
	Response: Application stop (with 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.

10.4.29 Error 35 Function activation

Subfault: 35.1 Description: Invalid TAN		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	Incorrect TAN was entered.	Enter TAN again.
	The TAN was not created for this device.	Check TAN.
	When using a double axis, the TAN was generated for the wrong sub address in the device.	Enter a TAN for the assigned sub address.

Subfault: 35.2 Description: Application requires a higher license		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	The activated application module requires a higher license.	Enter a TAN for higher application activation.

Subfault: 35.3 Description: Technology activation missing		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	An activated technology function requires a technology activation that is not available.	– Enter a TAN to activate the required technology function. – Activate technology function that can be operated with the current technology activation.

23061715/EN – 03/2017

Subfault: 35.4 **Description: Technology activation for wrong device variant**		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	This device does not support the technology activation included in this TAN.	– Activate a technology function that is supported by this device. – Use a device that supports the required technology function.

10.4.30 Error 42 Lag error

Subfault: 42.1 **Description: Positioning lag error**		
	Response: Positioning lag error	
	Cause	Measure
	A lag error occurred during positioning. Incorrect encoder connection.	Check encoder connection.
	Inverted position encoder or position encoder that was incorrectly installed at the track.	Check installation and connection of the position encoder.
	Wiring faulty.	Check wiring of encoder, motor, line phases.
	Acceleration ramps too short.	Extend acceleration ramps.
	P component of positioning controller too small.	Set larger P component of positioning controller.
	Incorrectly set speed controller parameters.	Check controller parameters.
	Value of lag error tolerance too small.	Increase lag error tolerance.
	Mechanical components cannot move freely or are blocked.	Make sure mechanical parts can move freely, check whether they are blocked.

Subfault: 42.2 **Description: Jog mode lag error**		
	Response: Inhibit output stage	
	Cause	Measure
	A lag error occurred in jog mode (FCB 20). Incorrect encoder connection.	Check encoder connection.
	Inverted position encoder or position encoder that was incorrectly installed at the track.	Check installation and connection of the position encoder.
	Wiring faulty.	Check wiring of encoder, motor, line phases.
	Acceleration ramps too short.	Extend acceleration ramps.
	P component of positioning controller too small.	Set larger P component of positioning controller.
	Incorrectly set speed controller parameters.	Check controller parameters.
	Value of lag error tolerance too small.	Increase lag error tolerance.
	Mechanical components cannot move freely or are blocked.	Make sure mechanical parts can move freely, check whether they are blocked.

Subfault: 42.3 **Description: Standard lag error**		
	Response: Inhibit output stage	
	Cause	Measure
	A lag error occurred outside a positioning process. Incorrect encoder connection.	Check encoder connection.
	Inverted position encoder or position encoder that was incorrectly installed at the track.	Check installation and connection of the position encoder.
	Wiring faulty.	Check wiring of encoder, motor, line phases.
	Acceleration ramps too short.	Extend acceleration ramps.
	P component of positioning controller too small.	Set larger P component of positioning controller.
	Incorrectly set speed controller parameters.	Check controller parameters.
	Value of lag error tolerance too small.	Increase lag error tolerance.

10.4.31 Fault 45 Fieldbus option

Subfault: 45.50 **Description: Option card – warning**		
	Response: Warning with self-reset	
	Cause	Measure
	The fieldbus interface signals a subcomponent fault of the type "warning".	Refer to the subcomponent fault of the fieldbus interface and perform the action required for eliminating the fault.

10.4.32 Error 46 Safety option

Subfault: 46.1 **Description: No response**		
	Response: Inhibit output stage System state: Fault acknowledgement with CPU reset	
	Cause	Measure
	Failed to synchronize with subcomponent.	– Check device assignment of basic device and option. – Check card slot and installation and correct if necessary. – Perform device restart. – Contact SEW-EURODRIVE Service.

Subfault: 46.2 **Description: Invalid variant**		
	Response: Inhibit output stage	
	Cause	Measure
	The plugged safety option variant does not match the inverter type.	– Remove option. – Use the correct variant of the safety option.
	For double axes, only variants without encoder interface can be used.	– Remove option. – Use the variant without encoder interface.
	For double axes, no encoder option must be plugged in.	Remove the option.

Subfault: 46.3 **Description: Internal communication timeout**		
	Response: Inhibit output stage	
	Cause	Measure
	Communication interrupted between inverter and safety option.	Check card slot and installation and correct if necessary. – Contact SEW-EURODRIVE service if the error is still present.
	The safety option signals a subcomponent fault of the type "warning".	Check card slot and installation and correct if necessary. – Contact SEW-EURODRIVE service if the error is still present.

Subfault: 46.50 **Description: Warning**		
	Response: Warning with self-reset	
	Cause	Measure
	– The safety option signals a subcomponent fault of the type "warning".	

Subfault: 46.51 **Description: Fault**		
	Response: Emergency stop (with output stage inhibit) with self-reset	
	Cause	Measure
	– The safety option signals a subcomponent fault of the type "standard fault".	

Subfault: 46.52 **Description: Critical fault**		
	Response: Inhibit output stage with self-reset	
	Cause	Measure
	– The safety option signals a subcomponent fault of the type "critical fault".	

23061715/EN – 03/2017

10.4.33 Fault 47 Supply unit

Subfault: 47.1 Description: Supply unit – warning		
	Response: Warning with self-reset	
	Cause	Measure
	– The supply unit signals a fault with response type "warning". The fault is only displayed.	

Subfault: 47.2 Description: Supply unit – standard fault		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	– The supply unit signals a fault with response type "standard". The axis performs a fault response that is determined by the driver for the supply unit implemented on the axis.	

Subfault: 47.3 Description: Supply unit – critical fault		
	Response: Inhibit output stage	
	Cause	Measure
	– The supply unit signals a fault with response type "Critical error". The axis performs a fault response that is determined by the driver for the supply unit implemented on the axis.	

10.4.34 Error 48 Module bus

Subfault: 48.1 Description: Incompatible		
	Response: Inhibit output stage	
	Cause	Measure
	– Module bus slave and module bus master are not compatible.	

Subfault: 48.2 Description: Timeout		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	Timeout detected by module bus.	Check cable connections and voltage supply of module bus stations.

10.4.35 Error 50 I/O option

Subfault: 50.1 Description: Boot synchronization timeout		
	Response: Inhibit output stage	
	Cause	Measure
	Card is plugged in device but cannot be addressed.	– Check device assignment of basic device and option. – Check card slot and installation and correct if necessary. – Restart device.

Subfault: 50.2 Description: CRC error of FPGA driver		
	Response: Inhibit output stage	
	Cause	Measure
	Communication between FPGA and option card does not work, or is interrupted.	– Check card slot and installation and correct if necessary. – Check for EMC-compliant installation. – Restart device.

Subfault: 50.3 **Description: CRC error of option card**	
Response: Inhibit output stage	
Cause	Measure
The option card signals a CRC error on the SPI bus.	– Check card slot and installation and correct if necessary. – Check for EMC-compliant installation. – Restart device.

Subfault: 50.4 **Description: Timeout error of the option card**	
Response: Inhibit output stage	
Cause	Measure
The option card signals a timeout error on the SPI bus.	– Check card slot and installation and correct if necessary. – Check for EMC-compliant installation. – Restart device.

Subfault: 50.5 **Description: Watchdog error of the option card**	
Response: Inhibit output stage	
Cause	Measure
Microcontroller of the option card signals a watchdog error.	– Check card slot and installation and correct if necessary. – Check for EMC-compliant installation. – Restart device.

Subfault: 50.6 **Description: Ready signal timeout**	
Response: Inhibit output stage	
Cause	Measure
The card has booted but cyclic communication is not possible.	– Check card slot and installation and correct if necessary. – Check for EMC-compliant installation. – Restart device.

10.4.36 Error 51 Analog processing

Subfault: 51.1 **Description: Analog current input 4 mA limit**	
Response: Warning with self-reset	
Cause	Measure
The input current of AI2/AI3 is below 4 mA.	Monitoring of input current of AI2/AI3.

10.4.37 Error 52 Explosion protection category 2 function

Subfault: 52.1 **Description: Startup fault**	
Response: Inhibit output stage	
Cause	Measure
No valid startup available.	Perform startup.

Subfault: 52.2 **Description: Illegal system function**	
Response: Inhibit output stage	
Cause	Measure
– An illegal system function is active.	

Subfault: 52.3 **Description: Inverter too large**	
Response: Inhibit output stage	
Cause	Measure
– Ratio of inverter current and nominal motor current too large.	

23061715/EN – 03/2017

Subfault: 52.4 Description: Parameterization of current limit characteristic		
	Response: Inhibit output stage	
	Cause	Measure
	– Error while setting the parameters for the current limit characteristic.	

Subfault: 52.5 Description: Timeout f < 5 Hz		
	Response: Emergency stop (with output stage inhibit)	
	Cause	Measure
	– Duration of 60 s for f < 5 Hz exceeded.	

10.5 Responses to error acknowledgement

10.5.1 Error acknowledgement

During error acknowledgement, the final error status determines which reset type will be executed, see following table.

Final fault status	Responses to error acknowledgement
System blocked	System restart
System waiting	Warm start: Delete error code
Only display error	Warm start: Delete error code

Software reset

Response	Effect
System restart with start of the CPU	Behavior equal to device start
	Reference is lost
	Fieldbus interface is restarted
	EtherCAT®/SBus^{PLUS} is restarted
	The active "fault message" is reset (digital output = 1, system status = 0).

Software restart

A software restart is **no** real reset of the microcontroller.

Response	Effect
Software restart	The firmware will be restarted, without the boot loader becoming active (no display "b0"!).
	Reference positions of incremental encoder systems will be lost.
	Any existing fieldbus interfaces are not affected.
	The interface between options and firmware system is initialized again. A new boot synchronization to the fieldbus or control option takes place.
	The active "fault message" is reset [digital output = 1, system status = 0].

The ready signal is set again depending on the system state after the reset by the system state control.

23061715/EN – 03/2017

Warm start

A warm start only resets the fault code.

Response	Effect
Warm start	The firmware system is not rebooted.
	All reference positions will be maintained.
	Communication is not interrupted.
	The active "fault message" is reset [digital output = 1, system status = 0].

Fieldbus timeout

After manual reset of an fault, the fault message is deleted. The system changes to the state "Waiting for data".

10.6 Fault responses

10.6.1 Default – fault response

Fault response	Description
No response	The inverter ignores the event.
Warning with self reset	The inverter issues a warning message.
Warning	
Application stop (with output stage inhibit)	The inverter stops with the deceleration set for the application limit. Parameter set 1 Index 83750-13 Parameter set 2 Index 83758-13 For n=0: Brake "applied" and output stage "off".
Application stop (with output stage inhibit) with self reset	
Emergency stop (with output stage inhibit)	The inverter stops with the set emergency stop deceleration. Parameter set 1 Index 83750-20 Parameter set 2 Index 83758-20
Emergency stop (with output stage inhibit) with self reset	
Inhibit output stage with self reset	The output stage is deactivated and the brake is applied.
Inhibit output stage	

Self-reset means: Eliminating the cause of the fault acknowledges the fault. The inverter automatically resumes the operation performed before the fault. The drive restarts automatically.

10.6.2 Parameterizable faults

Parameterizable faults	Description	Index no.	Possible fault response
Manual mode – timeout response	This parameter is used to set the response to a bus timeout during manual mode.	8504.3	• Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage
Heat sink overtemperature – prewarning	Here, you can set the device response when the prewarning threshold for heat sink utilization is exceeded (index 8336.1).	8622.2	• No response • Warning
Positioning lag error	This parameter is used to set the device response to a lag error (lag error window exceeded, index 8509.4).	8622.3	• No response • Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage
Line phase failure	This parameter is used to set the device response to a line phase failure (values below threshold defined by the user, index 8351.5).	8622.4	• No response • Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage
External fault	This parameter is used to set the device response to an external fault (e.g. triggered by terminal or control word).	8622.5	• No response • Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage
Fieldbus – timeout	This parameter is used to set the device response to an EtherCAT®/SBus^{PLUS} timeout (timeout time, index 8455.3).	8622.6	• Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage • Warning with self reset • Application stop (with output stage inhibit) with self reset • Emergency stop (with output stage inhibit) with self reset • Inhibit output stage with self reset

23061715/EN – 03/2017

Parameterizable faults	Description	Index no.	Possible fault response
External synchronization	This parameter is used to set the device response to loss of external synchronization.	8622.7	• No response • Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage • Warning with self reset • Application stop (with output stage inhibit) with self reset • Emergency stop (with output stage inhibit) with self reset • Inhibit output stage with self reset
Motor temperature prewarning – current parameter set	Motor temperature active parameter set – prewarning.	8622.8	• No response • Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage
Electromechanical utilization – prewarning	This parameter is used to set the device response to an exceeded prewarning threshold for electromechanical utilization (index 8336.2).	8622.10	• No response • Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage
HW limit switches – current parameter set		8622.11	• No response • Emergency stop (with output stage inhibit) • Emergency stop (with output stage inhibit) with self reset
SW limit switches – current parameter set		8622.12	• No response • Emergency stop (with output stage inhibit) • Emergency stop (with output stage inhibit) with self reset
Encoder – warning	This parameter is used to set the device response to an encoder warning.	8622.13	• Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage
Encoder – fault	This parameter is used to set the device response to an encoder fault.	8622.14	• Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage
Additional encoder	This parameter is used to set the device response to a fault of an encoder that is not used for control (speed or positioning control).	8622.15	• Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage
Encoder 1 – latest fault		8622.16	• No response
Encoder 2 – latest fault		8622.17	• No response
Encoder 1 – latest critical fault		8622.18	• No response • Inhibit output stage
Encoder 2 – latest critical fault		8622.19	• No response • Inhibit output stage
Response to external braking resistor fault	External braking resistor fault	8622.20	• No response • Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage

Parameterizable faults	Description	Index no.	Possible fault response
Application heartbeat timeout	This parameter is used to set the device response to a timeout of the application heartbeat.	8622.21	• Warning • Application stop (with output stage inhibit) • Emergency stop (with output stage inhibit) • Inhibit output stage

23061715/EN – 03/2017

11 Service

11.1 Electronics Service by SEW-EURODRIVE

If you are unable to rectify a fault, contact SEW-EURODRIVE Service. For the addresses, refer to www.sew-eurodrive.com.

When contacting the SEW-EURODRIVE Service, always specify the following information so that our service personnel can assist you more effectively:

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

11.2 Extended storage

If the application inverters are stored in a temperature range of 5 °C to 40 °C, no measures are required.

The following table lists the application inverters, time intervals, and measures that are required if the application inverters are stored outside the above mentioned temperature range.

For all application inverters other than the ones listed, **no** measures are required.

Modules	Time interval	Measure
- MDX90A-0020 – 0160-5_3-.. - MDX90A-0070 – 0140-2_3-..	Every 2 years	Line connections: Connect the device to the line voltage for 5 minutes.
All application inverters	Every 2 years	Connect the device to 24 V for 5 minutes

23061715/EN – 03/2017

11.2.1 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 steps are recommended:

AC 400/500 V devices:

- Step 1: 0 V to AC 350 V within a few seconds
- Step 2: AC 350 V for 15 minutes
- Step 2: AC 420 V for 15 minutes
- Step 3: AC 500 V for 1 hour

11.3 Shutdown

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

⚠ WARNING

Electric shock due to 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.

11.4 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

23061715/EN – 03/2017

12 Functional safety

12.1 General information

12.1.1 Underlying standards

The safety assessment of the application inverter is based on the following standards and safety classes:

Underlying standards	
Safety class/underlying standard	• Performance level (PL) according to EN ISO 13849-1:2008 • Safety Integrity Level (SIL) according to EN 61800-5-2:2007 • Safety Integrity Level Claim Limit (SIL_{CL}) according to EN 62061:2005/A1:2013

12.2 Integrated safety technology

The safety technology of the application inverter described below has been developed and tested in accordance with the following safety requirements:

- Safety Integrity Level 3 according to EN 61800-5-2:2007, EN 61508:2010.
- PL e according to EN ISO 13849-1: 2008.

This was certified by TÜV Rheinland. Copies of the TÜV certificate and the corresponding report are available from SEW-EURODRIVE on request.

12.2.1 Safe condition

For safety-related operation of the application inverter, safe torque off is defined as safe condition (see STO safety function). The safety concept is based on this.

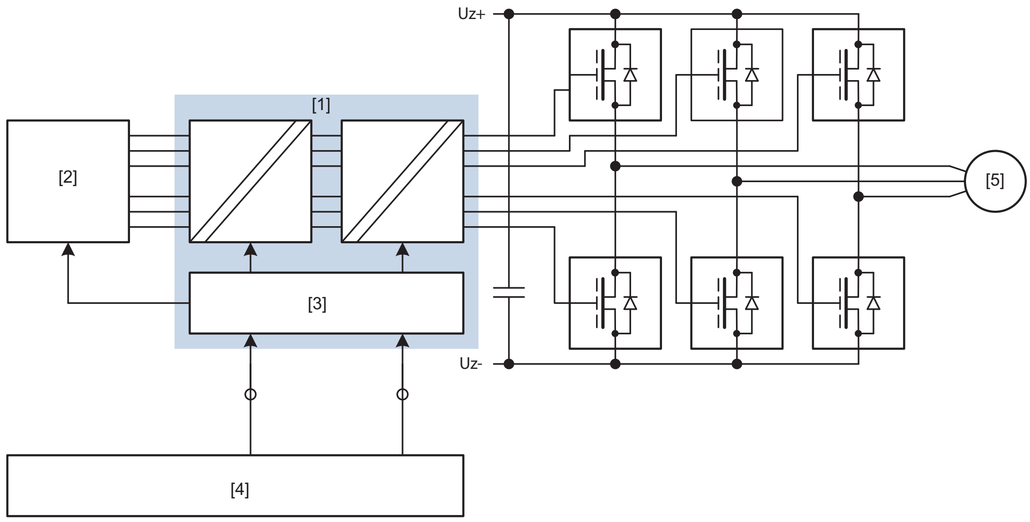
12.2.2 Safety concept

The application inverter is supposed to be able to perform the safety function "Safe Torque Off" according to EN 61800-5-2:

- The application inverter is characterized by the optional connection of a safety relay/external safety controller. This external safety controller/safety relay disconnects the safety-related STO input via a 2-pole 24 V switching signal (sourcing/sinking) when a connected control device (e.g. emergency stop button with latching function) is activated. This activates the STO function of the application inverter.
- An internal, dual-channel structure with diagnostics prevents the generation of pulse trains at the power output stage (IGBT).
- Instead of galvanic separation of the drive from the supply system by means of contactors or switches, the disconnection of the STO input described here safely prevents the control of the power semiconductors in the output stage. The rotary-field generation for the respective motor is deactivated even though the line voltage is still present.
- When the STO safety function is activated, the PWM signals generated by the application inverter are interrupted and not transmitted to the IGBTs.

- If the STO function detects a discrepancy between both channels, the PWM signals are permanently inhibited.
- The STO safety function can be activated externally e.g. via an external safety device via the STO input.

12.2.3 Schematic representation of the safety concept



9007214467507851

[1] STO function

[2] Drive controller

[3] Diagnostics and inhibiting device

[4] Safety-related connection

[5] Motor

23061715/EN – 03/2017

12.2.4 Safety functions

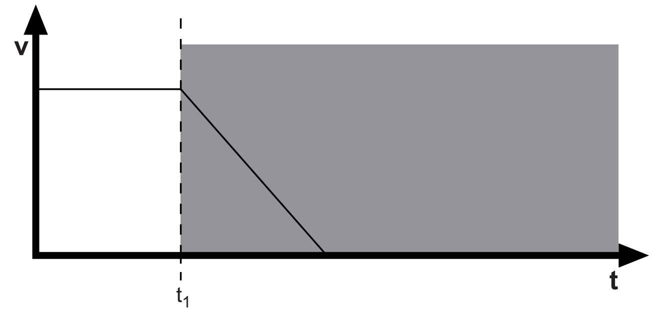
The following drive-related safety functions can be used:

- **STO** (safe torque off according to EN 61800-5-2) by disconnecting the STO input.

  If the STO function is activated, the frequency inverter no longer supplies power to the motor for generating torque. This safety function corresponds to a non-controlled stop according to EN 60204-1, stop category 0.

  The STO input must be disabled by a suitable external safety controller/safety relay.

  The following figure shows the STO function:



2463228171

v	Speed
t	Time
t_1	Point of time when STO is triggered
	Disconnection range

- **SS1(c)** (safe stop 1, function variant c according to EN 61800-5-2) by means of suitable external control (e.g. safety relay with delayed disconnection).

  The following sequence is mandatory:

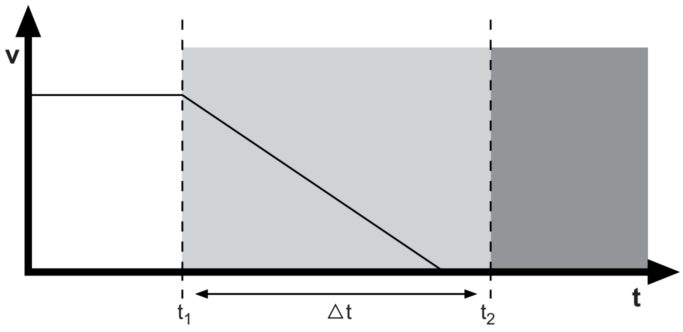
  – Decelerate the drive using an appropriate brake ramp specified via setpoints.

  – Disconnect the STO input (= triggering the STO function) after a specified safety-related time delay.

  This safety function corresponds to a controlled stop according to EN 60204-1, stop category 1.

  The following figure illustrates the SS1(c) function:

23061715/EN – 03/2017



2463226251

v	Speed
t	Time
t_1	Point of time when the brake ramp is initiated
t_2	Point of time when STO is triggered
Δt	Delay time until STO is triggered
	Safe time delay range
	Disconnection range

12.2.5 Restrictions

- Note that if the drive does not have a mechanical brake, or if the brake is defective, the drive may coast to a halt (depending on the friction and mass moment of inertia of the system). In case of regenerative loads, or with axes that are loaded with gravitational forces or driven externally, the drive can even accelerate. This must be taken into account in a risk assessment of the system/machine. Additional safety measures might have to be implemented (e.g. safety brake system).

  The application inverter cannot be used without an additional brake system for application-specific safety functions that require active deceleration (braking) of the dangerous movement.
- When using the SS1(c) function as described in chapter "Safety functions" (→ 🗎 285), the brake ramp of the drive is not monitored with respect to safety. In case of a fault, the drive might not be decelerated after the delay time, or it might be accelerated in the worst case. In this case, the safety-related disconnection via the STO function is only activated after the set time delay has passed, see chapter "Safety functions" (→ 🗎 285). The resulting danger must be taken into account in the risk assessment of the system/machine. Additional safety measures might have to be implemented.
- The STO function cannot prevent a possible jerk or DC braking.

12

⚠ WARNING

The safety concept is only suitable for performing mechanical work on driven system/machine components.

When the STO signal is disconnected, the line voltage is still present at the DC link of the application inverter.

- Before working on the electric part of the drive system, disconnect it from the supply voltage using an appropriate external disconnecting device and secure it against unintentional reconnection to the voltage supply.

⚠ WARNING

Electric shock due to charged capacitors.

Severe or fatal injuries.

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

INFORMATION

In case of safety-related disconnection of the DC 24 V supply voltage at X16 (STO activated), the brake is **always** applied. The brake control in the application inverter is not safety-related.

23061715/EN – 03/2017

12.3 Safety conditions

The requirement for safe operation is that the safety functions of the application inverter are properly integrated into an application-specific higher-level safety function. A system/machine-specific risk assessment must be carried out through the system/machine manufacturer and taken into account for the use of the drive system with the application inverter.

The system/machine manufacturer and the operator are responsible for compliance of the system/machine with applicable safety regulations.

The following requirements are mandatory when installing and operating the application inverter in safety-related applications:

- Approved units.
- Installation requirements.
- Requirements on external safety controllers and safety relays.
- Startup requirements.
- Operation requirements.

12.3.1 Approved devices

The following device types of MOVIDRIVE® system are permitted for safety-related applications:

Application inverter	Nominal output current
MOVIDRIVE® system	2 – 588 A

23061715/EN – 03/2017

12.3.2 Requirements on the installation

- The components must be protected against conductive dirt, e.g. by installing them in a control cabinet with degree of protection IP54 according to IEC 60529.

  If conductive dirt can be excluded at the installation site, a control cabinet with lower degree of protection is permitted under observance of the applicable standards, e.g. EN 60204-1.

  The same applies to temporary condensation, e.g. due to rapid changes of the ambient temperature.
- The wiring technology used must comply with the standard EN 60204-1.
- The STO control lines must be routed according to EMC guidelines and as follows:
  - Inside an electrical installation space: Individual conductors can be routed.
  - Adhere to the relevant regulations in force for the application.
  - The sinking and sourcing cables from the external safety device to the axis must be routed right next to each other with a cable length of ≤ 30 m.
  - The sinking and sourcing cables from the external safety device to the axis must have the same cable length. A difference in length ≤ 3% of the two cables is not permitted.
  - The STO control cable must be routed separately to the power lines of the drive.
- The STO function does not detect short circuits or interference voltage in the supply line. This is why you must make sure that:
  - No parasitic voltages can occur in the STO control lines

    or
  - The external safety controller can detect a crossfault from an external potential to the STO control lines.
- Observe the values specified for safety components when designing the safety circuits.
- The STO signal (STO_P1, STO_P2, and STO_M) may not be used for feedback.
- For safety controller/safety relays, you must only use grounded voltage sources with protective electrical separation (PELV) according to EN 61131-2 and EN 60204-1.
- If several voltage sources are used, each voltage source must be connected to a PE system.
- When planning the installation, observe the technical data of the application inverter.
- Do not use the 24-V-STO_Out of the application inverter for safety-related applications. Voltage is only permitted to supply the connection for safe disconnection X6 with plugged jumper plug.
- For safety-related applications with the application inverter, the jumper plug at the STO input X6 must be removed.

12.3.3 Requirements on the external safety controller

A safety relay can be used as an alternative to a safety controller. The following requirements apply analogously.

- The safety controller and all other safety-related subsystems must be approved for at least that safety class which is required in the overall system for the respective, application-related safety function.

  The following table shows an example of the required safety class of the safety controller:

Application	Safety controller requirements
Performance level d according to EN ISO 13849-1, SIL 2 according to EN 62062	Performance level d according to EN ISO 13849-1 SIL 2 according to EN 61508
Performance level e according to EN ISO 13849-1, SIL 3 according to EN 62061	Performance level e according to EN ISO 13849-1, SIL 3 according to EN 61508

- The wiring of the safety controller must be suitable for the required safety class, (see manufacturer documentation). The STO input of the application inverter can be switched with 2 poles (sourcing, sourcing/sinking, or serial sourcing) or with 1 pole (sourcing).
- The values specified for the safety controller must be strictly adhered to when designing the circuit.
- Electro-sensitive protective equipment (such as light grid or scanner) according to EN 61496-1 and emergency stop buttons must not be directly connected to the STO input. The connection must be realized using safety relays, safety controllers etc.
- To ensure protection against unintended restart in accordance with EN 1037, the safe control system must be designed and connected in such a way that resetting the control device alone does not lead to a restart. A restart may only be carried out after a manual reset of the safety circuit.
- If no fault exclusion is used for the STO wiring according to EN ISO 13849-2 or DIN EN 61800-5-2, the external safety device must detect the following faults in the STO wiring within 20 s depending on the connection type:
  - 2-pole sourcing:

    Short circuit of 24 V at STO_P1 or STO_P2 (Stuck-at 1)

    Crossfault between STO_P1 and STO_P2
  - 2-pole sourcing/sinking:

    Short circuit of 24 V at STO_P1 (Stuck-at 1)

    Short circuit of 0 V at STO_M (Stuck-at 0)
  - 2-pole serial sourcing:

    Fault exclusion is mandatory
  - 1-pole sourcing:

    Short circuit of 24 V at STO_P (Stuck-at 1)

2-pole sourcing:

- In disconnected state, no switch-on test pulses must occur in the sourcing cables.
- In connected state:

23061715/EN – 03/2017

- The switch-off test pulses on both sourcing channels must be switched with a time delay. However, additional switch-off test pulses may occur simultaneously.
- The switch-off test pulses in both sourcing channels must not exceed 1 ms.
- The next switch-off test pulse in one sourcing channel must only occur after a 2 ms time period.
- The signal levels must be played back by the safety controller and compared to the expected value.

2-pole sourcing/sinking:

- In disconnected state, no switch-on test pulses must occur in the sourcing cable.
- In connected state:
  - The switch-off test pulses in the sourcing and sinking channel must not exceed 1 ms.
  - The next switch-off test pulse in the sourcing or sinking channel must only occur after a 2 ms time period.
  - The signal levels must be played back by the safety controller and compared to the expected value.

2-pole serial sourcing:

- Fault exclusion in the connection lead is mandatory if no external test pulses are possible.

1-pole sourcing:

- In disconnected state, no switch-on test pulses must occur in the sourcing cable.
- In connected state:
  - The switch-off test pulse in the sourcing channel must not exceed 1 ms.
  - The next switch-off test pulse must only occur after a 2 ms time period.
  - The signal levels must be played back by the safety controller and compared to the expected value.

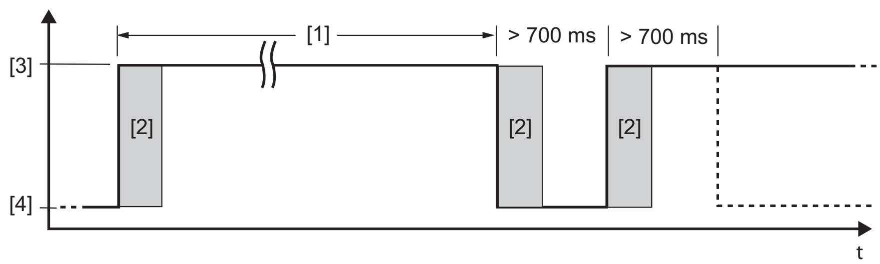
23061715/EN – 03/2017

12.3.4 Requirements on startup

- To validate the implemented safety functions, they must be documented and checked after successful startup (validation).
- Observe the restrictions for safety functions in chapter "Restrictions" for the validation of the safety functions. Non-safety-related parts and components that affect the result of the verification test (e.g. motor brake) must be deactivated, if necessary.
- For using the application inverter in safety-relevant applications, it is essential that you perform and record startup checks for the disconnecting device and correct wiring.

12.3.5 Requirements on operation

- Operation is only allowed within the limits specified in the data sheets. This principle applies to the external safety controller as well as the application inverter and approved options.
- The built-in diagnostic function is limited in case of a permanently enabled or permanently disabled STO input. Only with a level change of the STO signal, extended diagnostic functions are performed. This is why the safety function via STO input must be triggered with connected line voltage at least once every 12 months for PL d according to EN 13849-1 and at least once every 3 months SIL 2 EN 61800-5-2 and for PL e according to EN 13849-1 and SIL 3 EN 61800-5-2 to achieve a complete test coverage. Adhere to the following test sequences.



15205932683

[1] Maximum 12 months with PL d/SIL 2
Maximum 3 months with PL e/SIL 3

[2] Internal diagnostics

[3] High: No STO

[4] Low: STO active

- To achieve complete test coverage after a device reset (e.g. after connecting the line voltage), the test transition (STO active → not active) can only be started > 700 ms later. The device signals "ready for operation" or "STO – safe torque off" if it is not in error state.
- A detected hardware fault in the internal switch-off channels for STO will lead to a locking error state of the application inverter. If the fault is reset (e.g. by switching the line voltage on/off or by a low level at the STO input for at least 30 ms), a complete test with internal diagnostics according to the above mentions test procedure must be performed. If the error occurs again, replace the device or contact the SEW-EURODRIVE Service.

23061715/EN – 03/2017

12.4 Connection variants

12.4.1 General information

Generally, all the connection variants listed in this documentation are permitted for safety-relevant applications as long as the basic safety concept is met. This means you have to make sure that the DC 24 V safety inputs are operated by an external safety relay or a safety controller, thus preventing an automatic restart.

All safety conditions mentioned in chapter "Integrated safety technology" (→ 🗎 283), "Safety conditions" (→ 🗎 288) and "Connection variants" must be met for the basic selection, installation, and application of the safety components, such as safety relay, emergency stop switch, etc., and the approved connection variants.

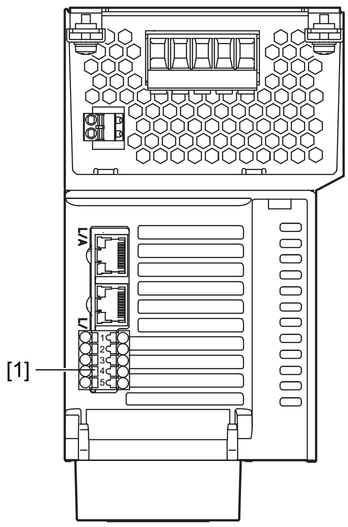
The wiring diagrams are block diagrams whose only purpose is to show the safety function(s) with the relevant components. For reasons of clarity, circuit-related measures that usually always have to be implemented are not shown in the diagram. These measures are e.g.:

- Ensuring touch guards.
- Handling overvoltages and undervoltages.
- Avoiding installation errors.
- Detecting ground faults or short circuits in externally installed lines.
- Guaranteeing the required interference immunity against electromagnetic interference.

12

Connection X6 at the application inverter

The following figure shows the X6 terminal at the top of the application inverter.



17915451659

[1] X6: Connection for safe disconnection (STO)

23061715/EN – 03/2017

12.4.2 Requirements

Use of safety relays

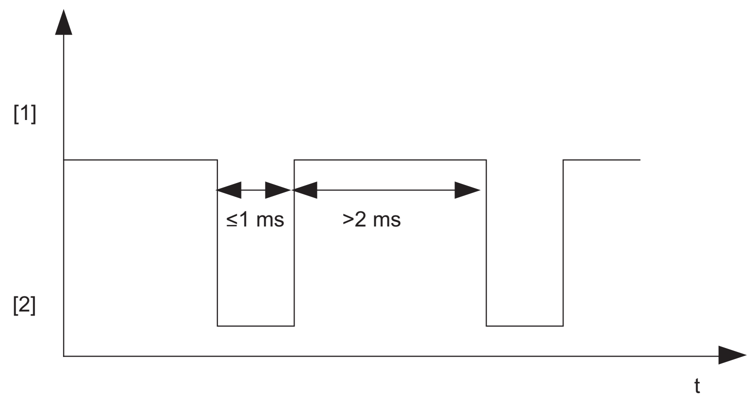
The requirements of the manufacturers of safety relays (such as protecting the output contacts against welding) or other safety components must be strictly observed. For cable routing, the basic requirements apply as described in this publication.

For connecting the application inverter with the safety relays, observe the installation requirements in chapter "Requirements on the installation" (→ 🗎 289).

All instructions by the manufacturer on the use of safety relays for specific applications must also be observed.

Use of safety controllers

The switch-off test pulse of the used safe digital outputs (F-DO) must be ≤ 1 ms and another switch-off test pulse must only occur 2 ms later.



15214338827

[1] High

[2] Low

INFORMATION

If the safety-related control voltage at X6 is switched off (STO activated), the specifications in chapter "Requirements on the external safety controller" (→ 🗎 290) must be adhered to in regard to the test pulses.

INFORMATION

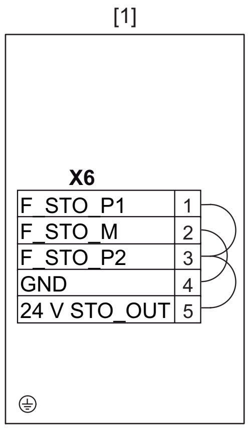
If all safety inputs (X6) are connected, STO is deactivated.

23061715/EN – 03/2017

Wiring diagrams

Delivery state

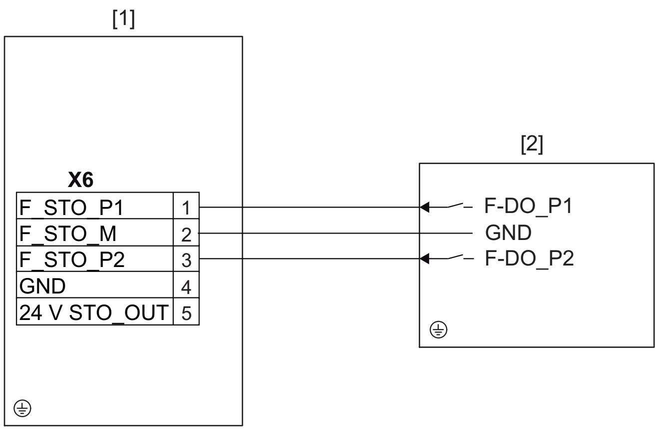
In delivery state, the terminals at the connection for safe disconnection X6 are jumpered.



9007214807030283

[1] MOVIDRIVE® system

2-pole sourcing



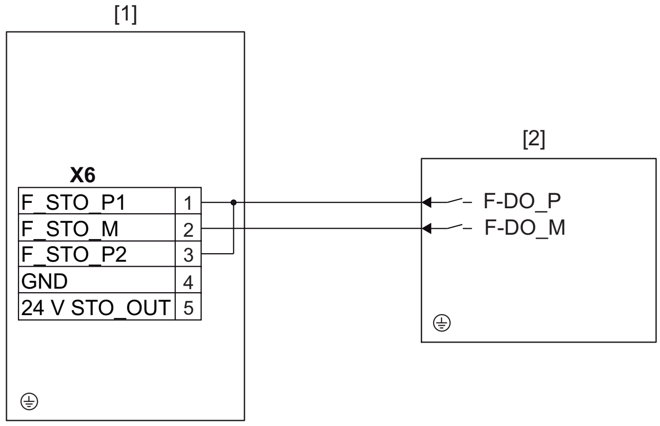
9007214803886091

[1] MOVIDRIVE® system

[2] External safety device

23061715/EN – 03/2017

2-pole sourcing/sinking

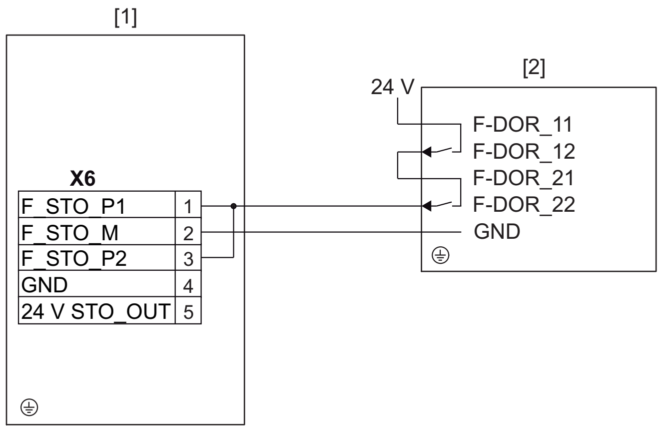


9007214805120139

[1] MOVIDRIVE® system

[2] External safety device

2-pole serial sourcing

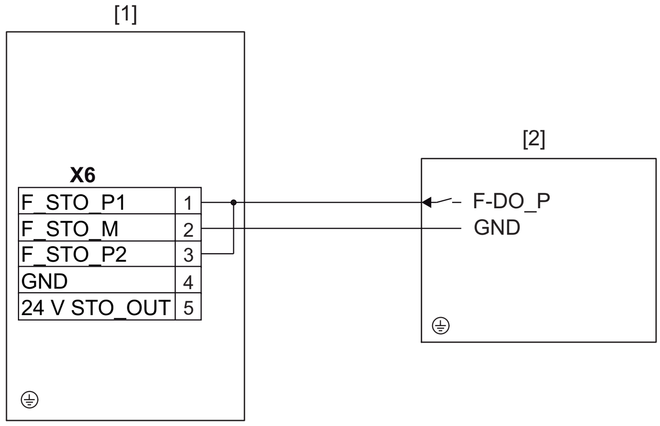


15991307275

[1] MOVIDRIVE® system

[2] External safety device

1-pole sourcing



9007214805125643

[1] MOVIDRIVE® system

[2] External safety device

23061715/EN – 03/2017

12.4.3 STO signal for group disconnection

For group drives, the STO signal for several application inverters can be provided by a single safety relay. The following requirements must be met:

- The cable length is limited to 30 m. Other instructions published by the manufacturer on the use of the safety device (for the respective application) must also be observed.
- The maximum output current and the maximally permitted contact load of the safety device must be observed.
- You must comply with the permitted signal levels at the STO input and all other technical data of the application inverter. The routing of the STO control cables and the voltage drop must be considered.
- Other requirements of the safety manufacturer (such as protecting the output contacts against welding) must be strictly observed. The basic cable routing requirements apply.
- A calculation based on the technical data of the application inverter must be performed separately for each case of group drive disconnection.
- A maximum of 20 axes of the application inverter must be used in a group disconnection.

23061715/EN – 03/2017

12.5 Safety characteristics

	Characteristic values according to	
	EN 61800-5-2	**EN ISO 13849-1**
Tested safety class/underlying standards	Safety integrity level 3	Performance level e
Probability of dangerous failure per hour (PFH value)	2.5×10^{-9} 1/h	
Service life	20 years, after which the component must be replaced with a new one.	
Proof test interval	> 20 years	-
Safe state	Safe torque off (STO)	
Safety function	STO, SS1[1] according to EN 61800-5-2	

1) With suitable external control

12

INFORMATION

With 1-pole wiring, the realizable performance level according to EN ISO 13849 is reduced to PL d. For the wiring between safety relay and STO input, an fault exclusion is necessary.

13 Appendix

13.1 Abbreviation key

The following table lists the abbreviations that are used in this document together with their unit and meaning.

Abbreviation	Information on the nameplate	Unit	Meaning
ASM			Asynchronous motor
C	C	µF	Additional capacitance
f_{max}	f	Hz	Maximum output frequency
f_{line}	f	Hz	Line frequency
f_{PWM}		kHz	Frequency of the pulse width modulation
h		m	Installation altitude
I_F		A	Tripping current (braking resistor)
I_{max}	Imax	A	Max. DC link current (specification on the nameplate)
I_{max}		A	Maximum output current (encoder cards)
I_{peak}		A	Output peak current (encoder cards)
$I_{A\ max}$		A	Max. output current
I_{Appl}		A	Total current of the application
I_N		A	Nominal output current/nominal current (filter, choke)
I_{line}	I	A	Nominal line current
I_{NDCL}	I	A	Nominal DC link current
L_N		mH	Inductance
LSPM			Line start permanent magnet
P_{eff}		kW	Effective power (braking resistor)
P_{max}		kW	Maximum power (braking resistor)
P_{Mot}	P(ASM)	kW	Motor power of the asynchronous motor
P_N		kW	Nominal motor power (rated power)
P_V		W	Power loss
PWM			Pulse width modulation
R_{BW}		Ω	Value of the braking resistor
R_{BWmin}		Ω	Minimum value of the braking resistor
S_N	S	kVA	Apparent output power
SM			Synchronous motor
V_O	U	V	Output voltage motor
V_{BR}		V	Brake supply voltage
V_N		V	Nominal line voltage (filter, choke)
V_{line}	U	V	Connection voltage
V_{NDCL}	U	V	Nominal DC link voltage

23061715/EN – 03/2017

Abbreviation	Information on the nameplate	Unit	Meaning
V_{OUT}		V	DC 24 V to supply STO_P1 and STO_P2
V_{S}		V	Supply voltage of encoder
V_{S12VG}		V	DC 12 V supply voltage of encoder
V_{S24VG}		V	DC 24 V supply voltage of encoder
V_{I24}		V	Voltage supply for electronics and brake
ϑ_{A}	T	°C	Ambient temperature

23061715/EN – 03/2017

13.2 Declaration of conformity

EU Declaration of Conformity

Translation of the original text **901910016/EN**

SEW-EURODRIVE GmbH & Co. KG
Ernst-Blickle-Straße 42, D-76646 Bruchsal
declares under sole responsibility that the following products

Frequency inverters of the product family	**MOVIDRIVE® system** **MDX9.A-0020-5E3-4-S00** **MDX9.A-0025-5E3-4-S00** **MDX9.A-0032-5E3-4-S00** **MDX9.A-0040-5E3-4-S00** **MDX9.A-0055-5E3-4-S00** **MDX9.A-0070-5E3-4-S00** **MDX9.A-0095-5E3-4-S00** **MDX9.A-0125-5E3-4-S00** **MDX9.A-0160-5E3-4-S00** **MDX9.A-0240-503-4-S00** **MDX9.A-0320-503-4-S00** **MDX9.A-0070-2E3-4-S00** **MDX9.A-0093-2E3-4-S00** **MDX9.A-0140-2E3-4-S00** **MDX9.A-0213-203-4-S00** **MDX9.A-0290-203-4-S00**

are in conformity with

Machinery Directive	**2006/42/EC** **(L 157, 09.06.2006, 24-86)**	

This includes the fulfillment of the protection targets for "electrical power supply" in accordance with annex I No. 1.5.1 according to the Low Voltage Directive 73/23/EEC -- Note: 2014/35/EU is currently valid.

EMC Directive	**2014/30/EU** **(L 96, 29.03.2014, 79-106)**	4)
Applied harmonized standards:	**EN ISO 13849-1:2015** **EN 60204-1:2006/A1:2009/AC:2010** **EN 61800-5-1:2007** **EN 61800-5-2:2007** **EN 61800-3:2004/A1:2012**	

4) According to the EMC Directive, the listed products are not independently operable products. EMC assessment is only possible after these products have been integrated in an overall system. For the assessment, the product was installed in a typical plant configuration.

Bruchsal	**12.07.2016**	
Place	Date	Johann Soder Managing Director Technology a) b)

a) Authorized representative for issuing this declaration on behalf of the manufacturer
b) Authorized representative for compiling the technical documents

23061715/EN – 03/2017

Index

T

U

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W

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23061715/EN – 03/2017

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Drive Center	Berlin	SEW-EURODRIVE GmbH & Co KG Alexander-Meißner-Straße 44 12526 Berlin	Tel. +49 306331131-30 Fax +49 306331131-36 dc-berlin@sew-eurodrive.de
	Ludwigshafen	SEW-EURODRIVE GmbH & Co KG c/o BASF SE Gebäude W130 Raum 101 67056 Ludwigshafen	Tel. +49 7251 75 3759 Fax +49 7251 75 503759 dc-ludwigshafen@sew-eurodrive.de
	Saarland	SEW-EURODRIVE GmbH & Co KG Gottlieb-Daimler-Straße 4 66773 Schwalbach Saar – Hülzweiler	Tel. +49 6831 48946 10 Fax +49 6831 48946 13 dc-saarland@sew-eurodrive.de
	Ulm	SEW-EURODRIVE GmbH & Co KG Dieselstraße 18 89160 Dornstadt	Tel. +49 7348 9885-0 Fax +49 7348 9885-90 dc-ulm@sew-eurodrive.de

23061715/EN – 03/2017

Germany			
	Würzburg	SEW-EURODRIVE GmbH & Co KG Nürnbergerstraße 118 97076 Würzburg-Lengfeld	Tel. +49 931 27886-60 Fax +49 931 27886-66 dc-wuerzburg@sew-eurodrive.de
Drive Service Hotline / 24 Hour Service			0 800 SEWHELP 0 800 7394357
Great Britain			
Assembly Sales Service	Normanton	SEW-EURODRIVE Ltd. DeVilliers Way Trident Park Normanton West Yorkshire WF6 1GX	Tel. +44 1924 893-855 Fax +44 1924 893-702 http://www.sew-eurodrive.co.uk info@sew-eurodrive.co.uk
	Drive Service Hotline / 24 Hour Service		Tel. 01924 896911
Greece			
Sales	Athens	Christ. Boznos & Son S.A. 12, K. Mavromichali Street P.O. Box 80136 18545 Piraeus	Tel. +30 2 1042 251-34 Fax +30 2 1042 251-59 http://www.boznos.gr info@boznos.gr
Hungary			
Sales Service	Budapest	SEW-EURODRIVE Kft. Csillaghegyí út 13. 1037 Budapest	Tel. +36 1 437 06-58 Fax +36 1 437 06-50 http://www.sew-eurodrive.hu office@sew-eurodrive.hu
Iceland			
Sales	Reykjavik	Varma & Vélaverk ehf. Knarrarvogi 4 104 Reykjavík	Tel. +354 585 1070 Fax +354 585)1071 http://www.varmaverk.is vov@vov.is
India			
Registered Office Assembly Sales Service	Vadodara	SEW-EURODRIVE India Private Limited Plot No. 4, GIDC POR Ramangamdi • Vadodara - 391 243 Gujarat	Tel. +91 265 3045200 Fax +91 265 3045300 http://www.seweurodriveindia.com salesvadodara@seweurodriveindia.com
Assembly Sales Service	Chennai	SEW-EURODRIVE India Private Limited Plot No. K3/1, Sipcot Industrial Park Phase II Mambakkam Village Sriperumbudur - 602105 Kancheepuram Dist, Tamil Nadu	Tel. +91 44 37188888 Fax +91 44 37188811 saleschennai@seweurodriveindia.com
	Pune	SEW-EURODRIVE India Private Limited Plant: Plot No. D236/1, Chakan Industrial Area Phase- II, Warale, Tal- Khed, Pune-410501, Maharashtra	Tel. +91 21 35 628700 Fax +91 21 35 628715 salespune@seweurodriveindia.com
Indonesia			
Sales	Medan	PT. Serumpun Indah Lestari Jl.Pulau Solor no. 8, Kawasan Industri Medan II Medan 20252	Tel. +62 61 687 1221 Fax +62 61 6871429 / +62 61 6871458 / +62 61 30008041 sil@serumpunindah.com serumpunindah@yahoo.com http://www.serumpunindah.com
	Jakarta	PT. Cahaya Sukses Abadi Komplek Rukan Puri Mutiara Blok A no 99, Sunter Jakarta 14350	Tel. +62 21 65310599 Fax +62 21 65310600 csajkt@cbn.net.id
	Jakarta	PT. Agrindo Putra Lestari JL.Pantai Indah Selatan, Komplek Sentra Industri Terpadu, Pantai indah Kapuk Tahap III, Blok E No. 27 Jakarta 14470	Tel. +62 21 2921-8899 Fax +62 21 2921-8988 aplindo@indosat.net.id http://www.aplindo.com

Indonesia			
	Surabaya	PT. TRIAGRI JAYA ABADI Jl. Sukosemolo No. 63, Galaxi Bumi Permai G6 No. 11 Surabaya 60111	Tel. +62 31 5990128 Fax +62 31 5962666 sales@triagri.co.id http://www.triagri.co.id
	Surabaya	CV. Multi Mas Jl. Raden Saleh 43A Kav. 18 Surabaya 60174	Tel. +62 31 5458589 Fax +62 31 5317220 sianhwa@sby.centrin.net.id http://www.cvmultimas.com
Ireland			
Sales Service	Dublin	Alperton Engineering Ltd. 48 Moyle Road Dublin Industrial Estate Glasnevin, Dublin 11	Tel. +353 1 830-6277 Fax +353 1 830-6458 http://www.alperton.ie info@alperton.ie
Israel			
Sales	Tel Aviv	Liraz Handasa Ltd. Ahofer Str 34B / 228 58858 Holon	Tel. +972 3 5599511 Fax +972 3 5599512 http://www.liraz-handasa.co.il office@liraz-handasa.co.il
Italy			
Assembly Sales Service	Milan	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via Bernini,14 20020 Solaro (Milano)	Tel. +39 02 96 980229 Fax +39 02 96 980 999 http://www.sew-eurodrive.it milano@sew-eurodrive.it
Ivory Coast			
Sales	Abidjan	SEW-EURODRIVE SARL Ivory Coast Rue des Pêcheurs, Zone 3 26 BP 916 Abidjan 26	Tel. +225 21 21 81 05 Fax +225 21 25 30 47 info@sew-eurodrive.ci http://www.sew-eurodrive.ci
Japan			
Assembly Sales Service	Iwata	SEW-EURODRIVE JAPAN CO., LTD 250-1, Shimoman-no, Iwata Shizuoka 438-0818	Tel. +81 538 373811 Fax +81 538 373814 http://www.sew-eurodrive.co.jp sewjapan@sew-eurodrive.co.jp hamamatsu@sew-eurodrive.co.jp
Kazakhstan			
Sales	Almaty	SEW-EURODRIVE LLP 291-291A, Tole bi street 050031, Almaty	Tel. +7 (727) 350 5156 Fax +7 (727) 350 5156 http://www.sew-eurodrive.kz sew@sew-eurodrive.kz
	Tashkent	SEW-EURODRIVE LLP Representative office in Uzbekistan 96A, Sharaf Rashidov street, Tashkent, 100084	Tel. +998 71 2359411 Fax +998 71 2359412 http://www.sew-eurodrive.uz sew@sew-eurodrive.uz
	Ulaanbaatar	IM Trading LLC Narny zam street 62 Sukhbaatar district, Ulaanbaatar 14230	Tel. +976-77109997 Fax +976-77109997 imt@imt.mn
Kenya			
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

23061715/EN – 03/2017

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			
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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

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

23061715/EN – 03/2017

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. Ul. 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

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 Fax +34 94 43184-71 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

23061715/EN – 03/2017

Ukraine			
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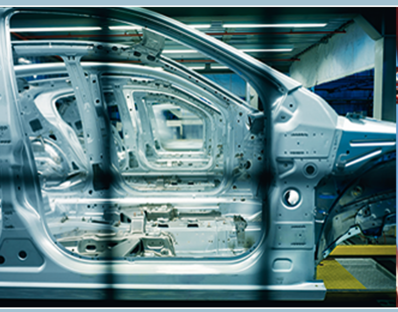
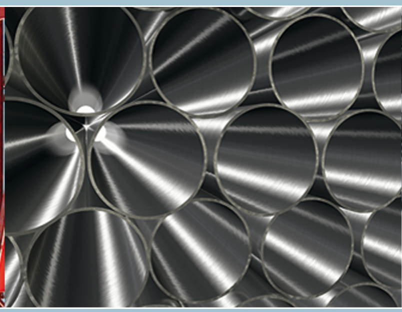
Uruguay			
Assembly Sales	Montevideo	SEW-EURODRIVE Uruguay, S. A. Jose Serrato 3569 Esqina Corumbe CP 12000 Montevideo	Tel. +598 2 21181-89 Fax +598 2 21181-90 sewuy@sew-eurodrive.com.uy
USA			
Production Assembly Sales Service	Southeast Region	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 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	IGLogistics@seweurodrive.com
	Additional addresses for service provided on request!		
Uzbekistan			
Technical Office	Tashkent	SEW-EURODRIVE LLP Representative office in Uzbekistan 96A, Sharaf Rashidov street, Tashkent, 100084	Tel. +998 71 2359411 Fax +998 71 2359412 http://www.sew-eurodrive.uz sew@sew-eurodrive.uz
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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Driving the world

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