SEW EURODRIVE

Operating Instructions

Standard Inverters
MOVITRAC® LTP-B

Edition 10/2023

30593557/EN

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1 General information

1.1 Structure of the safety notes

1.1.1 Meaning of signal words

The following table shows the 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.	

1.1.2 Meaning of the hazard symbols

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

Hazard symbol	Meaning
	General hazard
	Warning of dangerous electrical voltage
	Warning of hot surfaces
	Warning of automatic restart

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2 Safety notes

2.1 Target group

Specialist for mechanical work

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

- Qualifications in the field of mechanics in accordance with the national regulations
- Familiarity with this documentation

Specialist for electrotechnical work

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

- Qualifications in the field of electrical engineering in accordance with the national regulations
- Familiarity with this documentation

Additional qualifications

In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation.

The persons must have the express authorization of the company to operate, program, parameterize, label, and ground devices, systems, and circuits in accordance with the standards of safety technology.

Instructed persons

All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately. The purpose of the training is to give persons the ability to perform the required tasks and work steps in a safe and correct manner.

2.2 Designated use

The product is intended for control cabinet installation in electrical systems 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.

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.

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

2.2.1 Lifting applications

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

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

Application in ELSM® control mode

When the inverter is operated in ELSM® control mode, using it in lifting applications and inclining tracks is not permitted.

2.2.2 Restrictions of use

The following applications are prohibited unless the device is explicitly designed for such use:

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

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

- The reduction of the nominal output current and/or the line voltage is considered according to the data in chapter "Technical data" in the documentation.
- Above 2000 m above sea level, the air and creepage distances are only sufficient for overvoltage class II according to EN 60664. At altitudes above 2000 m above sea level, limiting measures must therefore be taken that reduce the line side overvoltage from category III to category II for the entire system.
- If a protective electrical separation (in accordance with EN 61800-5-1 and EN 60204-1) is required, then implement this outside the product at altitudes of more than 2000 m above sea level.

Observe the restrictions of use in chapter "General technical data".

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2.3 Functional safety technology

The product includes the STO safety sub-function. As an option, additional safety sub-functions can be included for the product.

The safety sub-functions are deactivated in the delivery state. The product may not perform any safety function without higher-level safety systems.

To use the STO safety sub-function or other safety sub-functions, please follow the product manual and the manual for the optional safety function of this device.

2.4 Transport

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

Observe the following notes when transporting the device:

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

If necessary, use suitable, sufficiently dimensioned handling equipment.

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

2.5 Installation/assembly

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

Protect the product from strong mechanical strain. Ensure that components are not deformed and insulation spaces are not changed, particularly during transportation and handling. Electrical components must not be mechanically damaged or destroyed.

Observe the notes in the chapter "Mechanical installation".

2.6 Electrical installation

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

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

2.6.1 Required preventive measure

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

2.6.2 Stationary application

Necessary preventive measure for the product:

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

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2.6.3 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.

2.7 Protective separation

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

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

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2.8 Startup/operation

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

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.

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.

Risk of burns due to arcing: Do not disconnect power connections during operation. Do not connect power connections during operation.

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 protective functions of the product can cause a motor standstill. Eliminating the cause of the problem or performing a reset may result in the drive restarting 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.

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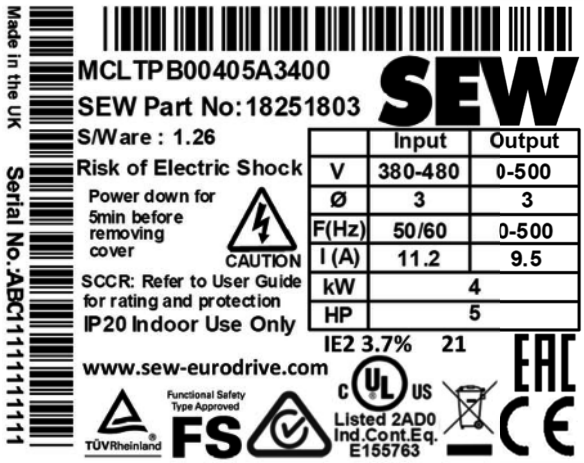
3 Device structure

3.1 Nameplate and type designations

3.1.1 Nameplate

The following figure shows an example of a nameplate.



3.1.2 Type designation

Example: MCLTPB0015-2B1-4-00 (60 Hz)		
Product name	MCLTP	MOVITRAC® LTP-B
Version	B	Version status of device series
Recommended motor power	0015	0015 = 1.5 kW
Connection voltage	2	2 = 200 to 240 V 5 = 380 to 480 V U = 480 to 525 V 6 = 500 to 600 V
Interference suppression on the input	B	0 = Device without filter (no interference suppression) A = Class C2 B = Class C1
Connection type	1	1 = 1-phase 3 = 3-phase
Quadrants	4	4 = 4-quadrant operation

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Example: MCLTPB0015-2B1-4-00 (60 Hz)		
Design	00	00 = Standard IP20 housing 10 = IP55/NEMA-12K housing 15 = IP55/NEMA-12K housing for operation on IT systems 30 = IP66/NEMA-4X housing without switch 40 = IP66/NEMA-4X housing with switch xH = High-frequency version
Country-specific variant	(60 Hz)	60-Hz design

3.2 Markings

The following table explains all markings that can be shown on the nameplate or be appended to the motor.

Mark	Definition
CE	The CE mark indicates compliance with the following European directives: • Low Voltage Directive 2014/35/EU • EMC Directive 2014/30/EU • Machinery Directive 2006/42/EC • Directive 2011/65/EU for limiting the use of certain hazardous substances in electrical and electronic equipment
UKCA	The UKCA mark indicates compliance with British guidelines.
50	The China RoHS mark indicates compliance with the directive SJ/T 11364-2014 regarding the restriction of use of certain hazardous substances in electrical and electronic equipment and its packaging.
	The waste disposal of this product is performed in compliance with the WEEE Directive 2012/19/EU.
	The NM mark states the compliance with the following Moroccan guidelines: • Low Voltage Directive No 2573-14 (16 July, 2015) • EMC Directive No 2574-14 (16 July, 2015)
Functional Safety Type Approved TÜVRheinland FS	TÜV/FS mark with code number to identify functional safety relevant components
c UL us LISTED	The UL and cUL mark indicates UL approval. cUL is equally eligible for approval by the CSA.

Mark	Definition
EAC	The EAC mark indicates compliance with the requirements of the technical regulations of the Customs Union (Eurasian Economic Union), Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia.
	The RCM mark indicates compliance with the technical regulations of the Australian Communications and Media Authority (ACMA).

All products comply with the following international standards:

- UL 508C Power Conversion Equipment
- EN 61800-3:2004/A1:2012 Adjustable-Speed Electrical Drive Systems – Part 3
- EN ISO 13849-1 Safe Torque Off (STO) according to PL d
- Degree of protection according to NEMA 250, EN 60529
- Flammability class according to UL 94
- Protection against environmental influences according to IEC 60721-3-3, IP20 inverter: 3S2/3C2 IP55- & IP66 inverter: 3S3/3C3
- Shock resistance/vibration resistance according to: IEC 60068-2-29, IEC 60068-2-64, IEC 60068-2-6

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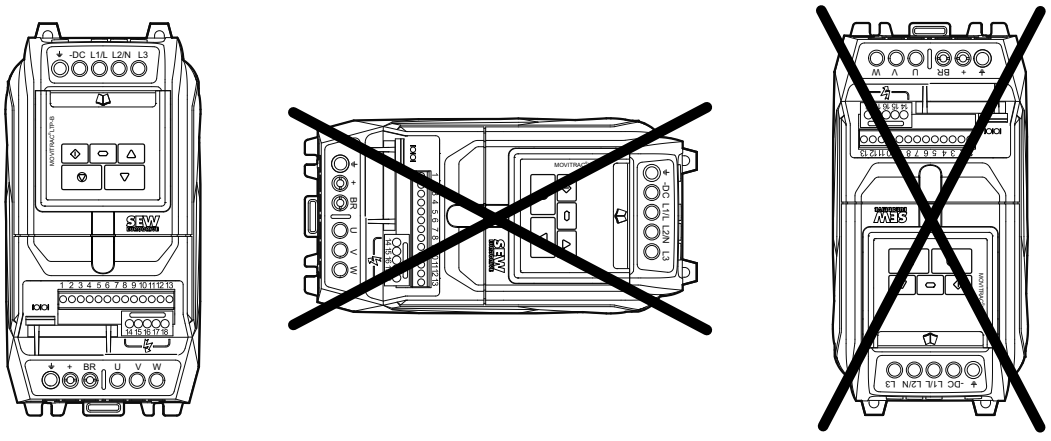
4 Mechanical installation

4.1 Installation notes

Please note the following information for mechanical installation:

- Carefully check the inverter for damage before the installation.
- Store the inverter in its original packaging until it is used. The storage location must be clean and dry with an ambient temperature between -40 °C and +60 °C.
- Install the inverter in a suitable housing on a level, vertical, non-flammable, and vibration-free surface. If a certain IP degree of protection is required, observe EN 60529.
- Keep flammable materials away from the inverter.
- Prevent the ingress of conductive or flammable foreign objects.
- The relative humidity must be kept below 95% (condensation is not permitted).
- Protect the IP55/IP66 inverter from direct sunlight. Use a cover when using the inverter outdoors.
- Inverters can be installed next to each other. Ensure sufficient ventilation space between the individual devices. If the inverter is to be installed above another inverter or another device that dissipates heat, then there must be a vertical minimum clearance of 150 mm. To enable self-cooling, the control cabinet must either be cooled through forced ventilation, or dimensioned accordingly. See chapter "IP20 housing: Installation and installation space" (→ 🗎 16).
- The permitted ambient temperatures are defined in chapter "Ambient conditions".
- The mounting rail can only be installed for the following inverters with IP20 degree of protection.
  - 200 to 240 V: 0.75 to 2.2 kW
  - 380 to 480 V: 0.75 to 4 kW
  - 500 to 600 V: 0.75 to 5.5 kW
- The mounting rail must have the dimensions 35 × 15 mm or 35 × 7.5 mm and be designed in accordance with EN 50022.



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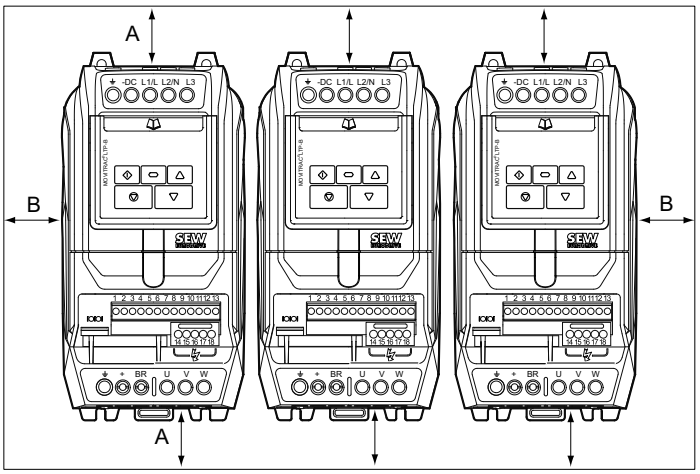
4.2 Installing the inverter

4.2.1 IP20 housing: Installation and installation space

Inverters with degree of protection IP20 must be installed in a control cabinet. Observe the following requirements:

- The control cabinet must be made of heat-conducting material, unless it has forced air cooling.
- If you use a control cabinet with ventilation openings, the openings must be provided below and above the inverter. This way, you ensure good air circulation. The air must be supplied underneath the inverter and extracted above it.
- If the outer surroundings contain particles such as dust, install a suitable particle filter on the ventilation openings and use forced air cooling. Clean and maintain the filter.
- In environments with high humidity, salt or chemicals concentrations, use a closed control cabinet (without ventilation openings).
- You can install the inverters in IP20 directly next to each other without spacing.



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Inverter power rating	A in mm	B in mm	Air flow rate per inverter
230 V: 0.75 – 2.2 kW (IP20) **400 V**: 0.75 – 4 kW (IP20) **575 V**: 0.75 – 5.5 kW (IP20)	75	10	>18 m³/h
230 V: 3 – 5.5 kW (IP20) **400 V**: 5.5 – 11 kW (IP20) **575 V**: 7.5 – 15 kW (IP20)	100	10	>54 m³/h

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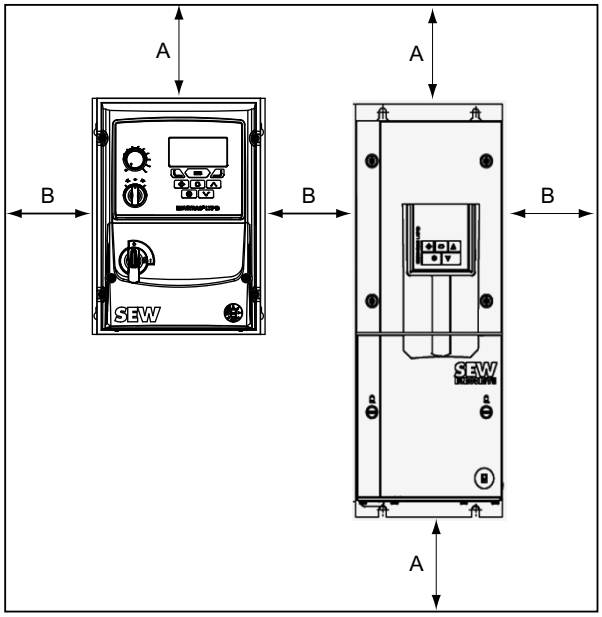
4.2.2 IP55/IP66 housing: Installation and control cabinet dimensions

Inverters with IP55/IP66 degree of protection can be used indoors.

The minimum distances in control cabinets or in the field must not be less than the ones shown here.



Power rating of the inverter	A in mm	B in mm	Cooling
200 to 240 V			
0.75 to 4 kW (IP66)	200	10	Convection
5.5 to 11 kW (IP66)	200	10	Fan
5.5 to 75 kW (IP55)	200	10	Fan
380 to 480 V			
0.75 to 7.5 kW (IP66)	200	10	Convection
11 to 22 kW (IP66)	200	10	Fan
11 to 160 kW (IP55)	200	10	Fan
200 to 250 kW (IP55)	350	50	Fan
500 to 600 V			
0.75 to 11 kW (IP66)	200	10	Convection
15 to 30 kW (IP66)	200	10	Fan
15 to 110 kW (IP55)	200	10	Fan
480 to 525 V			
132 to 200 kW (IP55)	200	10	Fan

INFORMATION

If the IP55/IP66 inverter is installed in a control cabinet, it must be ensured that the control cabinet is sufficiently ventilated. The control cabinet ventilation is dimensioned by the control cabinet manufacturer in consideration of all heat sources.

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4.3 Tightening torques

Tighten the terminal screws with the following tightening torques:

Power rating of the inverter	Tightening torque in Nm	
	Control terminals	Power terminals
Nominal line voltage 200 to 240 V		
0.75 to 2.2 kW (IP20)	0.5	1
3 to 5.5 kW (IP20)		1
0.75 to 2.2 kW (IP66)		1
3 to 5.5 kW (IP66)		1
7.5 to 11 kW (IP66)		2
5.5 to 11 kW (IP55)		2
15 to 18.5 kW (IP55)		4
22 to 45 kW (IP55)		15
55 to 75 kW (IP55)		15
Nominal line voltage 380 to 480 V		
0.75 to 4 kW (IP20)	0.5	1
5.5 to 11 kW (IP20)		1
0.75 to 4 kW (IP66)		1
5.5 to 11 kW (IP66)		1
15 to 22 kW (IP66)		2
11 to 22 kW (IP55)		2
30 to 37 kW (IP55)		4
45 to 90 kW (IP55)		15
110 to 160 kW (IP55)		15
200 to 250 kW (IP55)		60
Nominal line voltage 500 to 600 V		
0.75 to 5.5 kW (IP20)	0.5	1
7.5 to 15 kW (IP20)		1
0.75 to 5.5 kW (IP66)		1
7.5 to 15 kW (IP66)		1
18.5 to 30 kW (IP66)		2
15 to 30 kW (IP55)		2
37 to 45 kW (IP55)		4
55 to 110 kW (IP55)		15
Nominal line voltage 480 to 525 V		
132 to 200 kW (IP55)	0.5	15

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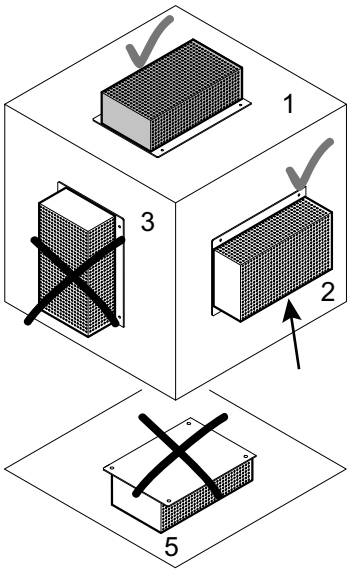
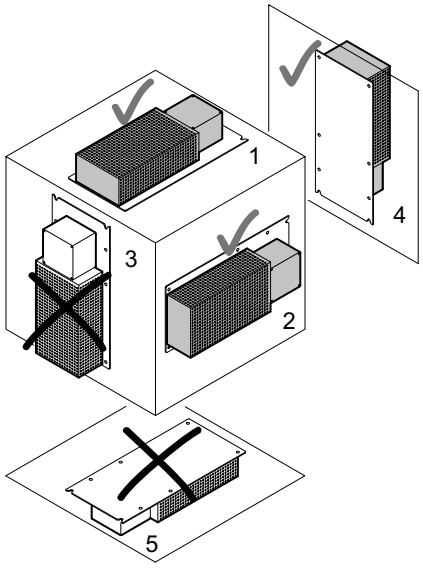
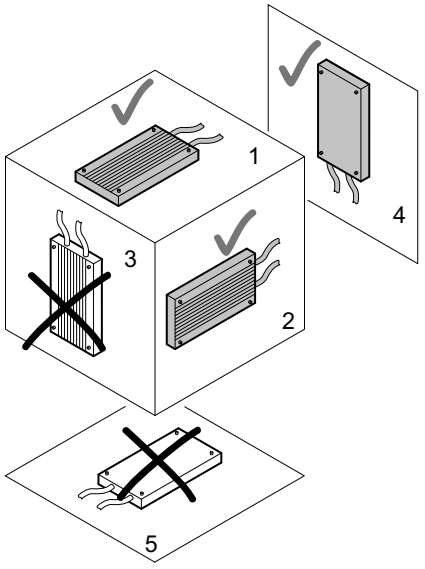
4.4 Installing braking resistors

The surfaces of the braking resistors will reach temperatures of up to 250 °C when the braking resistors are loaded with the nominal power. The installation location of the braking resistor must be designed according to the high temperatures. For this reason, the braking resistors are usually mounted outside the control cabinet. Non-permissible installation might lead to heat build-up in the braking resistor due to reduced convection. A tripping temperature contact or an overheated braking resistor can lead to a system standstill.

The following minimum clearances must be observed for convection cooling depending on the continuous braking power and the mounting position:

Continuous braking power at 100% cdf	Mounting position	Lateral distance or distance between resistors in mm	Downward distance in mm	Upward distance in mm
Up to 1 kW	horizontal[1)]	200	0	350
	vertical[2)]	150	250	300
Up to 10 kW	horizontal[3)]	300	0	650
	vertical[2)]	250	350	600
Up to 22 kW	horizontal[3)]	400	0	750
	vertical[2)]	350	400	700
Up to 44 kW	horizontal[3)]	500	0	850
	vertical[2)]	Not permitted	Not permitted	Not permitted

1) Corresponds to mounting position 1, 2, 5, 6.
2) Corresponds to mounting position 3, 4.
3) Corresponds to mounting position 1, 2, 5 and 6.

Permitted mounting positions		
Grid resistor, frame resistor	Wire resistor	Flat type resistor
		

The BW003-420-T and BW1.0-170 braking resistors may only be used in position 1.

5 Electrical installation

⚠ WARNING

Electric shock from charged capacitors. Dangerous voltage levels may still be present inside the device and at the terminals up to 10 minutes after disconnection from the grid.

Severe or fatal injuries.

- Wait 10 minutes after you have de-energized the inverter and disconnected the line voltage and the DC-24 V voltage.
- Make sure that the device is de-energized.
- Only then must you commence any work on the device.

⚠ WARNING

Danger of fatal injury from falling hoist.

Severe or fatal injuries.

- Do not use the inverter as a safety device for lifting applications. Use monitoring systems or mechanical protection devices as safety equipment.

- Only trained electricians may install the inverter in observation of the applicable rules and regulations.
- The grounding cable must be dimensioned for the maximum line fault current that is normally limited by fuses or motor circuit breakers.
- The inverter has the IP20 degree of protection. For a higher IP degree of protection, use a suitable enclosure or the IP55/NEMA 12K or IP66/NEMA 4X variants.
- Make sure that the devices are properly grounded. Adhere to the wiring diagram in chapter "Connecting the inverter and motor" (→ 🗎 43).

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5.1 Installation instructions

5.1.1 Before installation

- Make sure that the supply voltage, frequency and the number of phases (one or three-phase) correspond to the nominal values of the inverter on delivery.
- A circuit breaker or similar disconnector must be installed between the voltage supply and the inverter.
- Never connect the power supply to the output terminals U, V or W of the inverter.
- Do not install any contactors between the inverter and the motor. Where control cables and high-voltage power lines are installed close to each other, keep a minimum distance of 100 mm and an angle of 90° for crossing cables.
- The cables are protected only by inactive high-breaking-capacity fuses or a motor circuit breaker. For more information, refer to the section "Permitted voltage supply systems" (→ 🗎 21).
- Use a 4-core PVC-insulated and shielded cable as the motor cable. Lay this cable in compliance with the national industry regulations and according to these rules. Use conductor end sleeves to connect the motor cable to the inverter.
- Make sure that shieldings and sheaths of the motor cable are designed according to the wiring diagram in section "General specifications for connection of the motor shield".
- Make sure that the grounding terminal of each inverter is connected separately and **directly**, and if present via a filter, to the ground busbar (ground) of the installation site.
- Do not loop the ground connections of the inverter from inverter to inverter. You must also not lead the ground connections from other inverters to the inverters.
- Make sure that the impedance of the grounding circuit conforms to the local industry safety regulations.
- Make sure that all terminals are tightened with the respective tightening torques, see chapter "Permitted tightening torques" (→ 🗎 18).
- To fulfill the UL requirements, implement all ground connections with UL-listed crimp ring cable lugs.

Unlike direct operation in the supply system, inverters on the motor usually generate fast-switching output voltages (PWM). In the case of motors wound for operation with adjustable-speed drives, no further preventive actions are necessary. If, however, the insulation quality is unknown, contact the manufacturer of the motor because preventive actions may be necessary.

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Make sure that the earth connections are properly connected. The inverter can generate leakage currents > 3.5 mA. The grounding cable must be sufficiently dimensioned to carry the maximum fault current of the voltage source, which is usually limited by fuses or miniature circuit breakers.

Sufficiently rated fuses or miniature circuit breakers must be integrated into the inverter's mains supply in accordance with local laws and/or regulations.

5.1.2 Permitted voltage supply systems

- **Voltage supply systems with grounded star point**

  Inverters of all protection degrees are intended for operation on TN and TT voltage supply systems with a directly grounded star point.

- **Voltage supply systems with non-grounded star point**

  The following inverters can be used on supply systems with a non-grounded star point (e.g. IT systems) after a corresponding conversion (see chapter "Operation in IT Systems" (→ 🗎 23)):

  – All devices with degree of protection IP20/NEMA 1
  – All devices with degree of protection IP66/NEMA 4X
  – Devices with 200/250 kW with the IP55/NEMA 12K degree of protection
  – Inverters of sizes 4 to 7 with IP55 degree of protection in the LTP-B....-...-.-15 device variant can be operated directly on an IT system, see chapter "3-phase system AC 380 to 480 V as IT system version – device without filter".

- **Voltage supply systems with grounded outer conductor**

  Inverters of any protection degree may be operated only on voltage supply systems with a maximum phase-to-ground AC voltage of 300 V.

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5.1.3 Operation on an IT system

⚠ WARNING

Danger of electric shock. Dangerous voltage levels can occur inside the inverter and at the terminals for up to 10 minutes after disconnection from the supply system.

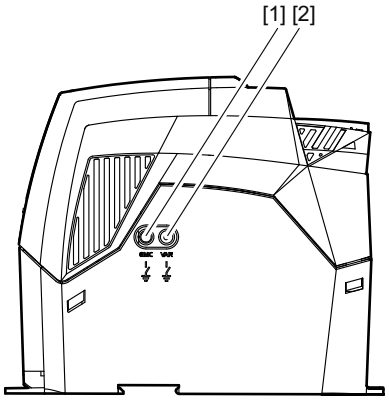
Severe or fatal injuries.

- Before unscrewing the EMC and VAR screws, disconnect the inverter from the power supply and wait for at least 10 minutes.

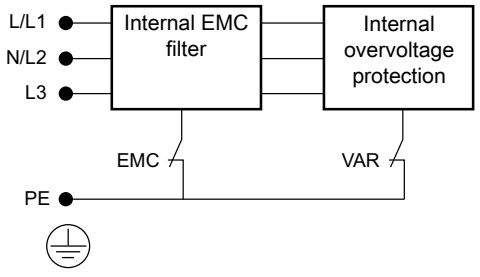
- Convert inverters with IP20 and IP66 degree of protection before operation on an IT system.
- The user must convert inverters of size 8 with IP55 degree of protection before operation on an IT system.
- You cannot convert inverters of sizes 4 to 7 with IP55 degree of protection.
- For the 3 × 380 to 480-V devices with the IP55 degree of protection, use the LTP-B....–...–.–15 IT system version without filter, see chapter "3-Phase System AC380 to 480 V as IT System Version – device without filter".
- For all other inverters with IP55 degree of protection, contact SEW-EURODRIVE.
- Deactivate the integrated EMC filter to operate a MOVITRAC® LTP-B on the IT system.

IP20 devices

- On IP20 devices, unscrew the EMC screw and the VAR screw on the side of the device.



[1] EMC screw
[2] VAR screw



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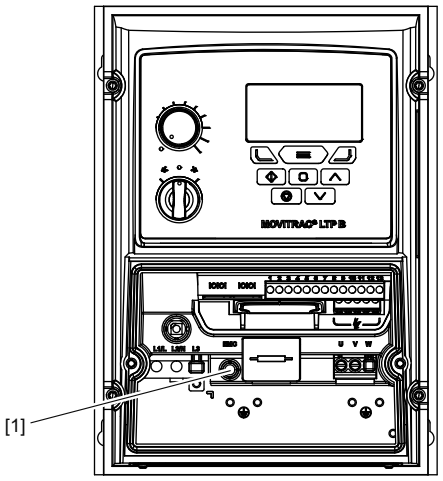
IP66 devices

- On IP66 devices, unscrew the EMC screw in the terminal connection under the cover.

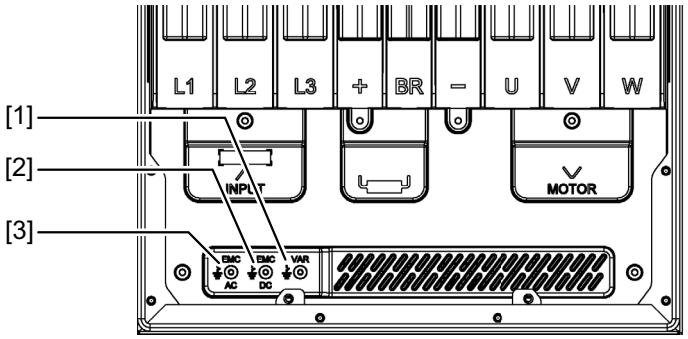


IP55 devices

The IT system conversion with degree of protection IP55 is only possible for the following devices:

- LTP-B 2000-5A3-4-10 (3 × AC 380 to 480 V with 200 kW)
- LTP-B 2500-5A3-4-10 (3 × AC 380 to 480 V with 250 kW)

On size 8, unscrew the screws [1], [2], and [3] in the terminal box under the middle front cover.



[1] VAR
[2] EMC DC
[3] EMC AC

SEW-EURODRIVE recommends using the insulation monitor with pulse-code measurement in voltage supply systems with a non-grounded star point (IT systems). This prevents a false tripping of the insulation monitor due to the earth capacitance of the inverter.

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5.1.4 Selecting the residual current device

The inverter can cause a direct current in the protective earthing conductor.

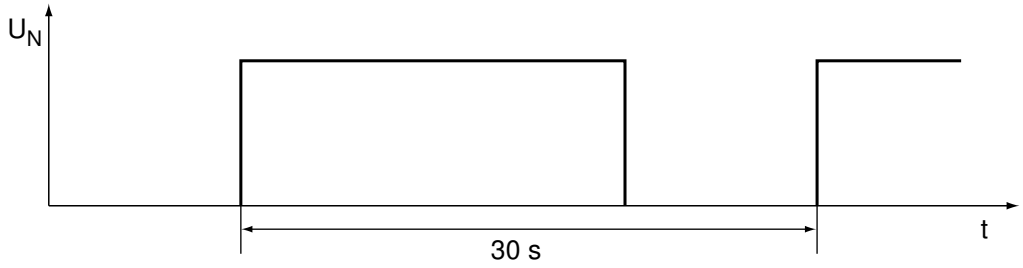
Proceed as follows when selecting the residual current device:

1. If using a residual current device is not mandatory according to the standards, SEW-EURODRIVE recommends not using a residual current device.
2. ⚠ **WARNING!** No protection against electric shock if an incorrect type of residual current device is used. Severe or fatal injuries.
   If a residual current device (residual current protection device RCD or residual current monitor RCM) is required, use a universal current sensitive type B RCD or RCM.
3. If a residual current device is required, then select the residual current device according to the requirements for personnel, fire, or system protection. During selection, be mindful of the trigger characteristic, the delay, and the trigger rated current of the residual current device.
4. During project planning, make sure that operation-related leakage currents are kept as low as possible in the system.
5. If the operation-related leakage currents are too high, then you can divide the current supply among several residual current devices.

5.1.5 Using the line contactor

Use only input contactors of the AC-3 utilization category (EN 60947-4-1).

Wait for at least 30 seconds between two switching cycles.



5.1.6 Mains fuses

Fuse types:

- Line protection types in operation classes gL, gG:
  - Nominal fusing voltage ≥ nominal line voltage
  - The nominal fusing current must be designed for at least 100% of the inverter nominal input current depending on the inverter utilization.
- Power circuit breaker with characteristics B, C:
  - Nominal circuit breaker voltage ≥ nominal line voltage
  - The nominal currents of the power circuit breakers must be 10% higher than the nominal inverter current.

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5.1.7 Motor cable

Cable length

For the maximum length of the motor cable, refer to the respective device listed in chapter "Technical data".

Cable cross section

Select the cable cross section of the motor cable in a way that a maximum of 5% voltage drop occurs at nominal motor current. Read the information in the relevant motor catalogs. An excessively high voltage drop means that the full motor torque is not achieved.

5.1.8 Multi-motor drive/group drive

- The total of motor currents must not exceed the nominal current of the inverter. The maximum permissible cable length for the group is limited to the values of the individual connection. See chapter "Technical data".
- The motor group is limited to 5 motors that must not differ from each other by more than 3 sizes.
- Multi-motor drive is possible only with AC asynchronous motors and not with synchronous motors.
- SEW-EURODRIVE recommends to use an output choke "HD LT xxx", additionally unshielded cables, and a maximum permitted output frequency of 4 kHz for groups of more than 3 motors.

Maximum motor cable length

The permitted total length of all motor supply leads connected in parallel (l_{tot}) must not exceed the maximum permitted motor cable length of the individual inverter (l_{max}).

$$l_{tot} \leq \frac{l_{max}}{n}$$

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l_{tot} = Maximum permissible total length of the motor cables connected in parallel: $l_{tot} = l1 + l2 + ... + ln$ (l1, l2, ... ln = line from inverter to motor 1, 2, ...)

l_{max} = Maximum motor cable length (see chapter "Technical data")

n = Number of motors connected in parallel.

Fusing

No additional fusing is required if the cross section of the motor cable corresponds to that of the supply system cable. If the cross section of the motor cable is smaller than the cross section of the supply system cable, you must secure the motor cable against short circuit for the corresponding cross section. Motor circuit breakers are suitable for this.

Comply with the regulations issued by specific countries and for specific machines regarding fusing and the selection of supply system and motor cables.

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5.1.9 Information regarding UL

INFORMATION

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

Ambient Temperature

The units in IP20 are suitable for an ambient temperature of 50 °C, max. 60 °C.

The units in IP55/IP66 are suitable for an ambient temperature of 40 °C, max 50 °C.

Thermal motor protection

Thermal motor overload protection shall be provided by one of the following means:

- NEC compliant installation of a motor temperature sensor, see also section "Motor temperature protection (TF/TH)" in the chapter "Electrical Installation" of the operating instructions.
- Using internal thermal motor overload protection according to NEC (National Electrical Code, US). Thermal motor overload protection can be activated via parameter *P4-17*.
- Implementing external measures to ensure thermal motor overload protection according to NEC (National Electrical Code).

Parameter

The following parameter must be set to enable the internal thermal motor protection according to NEC:

- *P4-17* Thermal motor protection according to NEC
  - 0: Disabled
  - 1: Enabled

Functional principle

The motor current is accumulated in an internal memory over the course of time. The inverter goes to fault state as soon as the thermal limit is exceeded (I.t-trP).

Once the output current of the inverter is less than the set rated motor current, the internal memory is decremented depending on the output current.

- When *P4-17* is disabled, thermal memory retention is reset upon shutdown or power loss.
- When *P4-17* is enabled, thermal memory retention is maintained upon shutdown or power loss.

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Branch Circuit Protection

1 × 200 – 240 V devices			
Devices	**Non semiconductor fuses (currents are maximum values)**	**Max. supply short circuit current**	**Max. line voltage**
0008	15 A	100 kA rms (AC)	240 V
0015	17.5 A		
0022	25 A		

3 × 200 – 240 V devices			
Devices	**Non semiconductor fuses (currents are maximum values)**	**Max. supply short circuit current**	**Max. line voltage**
0008	10 A	100 kA rms (AC)	240 V
0015	15 A		
0022	17.5 A		
0030	30 A		
0040	30 A		
0055	35 A		
0075	40 A		
0110	70 A		
0150	80 A		
0185	90 A		
0220	125 A		
0300	150 A		
0370	200 A		
0450	225 A		
0550	250 A		
0750	300 A		

3 × 380 – 480 V devices			
Devices	**Non semiconductor fuses (currents are maximum values)**	**Max. supply short circuit current**	**Max. line voltage**
0008	6 A	100 kA rms (AC)	480 V
0015	10 A		
0022	10 A		
0040	15 A		
0055	25 A		
0075	30 A		
0110	35 A		
0150	45 A		
0185	60 A		
0220	70 A		
0300	80 A		
0370	100 A		
0450	125 A		
0550	175 A		
0750	200 A		
0900	250 A		
1100	300 A		
1320	300 A		
1600	400 A		
2000	500 A		
2500	600 A		

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3 × 500 – 600 V devices			
Devices	**Non semiconductor fuses (currents are maximum values)**	**Max. supply short circuit current**	**Max. line voltage**
0008	6 A	100 kA rms (AC)	600 V
0015	6 A		
0022	10 A		
0040	10 A		
0055	15 A		
0075	20 A		
0110	30 A		
0150	35 A		
0185	45 A		
0220	60 A		
0300	60 A		
0370	80 A		
0450	100 A		
0550	125 A		
0750	150 A		
0900	175 A		
1100	200 A		

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5.2 Terminal assignment

5.2.1 Opening the front cover

To access the terminals of inverters with IP55/IP66 degree of protection, remove the red front cover of the inverter. Only use cross-head or slot screwdrivers to open the terminal cover.

You gain access to the terminals by loosening the marked screws on the front side of the product.

Proceed in reverse order to remount the front cover.

INFORMATION

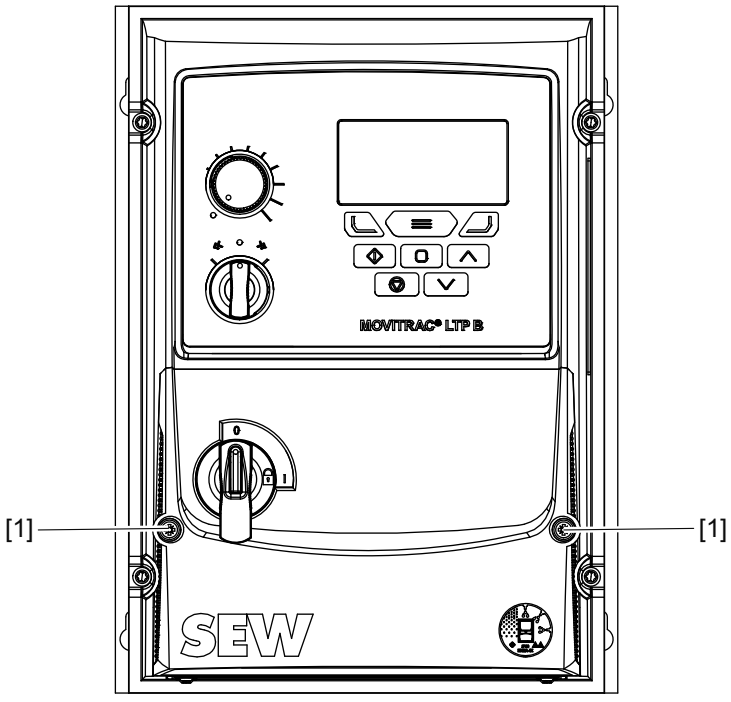
The front cover must be closed during operation for thermal reasons.

Inverters with degree of protection IP66/NEMA 4X

Remove the two screws on the front side of the inverter to open the front cover.

The following inverters have the housing shown below:

Nominal line voltage	Power rating of the inverter
200 to 240 V	0.75 to 11 kW
380 to 480 V	0.75 to 22 kW
500 to 600 V	0.75 to 30 kW



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[1] Screws of the front cover

Inverters with degree of protection IP55/NEMA 12K

To open the front cover, remove the marked screws on the front side of the inverter. The screws to be removed for each size are marked in the picture below.

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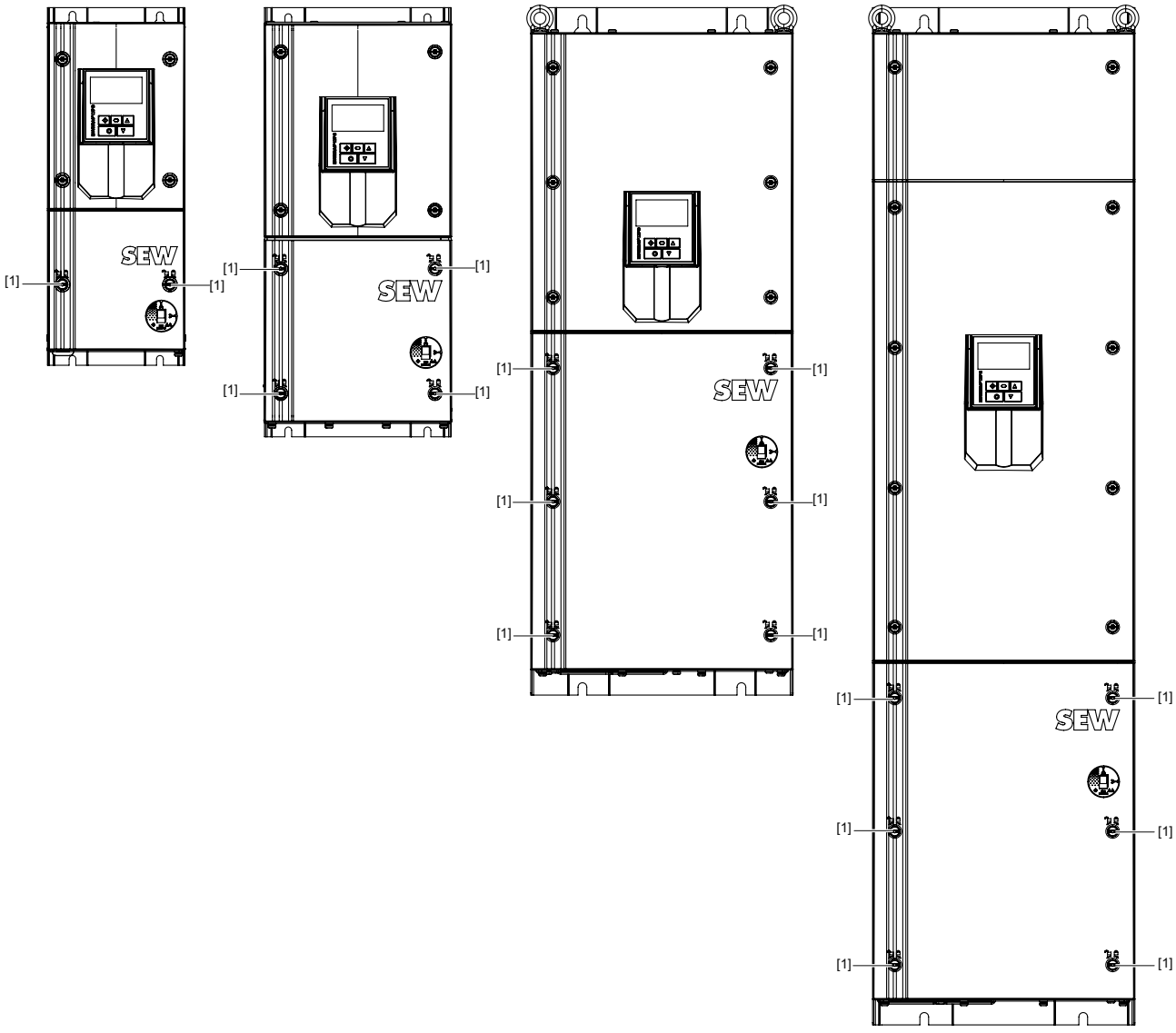
The following inverters have the housing shown below:

Nominal line voltage	Power rating of the inverter
200 to 240 V	5.5 to 75 kW
380 to 480 V	11 to 160 kW
500 to 600 V	15 to 110 kW
480 to 525 V	132 to 200 kW

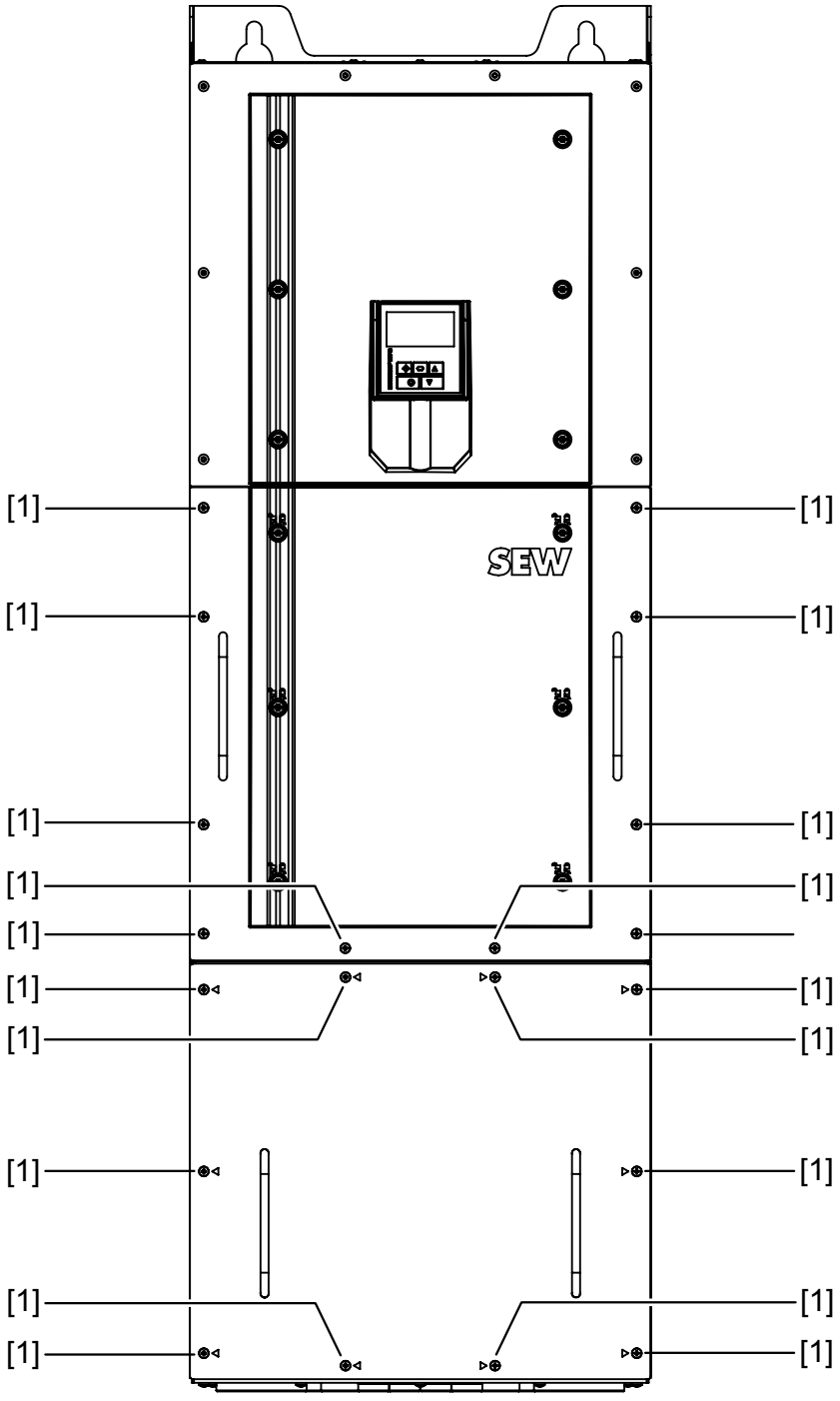


[1] Screws of the front cover

Remove all marked screws of the type cross PH to open the middle and lower front covers.

The following inverters have the housing shown below:

Nominal line voltage	Power rating of the inverter
380 to 480 V	200 to 250 kW



[1] Screws of the front cover (type: cross PH 2)

Removing the signal cable shield plates and terminal cover on size 8

1. To gain access to the terminals, first unscrew all marked screws of the type cross PZ 2.
2. Remove the signal cable shield plates in the order [5], [4], [3].

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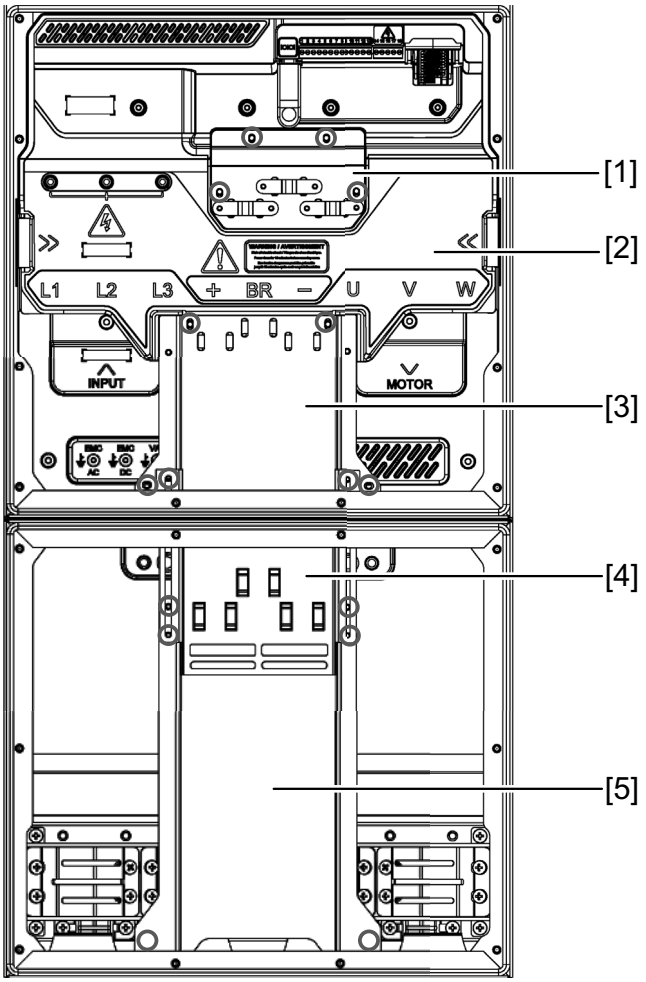
3. You can now release the terminal cover [2] according to the arrow direction and swing it out upward with a rotary movement.
4. After the installation, first re-install the terminal cover [2].
5. Re-install the signal cable shield plates in the order [3], [4], [5].
6. Fasten all screws.



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[1] Shield clip plate for signal and communication cables
[2] Terminal cover made of plastic
[3] to [5] Signal cable shield clips made of metal

5.2.2 Connecting AC brakemotors

For detailed information about the SEW-EURODRIVE brake system, refer to the "AC Motors" catalog, which you can order from SEW-EURODRIVE.

SEW-EURODRIVE brake systems are disk brakes with a DC coil that release electrically and brake using spring force. A brake rectifier supplies the brake with DC voltage.

INFORMATION

The brake rectifier must have a separate supply system cable for inverter operation. Supply via the motor voltage is not permitted.

5.2.3 Connection of the motor temperature protection TF, TH, KTY84, PT1000

Motors with an internal temperature sensor (TF, TH, KTY84, PT1000 or equivalent) can be connected directly to the frequency inverter.

If the thermal protection is triggered, the inverter displays the error "F-PTC".

For motor protection monitoring, the following types can be selected:

- PTC-th for thermal sensor TF or bimetallic switch TH with trigger threshold 2.5 kΩ
- KTY84 in temperature classes B (120 °C), F(155 °C) and H (180 °C)
- PT1000 in temperature classes B (120 °C), F(155 °C) and H (180 °C)

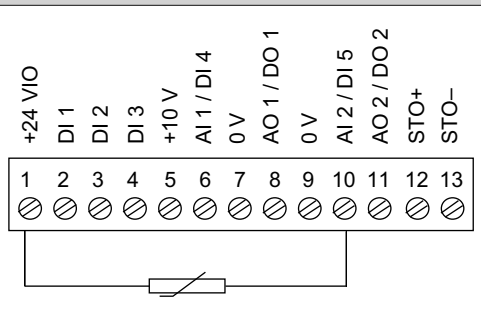
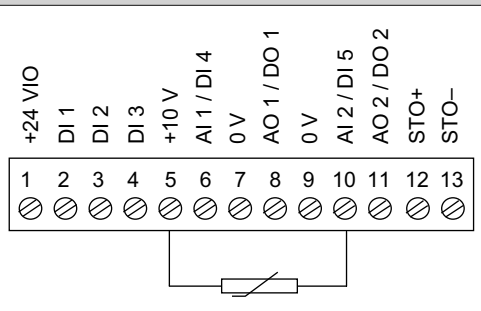
Use a shielded cable for the motor sensor lead.

The motor temperature can be read out using index 11234.

INFORMATION

First configure the connected temperature sensor using parameter P2-33 before connecting the temperature sensor. Then connect the temperature sensor according to the wiring diagram. Incorrect connection may lead to damage of sensor or inverter.

Connection example of the different temperature sensors and their parameterization:

TF temperature sensor TH bimetallic switch	KTY84 PT1000
	
P2-33 = PTC-th	P2-33 = KTY84 or PT1000 (B, F, H)
P1-15 = 0[1], 6, 7, 16, 17	P1-15 = 0[1]

1) For the setting P1-15 = 0 (free terminal assignment), the terminal assignment must be made via the parameter group 9. No function may be assigned to input DI5/AI2 in this case.

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5.2.4 Connection of the signal terminals

Main terminals

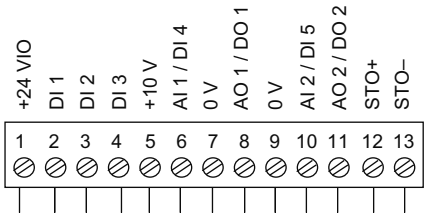
NOTICE

Applying impermissible voltages.

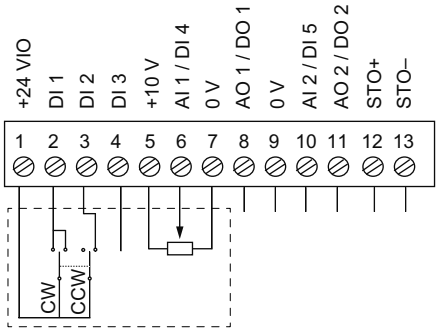
Possible damage to property.

- Do not connect any voltages to the output terminal.
- The voltage applied to the signal terminals must not exceed 30 V.

IP20, IP55, and IP66



IP66 with switch option



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INFORMATION

In the device variant IP66 with switch and potentiometer, the assignment to the corresponding terminal functions is connected internally. In the case of the external use of terminals 2, 3, and 6, you can deactivate the internally fitted switches and potentiometers.

For the relevant procedure, refer to chapter "Configuration parameters".

Signal connections of the signal terminal block

INFORMATION

- If the inputs of the inverter are supplied by an external 24 V voltage supply or PLC, connect the GND reference potential to the terminals 7 and 9. The control electronics of the inverter work in isolated fashion.
- If the STO of an external voltage supply system is actuated, wire it according to the connection examples given in chapter "Disconnection of single drive" (→ 🗎 47).
- If a TTL- or HTL-encoder is used, do not connect its GND signal to terminal 7 or 9.

Terminal no.	Signal	Connection	Description [1]
1	+24 VIO	+24 V: Reference voltage/ backup voltage	Reference voltage for controlling the digital inputs (max. 100 mA)[2]
2	DI 1	Digital input 1	
3	DI 2	Digital input 2	
4	DI 3	Digital input 3	Is also used as a frequency input (max. 20 kHz).
5	+10 V	Output +10 V: Reference voltage	10 V: Reference voltage for analog input (Potential supply +, 10 mA max., 1 to 10 kΩ)
6	AI 1 / DI 4	Analog input 1 (12 bits) Digital input 4	Analog: 0 to 10 V, 10 to 0 V, -10 to 10 V, 0 to 20 mA, 4 to 20 mA, 20 to 4 mA Digital: 0/24 V
7	0 V	0 V: Reference potential	
8	AO 1 / DO 1	Analog output 1 (10 bits) Digital output 1	Analog: 0 to 10 V, 10 to 0 V, 0 to 20 mA, 20 to 0 mA, 4 to 20 mA, 20 to 4 mA Digital: 0/24 V, max.: 20 mA
9	0 V	0 V: Reference potential	
10	AI 2 / DI 5	Analog input 2 (12 bits) Digital input 5/thermistor contact	Analog: 0 to 10 V, 10 to 0 V, PTC-th, 0 to 20 mA, 4 to 20 mA, 20 to 4 mA, KTY84, PT1000 Digital: 0/24 V
11	AO 2 / DO 2	Analog output 2 (10 bits) Digital output 2	Analog: 0 to 10 V, 10 to 0 V, 0 to 20 mA, 20 to 0 mA, 4 to 20 mA, 20 to 4 mA Digital: 0 / 24 V, max.: 20 mA
12	STO+	STO input	Safe digital input: DC +24 V input, max. 100 mA current consumption, high = DC 18 to 30 V
13	STO-		GND reference potential for safe digital input

1) Function assignment via P1-15

2) If the inverter is operated with the fieldbus option, terminal 1 can be used to supply the backup voltage.

The following switching thresholds apply to all digital inputs and multi-functional inputs with binary control:

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Logical "1" input voltage range 8 to 30 V

Logical "0" input voltage range 0 to 2 V

Response time of the digital inputs: < 4 ms

	Analog inputs	Analog outputs
Resolution	12 bit	10 bit
Accuracy	+/- 2%[1)]	+/- 1%[1)]
Response time	< 4 ms	64 ms

1) Related to the set maximum scaling.

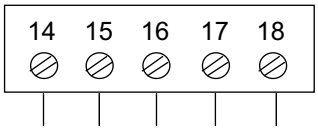
	Input impedance
Digital inputs	100 kΩ
Analog inputs in voltage mode	100 kΩ
Analog inputs in current mode	500 Ω

Relay terminals

NOTICE

Do not connect any inductive loads to the relay contact.

Possible damage to property.



Terminal no.	Signal	Relay function selection	Description
14	Relay output 1 supply	*P2-15*	Relay contact (AC 250 V / DC 30 V, max. 5 A) A brake control must be implemented via a contactor or a brake rectifier.
15	Relay output 1 NO contact		
16	Relay output 1 NC contact		
17	Relay output 2 supply	*P2-18*	
18	Relay output 2 NO contact		

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5.2.5 RJ45 communication socket

NOTICE

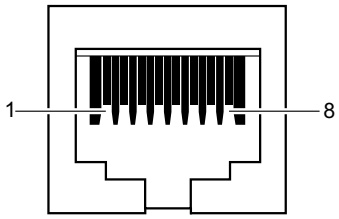
Voltage at socket contact not suitable for PCs.

Damage to PC when connected directly to RJ45 communication socket.

- Use the engineering adapters as described in chapter "Startup with the LT Shell engineering software" (→ 🗎 50).

- Inverters with degree of protection IP20/IP55 have one RJ45 socket contact for engineering and communication.
- Inverters with degree of protection IP66 have two RJ45 socket contacts for engineering and communication.

Socket contact on the device



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[1] SBus-/CAN bus-
[2] SBus+/CAN bus+
[3] 0 V
[4] RS485- (engineering)
[5] RS485+ (engineering)
[6] +24 V (output voltage/backup voltage)
[7] RS485- (Modbus RTU)
[8] RS485+ (Modbus RTU)

5.2.6 Connection of the 24 V backup voltage

Terminal control

Control via terminals does not require an external DC 24 V backup for the inverter.

Field bus connection via field bus card or SEW fieldbus gateway

If communication is to be maintained during a network outage, the inverter must be provided with external DC 24 V backup.

Requirements

Firmware version ≥ 1.20 (can be found in *P0-28*).

Range of functions

- Parameter access to parameter groups 1 to 9 (read-only access)
- Field bus communication (process data)

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Setting up 24 V backup mode

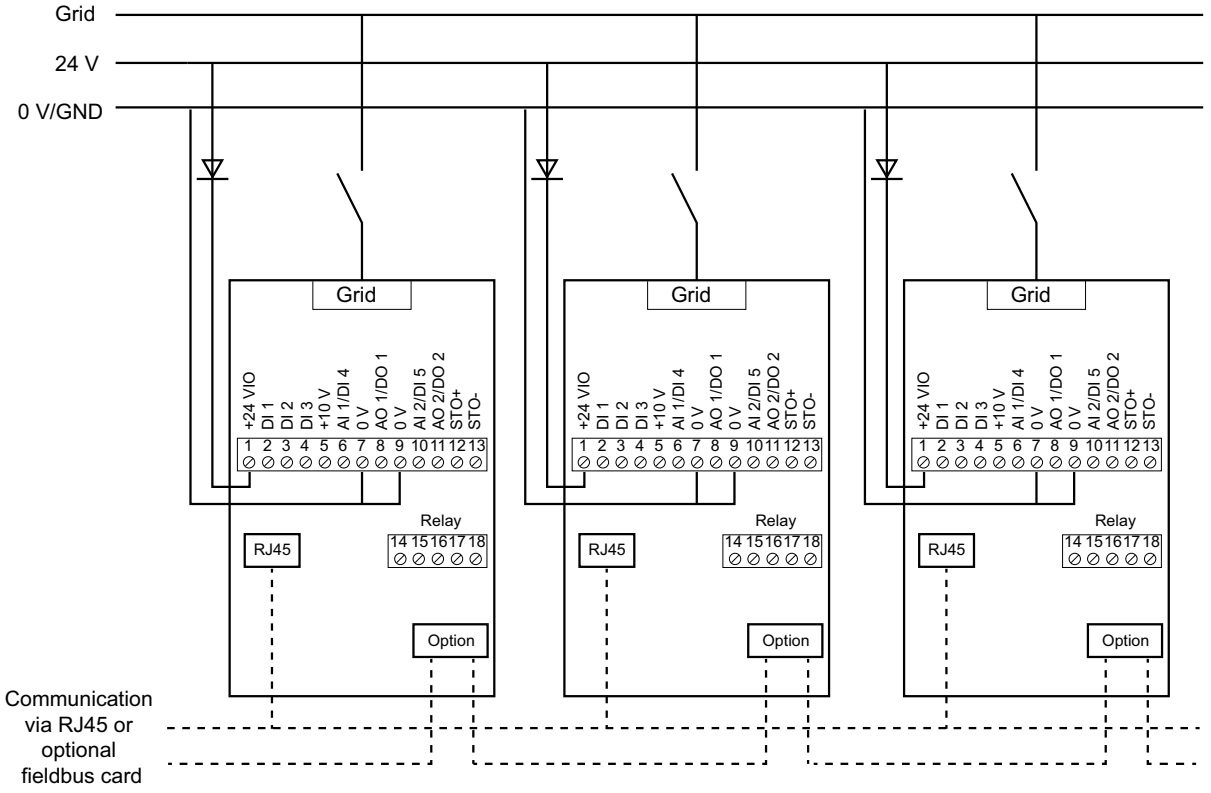
All inverters that are connected to each other in a communication network and use the 24 V backup mode have to be supplied simultaneously with external 24 V. Make sure that individual devices that are connected in the network are not separated from the 24 V supply.

INFORMATION

Errors in the fieldbus network may occur if the inverters are not supplied by the power supply and individual devices that are in the RJ45 network or the optional fieldbus network are separated from the external 24 V supply. Make sure that all connected inverters are always supplied with external 24 V at the same time.

The 24 V supply to the inverters must come via a diode terminal since the inverters could also supply other devices with 24 V, which can subsequently cause an overload of the internal switched-mode power supply and, under certain circumstances, cause damage as well.

Example of a wiring diagram



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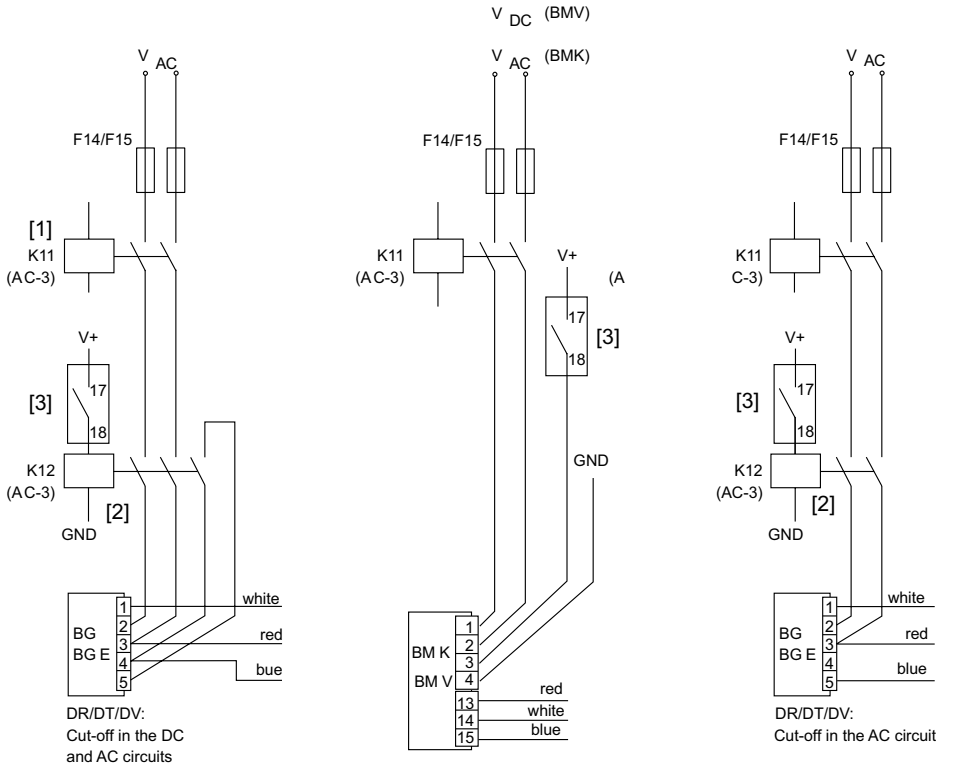
5.2.7 Brake control connection



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[1] Power supply of the brake rectifier, switched simultaneously via K10.
[2] Control contactor/control relay, draws voltage from the internal relay contact [3] of the inverter and supplies the brake rectifier.
[3] Isolated relay contact of the inverter.
V+ External voltage supply AC 250 V / DC 30 V at max. 5 A
V_{DC} (BMV) DC voltage supply BMV.
V_{AC} (BMK) AC voltage supply BMK.

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5.2.8 Braking resistor connection

⚠ WARNING

Danger of electric shock. The supply cables to the braking resistors carry a high DC voltage (approx. DC 900 V) during nominal operation.

Severe or fatal injuries.

- Before removing the supply cable, disconnect the inverter from the power supply and wait at least 10 minutes.

⚠ CAUTION

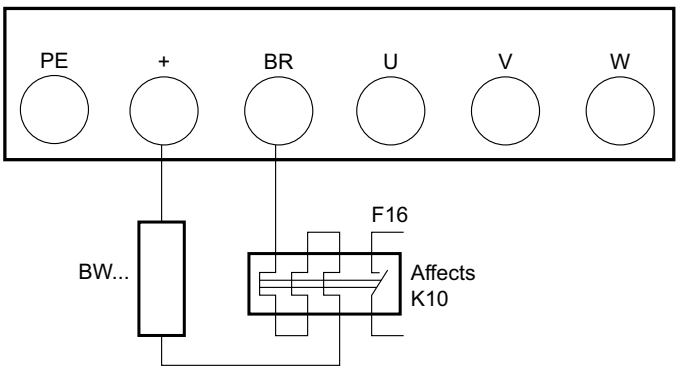
Risk of burns. The surfaces of the braking resistors reach high temperatures under a load of P_N.

Minor injuries.

- Select a suitable installation site.
- Do not contact the braking resistors.
- Mount a suitable touch guard.

The braking resistor is connected between the inverter terminals "BR" and "+". In case of a new device, these terminals have covers installed that can be broken out. Brake out the covers for first use.

- Cut the cables to the appropriate length.
- Use 2 tightly twisted leads or a 2-core shielded power cable. Dimension the cable cross section according to the tripping current I_F of F16 and the nominal voltage in accordance with DIN VDE 0298.
- Protect the braking resistor with a bimetallic relay and set the tripping current I_F of the respective braking resistor.
- The flatpack resistors have internal thermal overload protection (fuse cannot be replaced). Install the flatpack resistors using appropriate touch guards.
- For braking resistors of the BW...-...-T series, you can connect the integrated temperature sensor using a 2-core, shielded cable as an alternative to a bimetallic relay.



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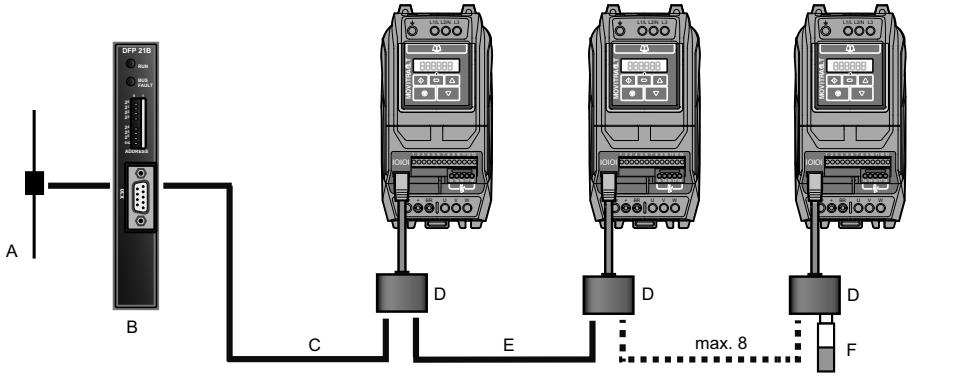
5.3 Connection of a gateway or controller (SBus MOVILINK®)

Connection of a gateway and MOVI-PLC®.



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[A] Bus connection
[B] Gateway, e.g. DFx / UOH
[C] Connection cable
[D] Splitter
[E] Connection cable
[F] Y-plug with terminating resistor

INFORMATION

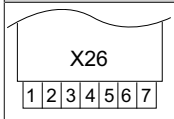
As of firmware version 1.20, a backup mode for maintaining communication in the event of a power failure is possible; this is not possible with older versions. Please also see chapter "Connection of the 24 V backup voltage" (→ 🗎 38) about this.

The terminating connector [F] is equipped with 2 terminating resistors and therefore establishes the terminating connection to CAN/SBus and Modbus RTU.

Instead of a terminating connector of cable set A, the Y-adapter of the engineering cable set C can also be used. It also includes a terminating resistor. For detailed information on the cable sets, refer to the "MOVITRAC® LTP-B" catalog.

Only use shielded cables for the communication connections and also apply the shielding at the gateway over a large surface area.

Wiring from the control to the "RJ45 communication socket" (→ 🗎 38) of the inverter:

Side view	Designation	Terminal on CCU / PLC	Signal	RJ45 socket contact[1)]	Signal
	MOVI-PLC® or gateway (DFX/UOH)	X26:1	CAN 1H	2	SBus/CAN bus h
		X26:2	CAN 1L	1	SBus/CAN bus l
		X26:3	DGND	3	GND
		X26:4	Reserved		
		X26:5	Reserved		
		X26:6	DGND		
		X26:7	DC 24 V		
	Non-SEW controller	X:?[2)]	Modbus RTU+	8	RS485+ (Modbus RTU)
		X:?[2)]	Modbus RTU-	7	RS485- (Modbus RTU)
		X:?[2)]	DGND	3	GND

1) Please note: The terminal assignment for the socket of the inverter, not for the connector, is specified above.
2) Assignment depends on the third-party controller

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5.4 Wiring diagram

⚠ WARNING

Danger of electric shock. Incorrect wiring can lead to dangerously high voltages.

Severe or fatal injuries.

- Adhere to the following points.

For the following applications, always switch off the brake on the AC and DC side:

- For all lifting applications.
- For all applications that require a quick brake reaction time.

Please note the following information:

- The following inverters with degree of protection IP66/NEMA 4X already have openings for supply system, motor and control cables.
  - 200 to 240 V: 0.75 to 11 kW
  - 380 to 480 V: 0.75 to 22 kW
  - 500 to 600 V: 0.75 to 30 kW

  The following inverters with degree of protection IP55/NEMA 12K are equipped with a metal entry board. The user can drill the cable bushings according to the requirements.
  - 200 to 240 V: 5.5 to 75 kW
  - 380 to 480 V: 11 to 160 kW
  - 500 to 600 V: 15 to 110 kW
  - 480 to 525 V: 132 to 200 kW

  The following inverters with degree of protection IP55/NEMA 12K already have openings for supply system, motor, braking resistor, communication, and control cables.
  - 380 to 480 V: 200 to 250 kW
- Connect the brake rectifier via a separate supply system cable.
- Supply via the motor voltage is not permitted!

INFORMATION

In case of a new device, the DC-, + (DC+) and BR terminal slots are initially provided with break-out covers. These must be broken out if necessary.

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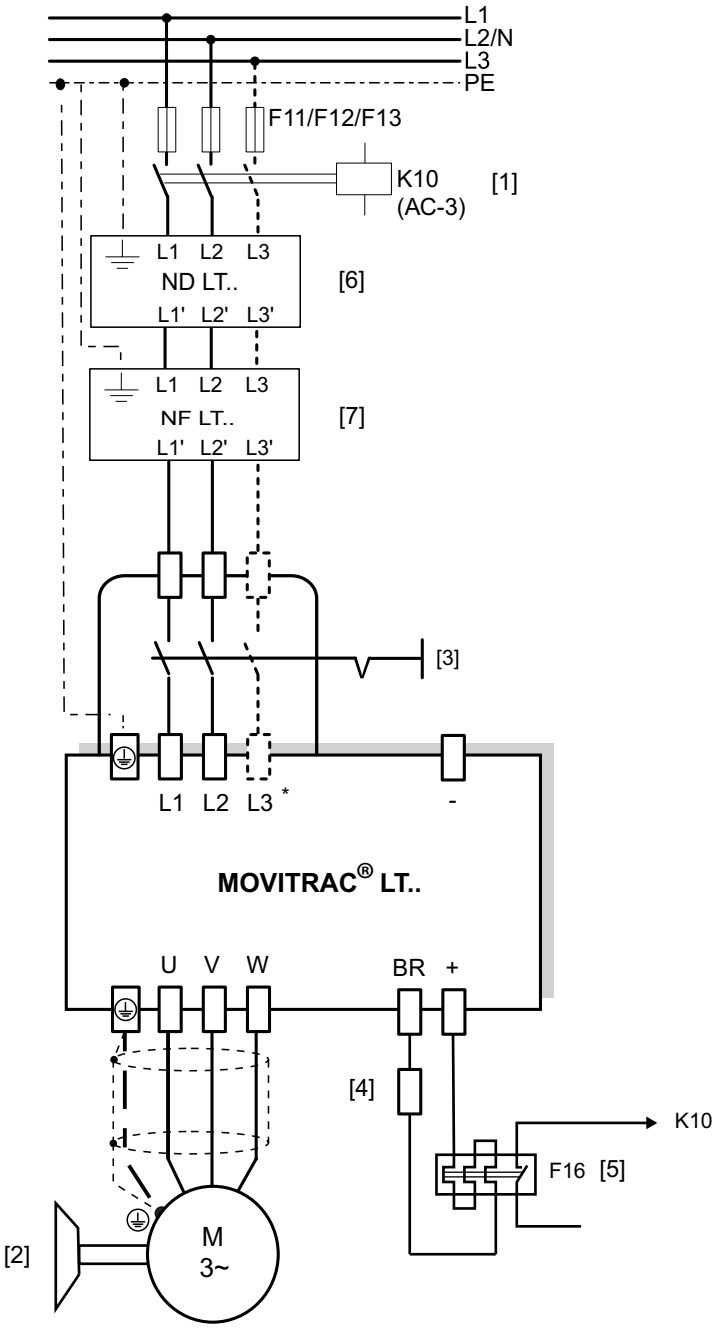

18014416890249867

[1] Line contactor between supply system and inverter
[2] Brake
[3] Main switch (only for unit design IP66/NEMA 4X housing with switch (MC LTP-B..-40))
[4] Connection of braking resistor BW../BW..T
[5] Bimetallic relay for the protection of the braking resistor
[6] Line choke (optional)
[7] Line filter (optional)

* not with 1-phase 230 V

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5.4.1 Connecting AC brakemotors

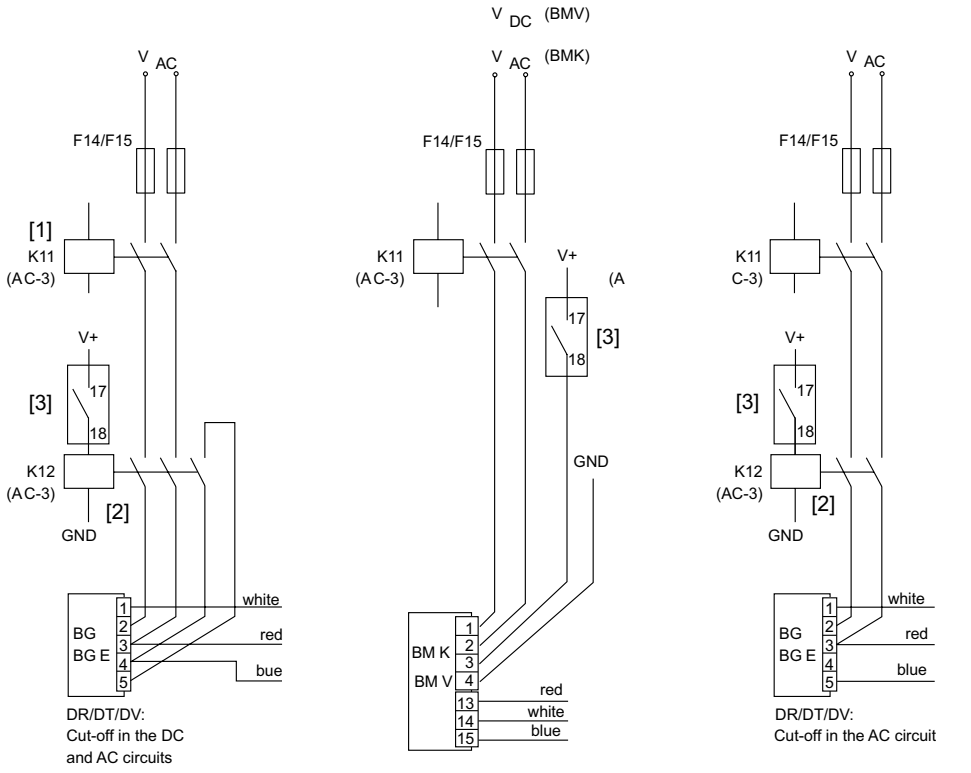
For detailed information about the SEW-EURODRIVE brake system, refer to the "AC Motors" catalog, which you can order from SEW-EURODRIVE.

SEW-EURODRIVE brake systems are disk brakes with a DC coil that release electrically and brake using spring force. A brake rectifier supplies the brake with DC voltage.

INFORMATION

The brake rectifier must have a separate supply system cable for inverter operation. Supply via the motor voltage is not permitted.

5.4.2 Brake control connection



18475023883

[1] Power supply of the brake rectifier, switched simultaneously via K10.
[2] Control contactor/control relay, draws voltage from the internal relay contact [3] of the inverter and supplies the brake rectifier.
[3] Isolated relay contact of the inverter.
V+ External voltage supply AC 250 V / DC 30 V at max. 5 A
V_{DC} (BMV) DC voltage supply BMV.
V_{AC} (BMK) AC voltage supply BMK.

5.4.3 Connection of the DC link connection

The DC link is routed on terminals for all power ratings. It is thus possible to couple all devices with a DC link connection or to directly supply them with DC voltage.

Contact SEW-EURODRIVE in such a case.

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5.4.4 Braking resistor connection

⚠ WARNING

Danger of electric shock. The supply cables to the braking resistors carry a high DC voltage (approx. DC 900 V) during nominal operation.

Severe or fatal injuries.

- Before removing the supply cable, disconnect the inverter from the power supply and wait at least 10 minutes.

⚠ CAUTION

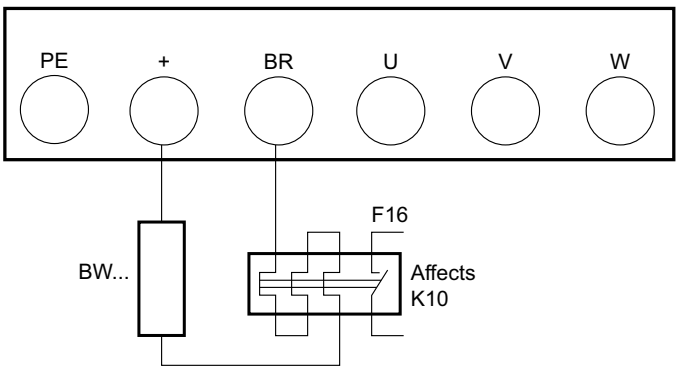
Risk of burns. The surfaces of the braking resistors reach high temperatures under a load of P_N.

Minor injuries.

- Select a suitable installation site.
- Do not contact the braking resistors.
- Mount a suitable touch guard.

The braking resistor is connected between the inverter terminals "BR" and "+". In case of a new device, these terminals have covers installed that can be broken out. Brake out the covers for first use.

- Cut the cables to the appropriate length.
- Use 2 tightly twisted leads or a 2-core shielded power cable. Dimension the cable cross section according to the tripping current I_F of F16 and the nominal voltage in accordance with DIN VDE 0298.
- Protect the braking resistor with a bimetallic relay and set the tripping current I_F of the respective braking resistor.
- The flatpack resistors have internal thermal overload protection (fuse cannot be replaced). Install the flatpack resistors using appropriate touch guards.
- For braking resistors of the BW...-...-T series, you can connect the integrated temperature sensor using a 2-core, shielded cable as an alternative to a bimetallic relay.



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5.5 Connection variants functional safety

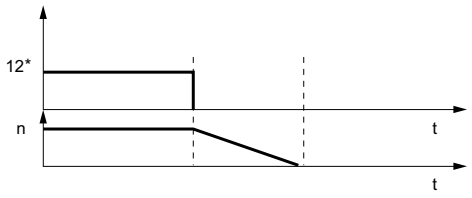
5.5.1 Disconnection of a single drive

STO according to PL d (EN ISO 13849-1)

The process is as follows:

- The safe digital input 12 is disconnected.
- The motor coasts down if there is no brake installed.

STO – Safe Torque Off (EN 61800-5-2)



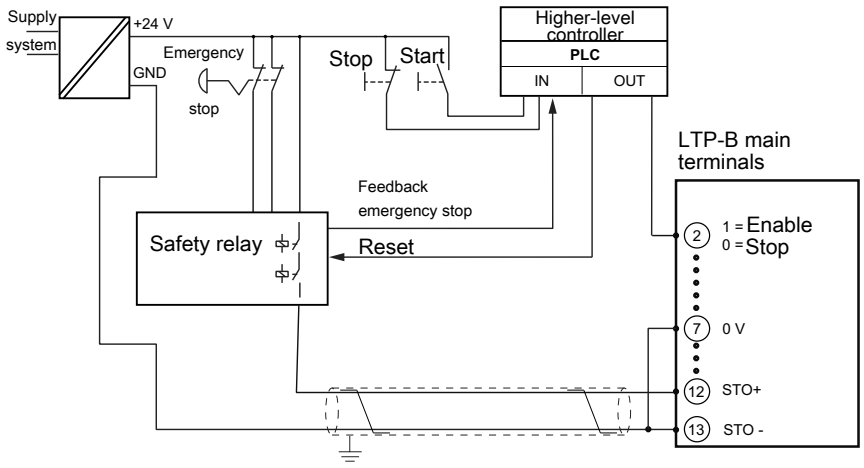
18014406471159051

* Safe digital input (terminal 12)
n Speed

INFORMATION

The shown STO disconnections can be used up to PL d in accordance with EN ISO 13849-1 and in consideration of chapter "Requirements for safety relays".

Control with safety relay with external 24 V supply



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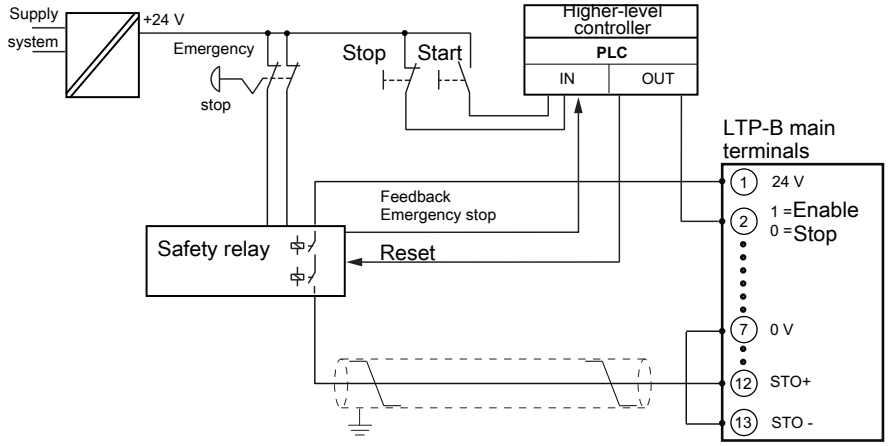
Control with safety relay with internal 24 V supply



44970972299

INFORMATION

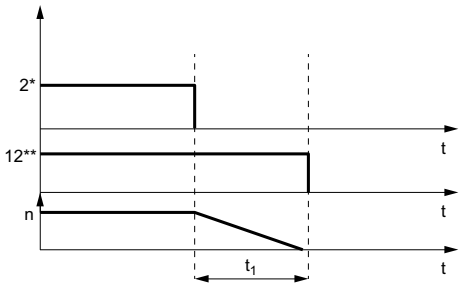
Certain presumptions of faults must be made in case of a single-channel disconnection. These can be controlled by means of by fault exclusion. See chapter "Requirements for safety relays".

SS1-t according to PL d (EN ISO 13849-1)

The process is as follows:

- Terminal 2 is disconnected, e.g. in the event of an emergency stop.
- During the safety time t_1, the motor runs its speed along the ramp until it reaches the idle state.
- The safety relay disconnects terminal 12 after t_1 has elapsed. The safe time t_1 must be configured so that the motor comes to a standstill during that time.

SS1-t – Safe Stop 1 (EN 61800-5-2)



18014407035653003

* Digital input 1 (terminal 2)
** Safe digital input (terminal 12)
n Speed

INFORMATION

The shown SS1-t disconnections can be used up to PL d according to EN ISO 13849-1 in consideration of chapter "Requirements for safety relays".

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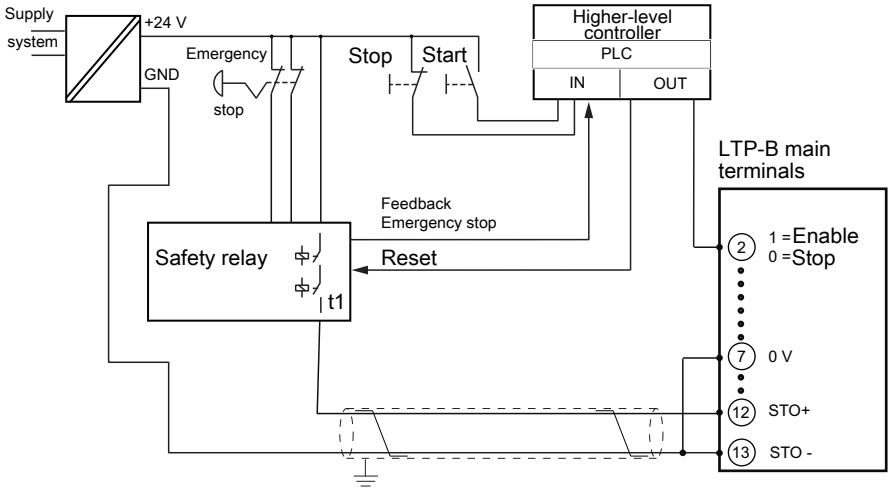
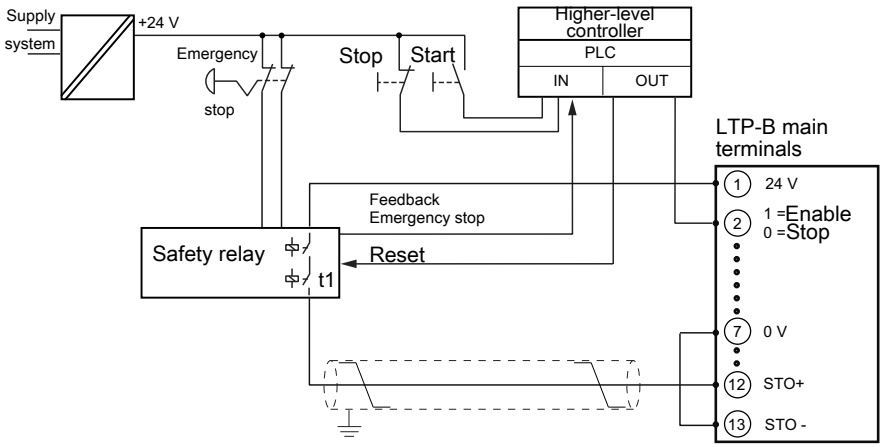
Control with safety relay with external 24 V supply



44971407243

Control with safety relay with internal 24 V supply



44978741643

INFORMATION

Certain fault assumptions are be made for the single-channel disconnection and to be controlled by fault exclusion. See chapter "Requirements for safety relays".

5.6 PC connection

5.6.1 Startup with the LT Shell engineering software

The LT Shell software enables simple and fast startup of the inverters. It can be downloaded from the SEW-EURODRIVE website. After installation of the software, perform software updates at regular intervals.

The inverter can be connected to the software together with the engineering package (cable set C) and the USB11A or USM21A interface adapter.

A maximum of 63 inverters can be connected to LT Shell in a network.

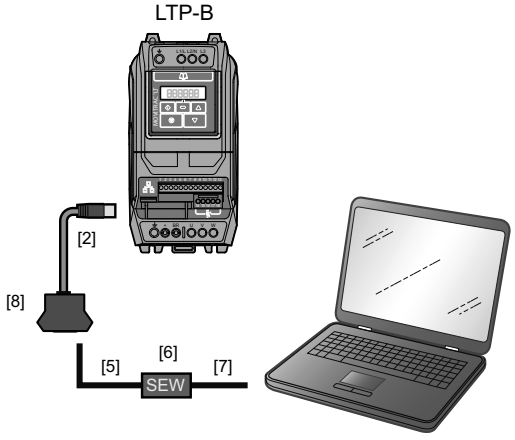
The software can be used to carry out the following tasks:

- Monitor, upload and download parameters
- Parameter printout
- Firmware update (manual and automatic)
- Export inverter parameters to Microsoft Word
- Monitor the state of the inputs and outputs and the motor
- Control inverter / manual mode
- Scope
- Offline startup with subsequent parameter set upload is possible in the 24 V backup mode

Connection to the LT Shell engineering software

The connection can be performed via an RS485 interface (USB11A or USM21A + PC engineering package) or via Bluetooth (parameter module).

Connection to LT Shell via RS485



44574682379

[2] RJ45 to RJ45 cable
[5] RJ10 to RJ10 cable
[6] USB11A or USM21A
[7] USB A-B cable
[8] RJ adapters (2 x RJ45, 1 x RJ10)

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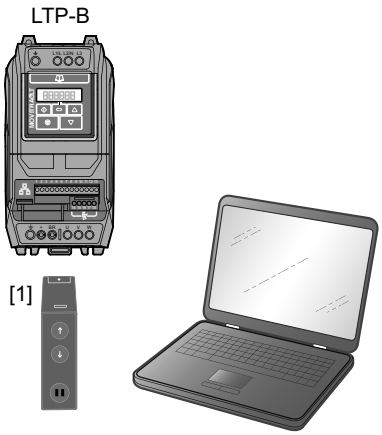
Connection to LT Shell via Bluetooth parameter module



18014415695300747

[1] Parameter module

5.6.2 Startup with the MOVITOOLS® MotionStudio engineering software

The software can be connected to the inverter as follows:

- Via an SBus connection between PC and inverter. The PC can be connected with the inverter via USM21A, for example.
- Via a connection of the PC with a gateway or a MOVI-PLC®. The PC gateway/ MOVI-PLC® connection can be made via USB11A, USM21A, USB or Ethernet, for example.

The following functions are available in MOVITOOLS® MotionStudio:

- Monitor, upload and download parameters
- Parameter printout
- Monitor the state of inputs/outputs and of the motor.

Connection to the MOVITOOLS® MotionStudio engineering software

The connection can be carried out indirectly via a gateway from SEW-EURODRIVE or a controller from SEW-EURODRIVE.

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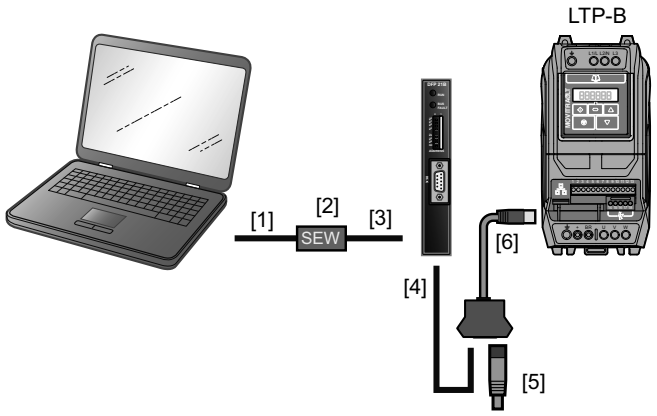
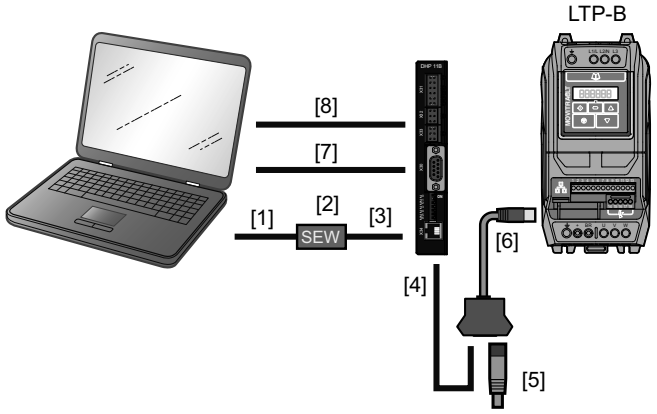
Connection to MOVITOOLS® MotionStudio via gateway



17186235147

[1]	USB A-B cable	[4]	RJ45 cable with open end
[2]	USB11A or USM21A	[5]	Terminating connector (120 Ω)
[3]	RJ10 to RJ10 cable	[6]	Cable distributor

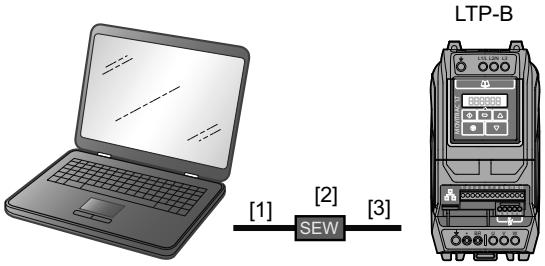
Connection to MOVITOOLS® MotionStudio via SEW-EURODRIVE controller



9007216441033995

[1]	USB A-B cable	[5]	Terminating connector (120 Ω)
[2]	USB11A or USM21A	[6]	Cable distributor
[3]	RJ10 to RJ10 cable	[7]	USB A-B cable
[4]	RJ45 cable with open end	[8]	RJ45 Ethernet cable

Connection to MOVITOOLS® MotionStudio via SBus with USM21A



34210070411

[1] USB A-B cable
[2] USM21A
[3] RJ10 to RJ45 cable

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6 Startup

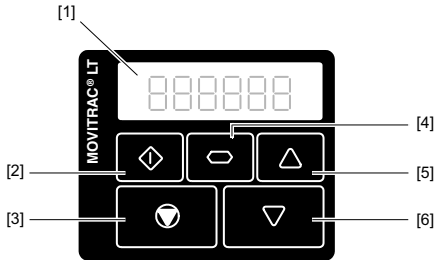
6.1 Keypads

The inverters in IP20 design are equipped with a standard keypad.

The inverters in IP55/IP66 design are equipped with a full text display with language switching function.

Both keypads allow for operation and setup of the inverter without additional devices.

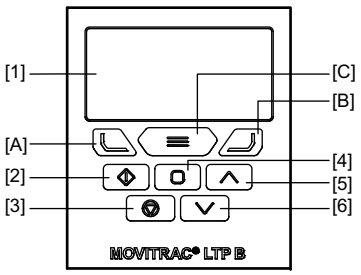
6.1.1 Standard keypad



27021600697887371

[1] 6-digit 7-segment display
[2] Start button
[3] Stop/Reset button
[4] Navigate button
[5] Up button
[6] Down button

6.1.2 Keypad with full text display



34354222219

[1] Full text display (multilingual)
[2] Start button
[3] Stop/Reset button
[4] Navigate button
[5] Up button
[6] Down button

The following keys are only available on IP66 devices with TFT display:

[A] F1 function key
[B] F2 function key
[C] Info/help menu

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6.1.3 Operation

Both keypads have 5 keys with the following functions:

Key 	Start [2]	• Enable the drive • Change the direction of rotation
Key 	Stop [3]	• Stop the drive • Acknowledge the fault
Key 	Navigate [4]	• Switch the menu • Save parameter values • Display real-time information
Key 	Up [5]	• Increase speed • Increase parameter values
Key 	Down [6]	• Decrease speed • Decrease parameter values

The following keys are only available on IP66 devices with TFT display:

Key 	F1 function [A]	• Language selection
Key 	F2 function [B]	• Standby display brightness
Key 	Info/help [C]	• Display of information in the operating state (inverter without faults) • Detailed description of the pending fault (inverter in fault state)

The parameter edit menu can only be accessed by pressing the <Navigate> key [4].

- To switch between the menu for changing parameters and real-time display (operating speed/operating current): Keep the key pressed for longer than 1 second.
- Switch between operating speed and operating current of the running inverter: Press the key briefly (< 1 second).

The operating speed is only displayed if a nominal motor speed has been entered in *P1-10*. Otherwise, the electrical rotating field speed is displayed.

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6.1.4 Switching the language at the keypad with full text display

To switch the language in the full text display, press the <Start> key and the <Up> key simultaneously. The inverter must not be enabled during this operation.

Then select one of the available languages and confirm the selection with the <Navigate> key.

For IP66 inverters with TFT screen, the language selection can also be accessed directly using the F1 function key [A].

6.1.5 Standby display brightness for keypads with TFT display (IP66 devices)

If the inverter is not operated or parameterized via the keys on the keypad, the display automatically switches to standby brightness after 320 seconds. The default setting is 50%. The setting range can be changed by the user between 5-100% using the F2 function key [B]. As soon as a key on the keypad is pressed, the brightness immediately increases to 100% again.

6.1.6 Info/help menu of keypads with TFT display (IP66 devices)

The various states of the inverter are displayed here in fault-free state (chapter "Status of the inverter" (→ 🗎 80)). A detailed description of the pending fault is displayed here if the inverter indicates a fault (chapter "6.4 Fault list" (→ 🗎 84)).

6.1.7 Resetting parameters to default settings

The following preconditions must be satisfied for the parameters to be reset to the factory setting:

- The inverter must not be enabled.
- The inverter must not be in fire mode/emergency mode.
- The display of the inverter must show "Inhibit".

1. Press the 3 keys  , and simultaneously for at least 2 sec.

   "P-deF" appears on the display.

2. Press the key to acknowledge the "P-deF" message.

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6.1.8 Key combinations

Function	The device displays:	Press:	Result	Example
Quick parameter group selection[1)]	Px-xx	<Navigate> + <Up> keys	The next higher parameter group is selected.	"P1-10" is displayed: • Press the <Navigate> + <Up> keys. • Now, "P2-01" is displayed.
	Px-xx	<Navigate> + <Down> keys	The next lower parameter group is selected.	"P2-26" is displayed: • Press the <Navigate> + <Down> keys. • "P1-01" is now displayed.
Selection of the lowest group parameter	Px-xx	<Up> + <Down> keys	The first parameter of a group is selected.	"P1-10" is displayed: • Press the <Up> + <Down> keys. • "P1-01" is now displayed.
Set the parameter to the lowest value	Numerical value (when changing a parameter value)	<Up> + <Down> keys	The parameter is set to the lowest value.	When changing *P1-01*: • "50.0" is displayed. • Press the <Up> + <Down> keys. • "0.0" is now displayed.
Changing individual digits of a parameter value	Numerical value (when changing a parameter value)	<Stop/reset> + <Navigate> keys	The individual parameter digits can be modified.	When changing *P1-10*: • “0” is displayed. • Press the <Stop/reset> + <Navigate> keys. • "_0" is now displayed. • Press the <Up> key. • "10" is now displayed. • Press the <Stop/reset> + <Navigate> keys. • "_10" is now displayed. • Press the <Up> key. • "110" is now displayed etc.
Switching languages	Select language	<Start> and <Up> 	The desired language can be selected now.	• English • German • French • Spanish • Portuguese • Russian • Swedish • Norwegian • Finnish
Fan and display test	The complete display lights up	Hold all the keys down at the same time	The display can be checked for possible damage. The function of the fans can be checked.	This can be checked during maintenance.

1) Parameter group access must be activated: Set P1-14 to "101" or "201".

6.2 Startup for motors

⚠ WARNING

If parameter *P4-02* is set to "1" (auto tune), the motor may start automatically.

Severe or fatal injuries.

- Make sure that no persons are within the reach of moving parts of the system.

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6.2.1 Startup with asynchronous motors with U/f control

1. Connect the motor to the inverter. During the connection, notice the nominal motor voltage.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = Nominal voltage of the motor
   - *P1-08* = Rated current of the motor
   - *P1-09* = Rated frequency of the motor
   - *P1-10* = Rated speed of the motor
     - Value = 0: Slip compensation deactivated
     - Value ≠ 0: Slip compensation activated
   - *P1-14* = 201 (extended parameter menu)
   - *P4-01* = 2 (U/f open-loop speed control)
3. Set the maximum and minimum speed using *P1-01* and *P1-02*.
4. Set the acceleration and deceleration ramps using *P1-03* and *P1-04*.
5. Start the "auto-tune" automatic motor measurement procedure as described in chapter "Auto-tune".

6.2.2 Startup with asynchronous motors with VFC speed control

1. Connect the motor to the inverter. Adhere to the nominal motor voltage when connecting.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = Nominal voltage of the motor
   - *P1-08* = Rated current of the motor
   - *P1-09* = Rated frequency of the motor
   - *P1-10* = Rated speed of the motor
   - *P1-14* = 201 (extended parameter menu)
   - *P4-01* = 0 (VFC speed control)
   - *P4-05* = Power factor
3. Set the maximum and minimum speed using *P1-01* and *P1-02*.
4. Set the acceleration and deceleration ramps using *P1-03* and *P1-04*.
5. Start the "auto-tune" automatic motor measuring procedure as described in chapter "Auto-tune automatic measuring procedure".
6. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

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6.2.3 Startup with asynchronous motors or torque motors with VFC torque control

1. Connect the motor to the inverter. Adhere to the nominal motor voltage when connecting.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = Nominal voltage of the motor
   - *P1-08* = Rated current of the motor
   - *P1-09* = Rated frequency of the motor
   - *P1-10* = Rated speed of the motor
   - *P1-14* = 201 (extended parameter menu)
   - *P4-01* = 1 (VFC torque control)
   - *P4-05* = Power factor
3. Set the maximum and minimum speed using *P1-01* and *P1-02*.
4. Set the acceleration and deceleration ramps using *P1-03* and *P1-04*.
5. Start the "auto-tune" automatic motor measuring procedure as described in chapter "Auto-tune automatic measuring procedure".
6. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

Example of speed and torque input via analog inputs

In the following example, analog input 2 is used as torque reference source, analog input 1 is used to set the speed:

- *P1-15* = 3 (input terminal assignment)
- *P4-06* = 2 (torque reference via analog input 2)
- *P6-07* = 100% (deactivating speed monitoring)
- *P6-17* = 0 (switching off the torque timeout threshold)
  = > 0 (possible application-dependent adjustment)

Example of speed and torque input via fieldbus

In the following example, the torque setpoint and the speed setpoint are specified via fieldbus:

- *P1-12* = 5, 6, 7 (selection of the control signal source)
- *P4-06* = 3 (torque reference via fieldbus)
- *P6-07* = 100% (deactivating speed monitoring)
- *P6-17* = 0 (switching off the torque timeout threshold)
  = > 0 (possible application-dependent adjustment)
- *P5-09* = 0, 1 (velocity control in min^{-1} or %) Parameter description "P5-09-P5-11 Fieldbus process data (POx) definition"
- *P5-10* = 2 (torque input in %) Parameter description "P5-09-P5-11 Fieldbus process data (POx) definition"

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6.2.4 Startup with synchronous motors without encoder feedback (PMVC control)

The synchronous motors are permanent magnet motors.

INFORMATION

Check the operation of encoder-free synchronous motors through a test application. Stable operation in this operating mode cannot be ensured for all application cases.

1. Connect the motor to the inverter. During the connection, notice the nominal motor voltage.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = internal voltage/idle voltage [V/min^{-1}] with rated motor speed
   - *P1-08* = Rated current of the motor
   - *P1-09* = Rated frequency of the motor
   - *P1-10* = Rated speed of the motor
   - *P1-14* = 201 (extended parameter menu)
   - *P4-01* = 3 (PMVC speed control)
   - *P2-24* = PWM frequency (at least 8 to 16 kHz)
3. Set the maximum speed with *P1-01* to the maximum rated motor speed and the minimum speed with *P1-02* to a minimum of 10% of the rated motor speed.
4. Set the acceleration and deceleration ramps using *P1-03* and *P1-04*.
5. Start the "auto-tune" automatic motor measurement procedure as described in chapter "Auto-tune".
6. Check the magnetizing current (*P0-14*) at half nominal speed without load.
   - If the value is greater than +0.3 A, the nominal motor voltage *P1-07* must be reduced.
   - If the value is smaller than -0.3 A, the nominal motor voltage *P1-07* must be increased.
7. Adjust the stiffness in *P7-10* to optimize the control behavior:
   - Increasing *P7-10* increases the stiffness of the motor. Decreasing the parameter has the opposite effect.
   - The setting range should be between 8 and 15, but may differ.
8. To adjust the rotor on enable and to achieve more torque in the lower speed range, set *P7-14* and *P7-15* to 10% first. Individual adjustment might be necessary. Note that the motor may heat up significantly due to the increased current flow.

In rare cases, it can be helpful to compare the parameters determined in the automatic motor measurement procedure to the parameters of the motor data. Correct them, if necessary. Note that the values may deviate in case of long motor cables.

A repeated measuring procedure is not required.

6.2.5 Startup with LSPM motors from SEW-EURODRIVE

DR..J type motors are motors with LSPM technology (Line Start Permanent Magnet motors).

1. Connect the motor to the inverter. During the connection, notice the nominal motor voltage.

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2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = internal voltage/idle voltage [V/min^{-1}] with rated motor speed
   - *P1-08* = Rated current of the motor
   - *P1-09* = Rated frequency of the motor
   - *P1-10* = Rated speed of the motor
   - *P1-14* = 201 (extended parameter menu)
   - *P4-01* = 6 (LSPM speed control).
3. Set the maximum speed *P1-01* and minimum speed *P1-02* = 300 min^{-1}.
4. Set the acceleration and deceleration ramps using *P1-03* and *P1-04*.
5. Start the "auto-tune" automatic motor measurement procedure as described in chapter "Auto-tune".
6. Adjust the boost parameters. A default setting is:
   - *P7-14* = 10%
   - *P7-15* = 10%.
7. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

6.2.6 Startup with synchronous reluctance motors (SYN-R control)

INFORMATION

Check the operation of synchronous reluctance motors by means of a test application. Stable operation in this operating mode cannot be ensured for all application cases.

1. Connect the motor to the inverter. During the connection, notice the nominal motor voltage.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = Nominal voltage of the motor
   - *P1-08* = Rated current of the motor
   - *P1-09* = Rated frequency of the motor
   - *P1-10* = Rated speed of the motor
   - *P1-14* = 201 (extended parameter menu)
   - *P4-01* = 7 (SYN-R speed control).
   - *P4-05* = Power factor
3. Set the maximum speed *P1-01* and minimum speed *P1-02*.
4. Set the acceleration and deceleration ramps using *P1-03* and *P1-04*.
5. Start the "auto-tune" automatic motor measurement procedure as described in chapter "Auto-tune".
6. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

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6.2.7 Startup with brushless DC motors (BLDC control)

1. Connect the motor to the inverter. During the connection, notice the nominal motor voltage.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = internal voltage/idle voltage [V/min^{-1}] with rated motor speed
   - *P1-08* = Rated current of the motor
   - *P1-09* = Rated frequency of the motor
   - *P1-10* = Rated speed of the motor
   - *P1-14* = 201 (extended parameter menu)
   - *P4-01* = 8 (BLDC speed control).
   - *P4-05* = Power factor
3. Set the maximum speed *P1-01* and minimum speed *P1-02*.
4. Set the acceleration and deceleration ramps using *P1-03* and *P1-04*.
5. Start the "auto-tune" automatic motor measurement procedure as described in chapter "Auto-tune".
6. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

6.2.8 Startup with preset motors from SEW-EURODRIVE

Startup can be performed if one of the following CMP.. motors (speed class 4500 min^{-1}) or MGF..-DSM motors (speed class 2000 min^{-1}) is connected to the inverter:

Motor type	Display
CMP40M	40M
CMP50S/CMP50M/CMP50L	50S/50M/50L
CMP63S/CMP63M/CMP63L	63S/63M/63L
CMP71S/CMP71M/CMP71L	71S/71M/71L
MGF..2-DSM-B	gF-2
MGF..4-DSM-B	gF-4
MGF..4-DSM-B/XT	gF-4Ht
MGF..1-DSM-C	gF-1c
MGF..2-DSM-C	gF-2c
MGF..4-DSM-C	gF-4c
MGF..4-DSM-C/XT	gF4cHt

Procedure

- Set *P1-14* to "201" for access to LTX-specific parameters.
- Set *P1-16* to the preset motor, see chapter "Parameter group 1: Servo-specific parameters (level 1)"

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Example

Example: 		
CMP.. size	50S	40M, 50S, 50M, 50L, 63S, 63M, 63L, 71S, 71M, 71L
Motor system voltage	4	• 2 = 230 V • 4 = 400 V
Brakemotors	b	b = Flashes for brakemotors

All the required parameters (voltage, current, etc.) are set automatically.

INFORMATION

"Auto Tune" is not necessary for preset motors.

If a CMP.. motor with an electronic nameplate is connected to the inverter, *P1-16* is selected automatically.

If a MGF..-DSM is selected, the upper torque limit in *P4-07* is automatically set to 200%. This value has to be adapted in accordance with the gear unit ratio according to the documentation "Addendum to the Operating Instructions, Drive Unit MGF..-DSM on LTP-B Inverter".

The corresponding motor temperature sensor must be connected and parameterized as described in chapter "Connection of the motor temperature protection TF, TH, KTY84, PT1000" (→ 🗎 34).

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6.3 Startup of the control signal source

⚠ WARNING

Installing sensors or switches at the terminals may cause an enable signal. The motor may start up automatically.

Severe or fatal injuries.

- Make sure that no persons are within the reach of moving parts of the system.
- Install the switches in open state.
- If you install a potentiometer, set it to 0 first.

6.3.1 Terminal mode (factory setting) *P1-12* = 0

For operation in terminal mode (factory setting):

- *P1-12* must be set to "0" (factory setting).
- Change the input terminal configuration according to your requirements in *P1-15*. For the possible settings, see chapter "P1-15 Digital input function selection".
- Connect a switch between terminals 1 and 2 on the user terminal block.
- Connect a potentiometer (1 k – 10 k) between terminals 5, 6 and 7. The center tap is connected to terminal 6.
- Connect terminals 12 and 13 of the STO input as described in chapter "Disconnection of a single drive" (→ 🗎 47).
- Enable the inverter by establishing a connection between terminals 1 and 2.
- Set the speed using the potentiometer.

6.3.2 Keypad mode (*P1-12* = 1 or 2)

For operation in keypad mode:

- Set *P1-12* to "1" (unidirectional) or "2" (bidirectional).
- Connect a wire link or a switch on the terminal block between terminal 1 and terminal 2 to enable the inverter.
- Connect terminals 12 and 13 of the STO input as described in chapter "Disconnection of a single drive" (→ 🗎 47).
- Now press the <Start> key. The inverter is then enabled with 0.0 Hz.
- To increase the speed, press the <Up> key. To reduce the speed, press the <Down> key.
- Press the <Stop/Reset> key to stop the inverter.
- After the <Start> key is pressed, the inverter starts according to the setting in *P2-37*. If bidirectional mode is enabled (*P1-12* = 2), the direction is reversed by pressing the <Start> key again.

INFORMATION

The desired setpoint speed can be preconfigured by pressing the <Stop/Reset> key in idle state. If you then press the <Start> key, the drive will start up along the configured ramp until this speed is reached.

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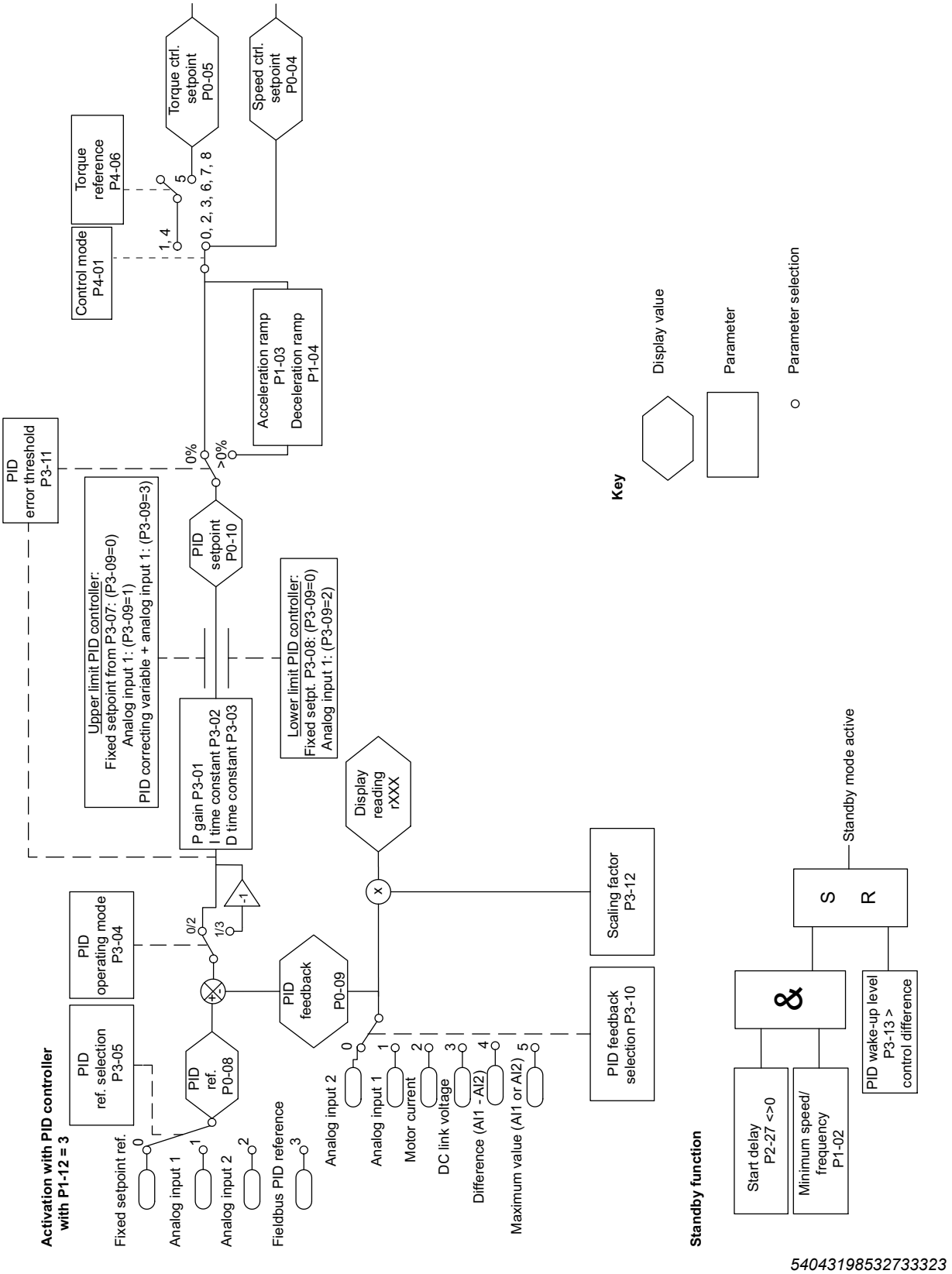
6.3.3 PID controller mode (*P1-12* = 3)

The implemented PID controller can be used for temperature control, pressure control or other applications.

The following figure shows the configuration options for the PID controller.



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General information on use

Connect the sensor for the controlled variable to analog input 1 or 2 depending on *P3-10*. The sensor value can be scaled using parameter *P3-12* in such a way that the user can see the value correctly displayed on the inverter display, for example 0 to 10 bar.

The target reference for the PID controller can be set using *P3-05*.

The setting of the speed ramp times has no effect when the PID controller is active. Acceleration and deceleration ramps can be activated depending on the control deviation (target value to actual value) using *P3-11*.

Fixed setpoint reference

The fixed setpoint reference entered in *P3-06* is used with the setting *P3-05* = 0. When the parameters *P9-34* and *P9-35* have a value other than "OFF", 3 additional fixed setpoint references *P3-14* to *P3-16* are activated and are selected according to the table below:

Terminal selection via *P9-34*	Terminal selection via *P9-35*	Fixed setpoint reference
0 (LOW)	0 (LOW)	*P3-06*
1 (HIGH)	0 (LOW)	*P3-14*
0 (LOW)	1 (HIGH)	*P3-15*
1 (HIGH)	1 (HIGH)	*P3-16*

P1-12 = 3 (control signal source: PID controller)

P1-15 = 0 (free terminal assignment via P9-xx)

P3-05 = 0 (PID reference selection: fixed setpoint reference)

P9-09 = 1 (source for activating terminal control)

P9-10 = 4 (setpoint source: PID)

P9-34 = (PID fixed setpoint reference selection input 0) e.g. DI2

P9-35 = (PID fixed setpoint reference selection input 1) e.g. DI3

Fieldbus PID reference

The following parameters must be set for operating the PID controller with fieldbus PID reference:

P1-12 = 5 (e.g. SBus control signal source)

P1-14 = 201 (extended parameter menu)

P1-15 = 0 (free function selection of the digital inputs)

P3-05 = 3 (PID reference selection: fieldbus PID reference)

P5-09 to *P5-11* = 4 (selection of the process output data word for the PID reference)

P9-01 = Input source enable

P9-10 = 4 (setpoint source: PID)

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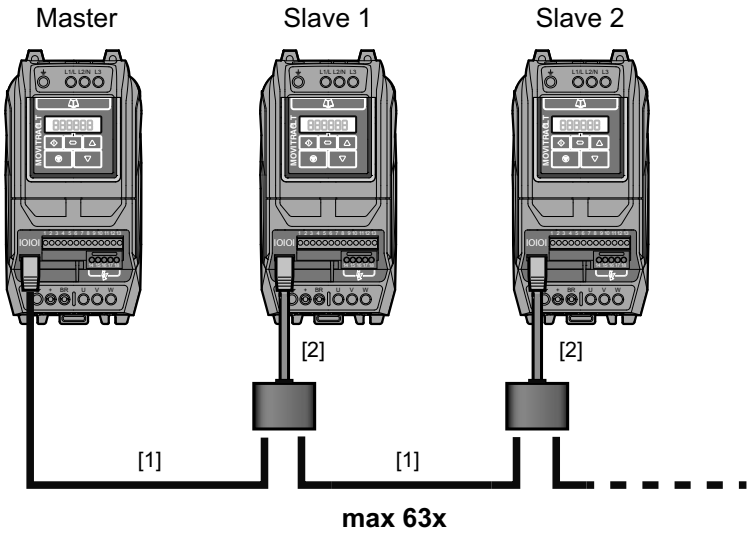
6.3.4 Master-slave mode (*P1-12* = 4)



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[1] RJ45 to RJ45 cable
[2] Cable splitter

The inverter has an integrated master-slave function.

Depending on the operating mode, the master-slave function supports two different configuration options:

- Speed synchronism
- Load distribution

The two tables below describe the respective configuration of the inverters of both operating modes.

The master-slave communication is obtained via a special protocol. In this case, the inverter communicates via the RS485 engineering interface. Up to 63 inverters can be connected with one another in a communication network using RJ45 connectors. The maximum length of the communication network is 1000 m.

One inverter is configured as master, the remaining inverters as slaves. Each network may have only one master inverter. This master inverter sends its operating state (e.g. activated, deactivated) and its actual motor speed every 30 ms. The slave inverters then follow the state of the master inverter.

INFORMATION

Cable set B can be used for setting up the master-slave network. It is not necessary to use a terminating resistor. For information on the cable sets, refer to the catalog.

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Configuration for speed synchronism

In the configuration for speed synchronization, the actual speed value of the master acts as the speed setpoint of the slave inverters. The speed setpoint of the slave inverters is also scalable.

Speed synchronism is supported only in the following operating modes/motor controls:

P4-01 = 0, 2, 3, 6, 7, 8

Parameter description	Master settings	Slave settings
P1-03 (acceleration ramp)	User-defined	≤ master ramps
P1-04 (deceleration ramp)		
P1-12 (control signal source)	0, 1, 2, 3, 5, 6, 7, 8	4
P1-14 (extended parameter menu)	201	201
P4-19 (master-slave torque reference)	0	0
P5-01 (inverter address communication)	1	2 – 63
P2-28 (speed scaling)	–	User-defined
P2-29 (scaling factor)	–	User-defined

Configuration for load distribution

In the configuration for load distribution, the actual torque value of the master (*P0-12*) acts as the torque setpoint of the slave inverters (*P0-05*).

The speed setpoint of the master (*P0-04*) acts as a speed limit value of the slave (*P0-04*), but the slave always follows the current actual value of the master.

The load distribution is only supported in the positive rotation direction of the master and only in the following operating modes and/or with the following motor settings:

P4-01 = 0, 3, 6, 7, 8

Parameter description	Master settings	Slave settings
P1-03 (acceleration ramp)	user-defined	0.1 sec.[1)]
P1-04 (deceleration ramp)		
P1-12 (control source)	0, 1, 2, 3, 5, 6, 7, 8	4
P1-14 (extended parameter menu)	201	201
P4-06 (torque reference/limit value source)	0, 1, 2, 3, 5	4
P4-19 (master-slave torque reference)	1	0
P5-01 (inverter address communication)	1	2 – 63

1) If the drive oscillates, the value must be increased slightly

General wiring of the slave error message

In the event of a fault in the master, the slaves stop automatically.

In order to detect a fault in the slaves at the master, relay 1 of the slaves must be configured to "Inverter ready" and a digital input of the master must be configured to "External fault input". They must be connected as follows:

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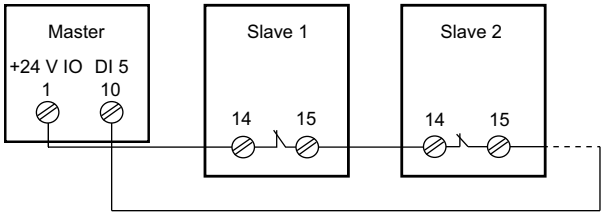
In the following example, DI5 is used with the function selection *P1-15* = 6, 7, 16 or 17.



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6.3.5 Fieldbus mode (P1-12 = 5, 6 or 7)

See chapter "Fieldbus mode".

6.4 Startup of the brake control

The brake control is installed via relay 2.

- For horizontal applications, set the function of relay 2 (*P2-18*) to 0 or 3 as needed.
- For hoists, activate the function of the motor brake control (*P4-12*). It locks the selection into *P2-18*, see chapter "Hoist function" (→ 🗎 69).

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6.5 Hoist function

The hoist function enables the pre-tensioning of the motor against the locked brake to prevent sagging during the start-up. At the same time, the proper operation is monitored by various functions.

6.5.1 Project planning

- SEW-EURODRIVE recommends that you refrain from operating the motor below 1.5-times the rated motor slip speed.
- A sufficiently dimensioned braking resistor is necessarily required for fault-free operation.
- Dimension the motor according to the requirements of the application.

6.5.2 Installation

The motor brake control must be implemented by relay 2 of the inverter.

6.5.3 Startup for hoist function

1. First, perform a motor startup with VFC speed control according to chapter "Start-up of asynchronous motors with VFC speed control" (→ 🗎 57).
2. Activate brake control for lifting applications *P4-12* = 1.
3. Set the ramp times for *P1-03* and *P1-04* as short as possible.
4. Set the minimum speed *P1-02* to at least 1.5 times the rated motor slip.
5. If no sensor is used for protecting the braking resistor, you can use the following parameters optionally for protection against overtemperature of the braking resistor. However, only a sensor provides adequate protection.
   - *P6-19*: Braking resistance value
   - *P6-20*: Braking resistance output
6. Observe the motor's direction of rotation:
   - Positive speed on the display = raise hoist.
   - Negative speed on the display = lower hoist

6.5.4 Operation

INFORMATION

Start the inverter by pressing enable while the hoist mode is activated. If you activate the enable command simultaneously or earlier than the STO, the inverter stays in "STOP" mode.

- In the encoder-free mode, never keep the load at zero rotation speed without the brake being engaged. Always stop the drive by canceling the enable command.
- To reverse the direction of rotation, stop the drive by canceling the enable command. The brake will engage automatically. Then enable the drive in the opposite direction.

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6.5.5 Troubleshooting and optimizing the hoist function

The following hoist parameters are already predefined for motors of the same performance class. However, you can adjust the hoist parameters at any time for optimization of the system:

- *P2-07*: Fixed target speed 7 becomes the brake release speed:
  - Reference value for operation without encoder: 2-times the motor slip
  - Reference value for operation with encoder: 1.5-times the motor slip
- *P2-08*: Fixed target speed 8 becomes the brake engagement speed:
  - Reference value for operation without encoder: 2-times the motor slip
  - Reference value for operation with encoder: 1.5-times the motor slip
- *P4-15*: Torque limit for brake release:
  - Increase the value when the hoist sags.
- *P4-16*: Torque limit for timeout:
  - Reference value = pre-magnetization time (*P7-12*) of the motor
- *P4-13*: Brake release time:
  - Adjust the value according to the technical brake data.
- *P4-14*: Brake engagement time:
  - Adjust the value according to the technical brake data.
- *P2-23*: Zero-speed holding time:
  - This is used for post-magnetization.
- P7-07: Expanded generator control
  - Activate with very high generator loads.
- *P7-10*: Stiffness:
  - Higher values make the application stiffer
- *P7-14*/*P7-15*: Boost parameters for torque servo control:
  - Increase the values slightly when the hoist sags.

6.5.6 Additional information

To ensure safe operation , the following parameters are preset, locked or ignored while the hoist function is active:

- *P1-06*: Energy-saving function is deactivated
- *P2-09/P2-10*: Skip frequencies are ignored.
- *P2-18*: Relay contactor 2 is locked for control of the brake rectifier.
- *P2-26*: The flying start function is deactivated.
- *P2-27*: Standby mode is deactivated.
- *P2-36*: The start mode is edge-triggered (Edgr-r).
- *P2-38*: Voltage failure results in coast to a stop.
- *P4-07*: The upper torque limit is set to 200%.
- *P4-08*: The bottom torque limit is set to 0%.
- *P4-09*: The upper limit of the generator torque is set to 200%.

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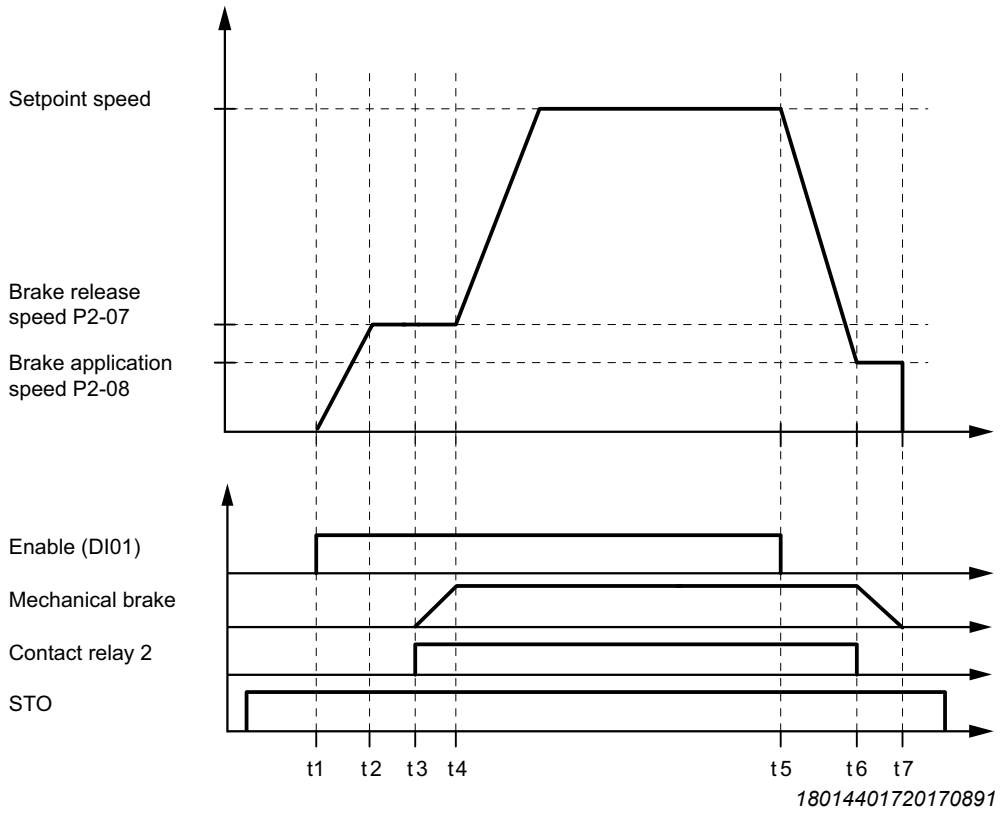
6.5.7 Cycle diagram for the hoist mode

The following diagram shows the hoist mode.



t_1 Inverter enable

t_1 - t_2 The motor runs up to brake release speed (fixed setpoint speed 7).

t_2 Brake release speed is reached.

t_2 - t_3 Torque threshold *P4-15* verified. The inverter indicates a fault if the torque threshold exceeds the timeout set in *P4-16*.

t_3 Relay opens.

t_3 - t_4 Brake opens within brake release time *P4-13*.

t_4 Brake is released. The drive runs up to the setpoint speed.

t_4 - t_5 Normal operation

t_5 Inverter lock

t_5 - t_6 Drive slows down to brake application speed (fixed setpoint speed 8).

t_6 Relay closes.

t_6 - t_7 Brake applied within brake application time *P4-14*.

t_7 Brake is closed and drive stopped.

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6.6 Fire mode/emergency mode

In "Fire mode/emergency mode", the inverter drives the motor at the speed defined in *P6-14*. The inverter automatically resets all faults and ignores all setpoints, control signal sources and shutdowns (e.g.: external fault or enable signal revoked). Operation of the inverter is maintained for as long as possible. Active emergency mode is indicated by the message "FirE" on the display.

Set the fire mode/emergency mode as follows:

- Perform a motor startup.
- Set parameter *P1-14* to "201" to access further parameters.
- Set parameter *P1-15* to "0" to configure the digital inputs.
- Configure the inputs depending on the requirements in parameter group *P9-xx*. For control via terminals, set parameter *P9-09* to "9 = terminal control".
- Set parameter *P9-33 Fire mode/emergency mode input selection* to the desired input.
- Set parameter *P6-13* to "0" or "1", depending on the wiring.
- Set parameter *P6-14* to the speed that will be used in fire mode/emergency mode. You can specify a positive or a negative speed setpoint.

For evaluating the fire mode/emergency mode, the following two indices can be readout via index communication:

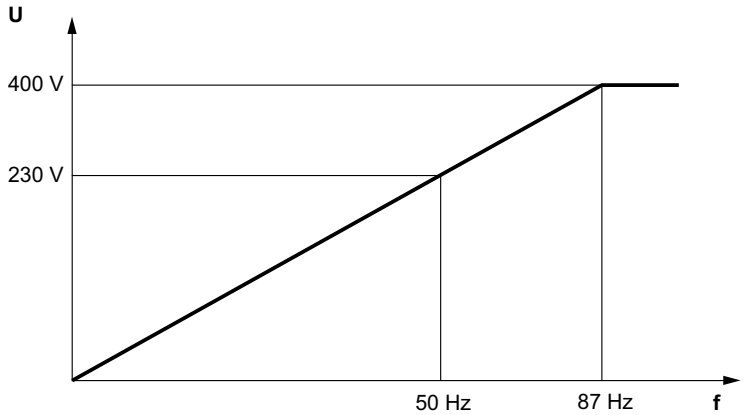
- SBus index 11358 is the fire mode/emergency mode start time: Time stamp related to (*P0-65*) at the time of activation of the fire mode/emergency mode.
- SBus index 11359 is the fire mode/emergency mode runtime in minutes. It specifies how long the fire mode/emergency mode was active.

INFORMATION

A reset to factory settings cannot be carried out during active emergency mode.

6.7 Operation at the 87 Hz characteristic (50 Hz motors)

The U/f ratio remains the same at 87 Hz operation. However, higher power and speeds are generated which causes a higher current flow.



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Do the following to set "87 Hz characteristic" operation:

- Set parameter *P1-07* to star voltage (data on the motor nameplate).

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- Set parameter *P1-08* to delta current (data on the motor nameplate).
- Set parameter *P1-09* to "87 Hz".
- Set parameter *P1-10* to "(synchronous speed at nominal frequency) × (87 Hz / 50 Hz) – (slip speed at nominal frequency)".
- Select an operating mode suitable for the motor in P4-01.
- Set the cos phi in *P4-05*
- Start the automatic motor measuring procedure "Auto Tune" as described in chapter "Auto-tune automatic measuring procedure".

Example of calculating P1-10:

DRN80M4: 0.75 kW, 50 Hz

Nominal speed 1440 min^{-1}

P1-10 = 1500 min^{-1} × (87 Hz / 50 Hz) - (1500 min^{-1} - 1440 min^{-1}) = 2550 min^{-1}

INFORMATION

Set *P1-01 Maximum speed* according to your requirements. In 87 Hz operation, the inverter has to provide a current that is √3-times higher. For this purpose, select an inverter with a √3-times higher power rating.

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6.8 Examples of analog input scaling and offset setting

Analog input format, scaling and offset are connected to each other.

Inverter setting:

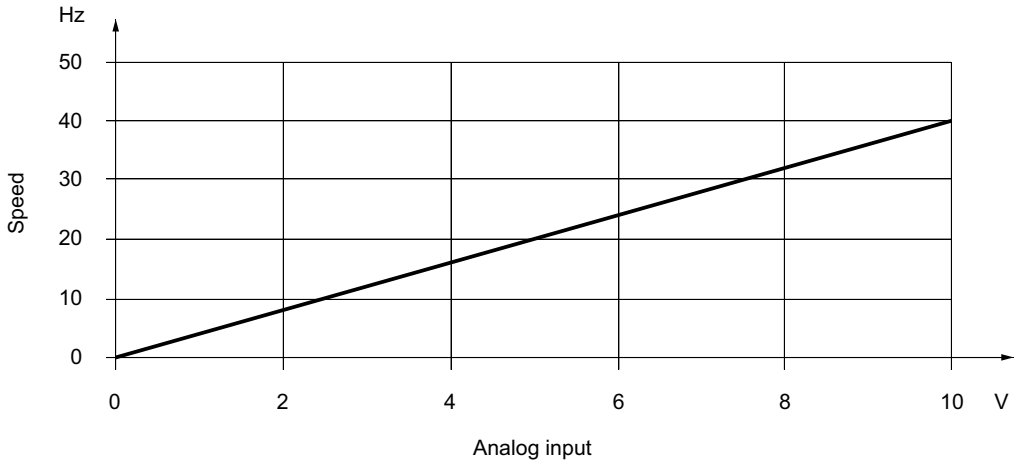
P1-01 = 50 Hz

6.8.1 Example 1: Analog input scaling

Control 0 – 40 Hz with analog input 0 – 10 V:

n_1 = 0 Hz, n_2 = 40 Hz

P2-31 = 80%



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$$P2\text{-}31 = \frac{n_2 - n_1}{P1\text{-}01} \times 100\% = \frac{40\,Hz - 0\,Hz}{50\,Hz} \times 100\% = 80\%$$

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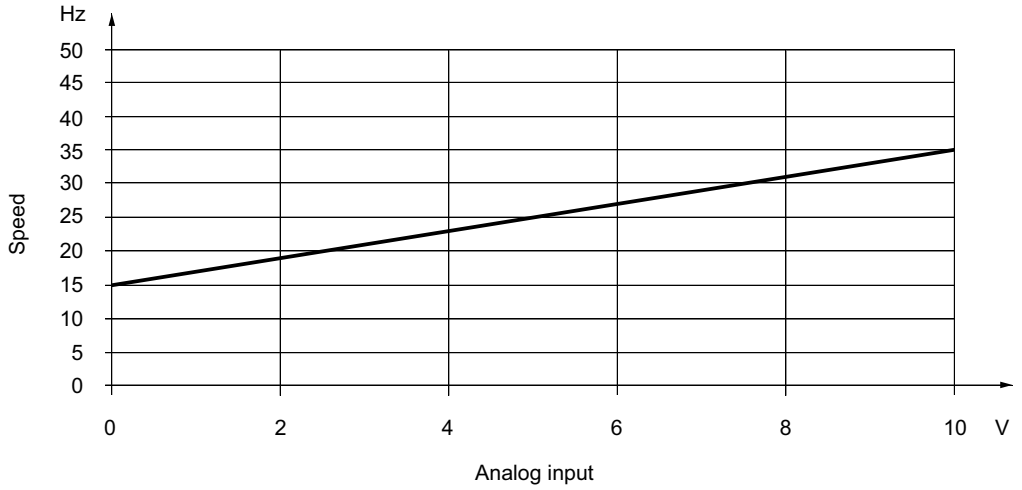
6.8.2 Example 2: Analog input offset

Control 15 – 35 Hz with analog input 0 – 10 V:

$n_1 = n_{Offset}$ = 15 Hz, n_2 = 35 Hz

P2-31 = 40%, P2-32 = -75%



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$$P2\text{-}31 = \frac{n_2 - n_1}{P1\text{-}01} \times 100\% = \frac{35\,Hz - 15\,Hz}{50\,Hz} \times 100\% = 40\%$$

$$P2\text{-}32 = \frac{\frac{-n_{Offset}}{P1\text{-}01} \times 100\%}{P2\text{-}31} = \frac{\frac{-15\,Hz}{50\,Hz} \times 100\%}{0.40} = -75\%$$

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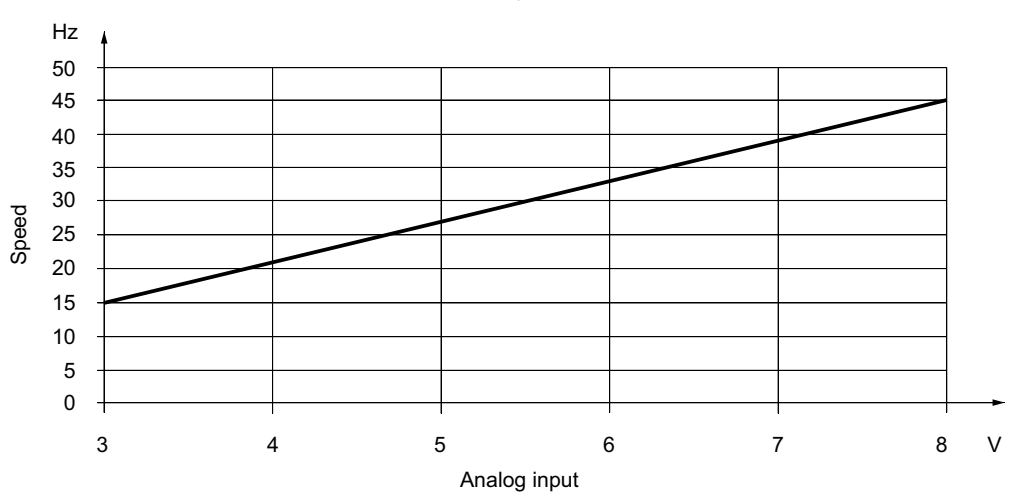
6.8.3 Example 3: Analog input scaling and offset

Control 15 to 45 Hz with analog input 3 to 8 V: n_1 is the difference from the minimum speed.



$$P2-31 = \frac{n_2 - n_1}{P1-01} \times 100\% \times \frac{AI_{full\_range}}{AI_{control\_range}}$$

$$P2-31 = \frac{45Hz - 15Hz}{50Hz} \times 100\% \times \frac{100\%}{50\%}$$

$$P2-31 = 120\%$$

$$P2-32 = AI_{min}(\%) - \frac{n_1 \times AI_{control\_range}}{(n_2 - n_1)}$$

$$P2-32 = 30\% - \frac{15Hz \times 50\%}{(45Hz - 15Hz)}$$

$$P2-32 = 5\%$$

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6.9 Fan and pumps

Startup of pumps and fans

1. Start up the connected motor type according to the control mode and parameterization intended for this purpose, see chapter "Startup with motors". For asynchronous motors, use the U/f control.
   ⇨ The slip compensation must stay deactivated (*P1-10* = 0).
2. Set the ramps *P1-03* and *P1-04* to the most reasonable values possible.
   ⇨ The difference between acceleration and brake delay should be as small as possible.
3. For freely rotating fans or pumps, always activate the flying start function *P2-26* = 1, provided they are operated with asynchronous motors.
4. If the process does not require overload, limit *P4-07* and *P4-09* to 110%. Individual adjustment to at most 150% may be necessary.
5. Do not change any values in parameter group 7 manually. These parameters may only be changed if needed and only by experts.

Further functions for applications with pumps or fans

The following functions are available additionally for applications with pumps or fans:

- Voltage boost *(P1-11*)
- Adjustment of the U/f characteristic curve (*P4-10, P4-11*)
- Energy-saving function (*P1-06*)
- Overload management (*P4-18*)
- Zero speed holding time (*P2-23*)
- Standby mode (*P2-27*)
- Skip frequency with resonance vibrations (*P2-09*, *P2-10*)
- PID controller, see "Parameter group 3: PID controller (level 2)"
- Fire mode/emergency mode, see "Fire mode/emergency mode" (→ 🗎 72)

6.10 Motor potentiometer

The motor potentiometer function lets the inverter respond to key commands.

If the digital inputs are activated that increase or decrease the speed, the speed changes along the preset ramps *P1-03* and *P1-04*.

If both digital inputs are activated at the same time, the inverter stops along the rapid stop ramp *P2-25*. If none of the two inputs are activated, the current speed and direction of rotation are maintained.

The enable is superordinate to this function and is necessary for the function.

To use the motor potentiometer function, select one of the possible function selections of the digital inputs with *P1-15* = 10 or 20. Also refer to chapter "P1-15 Digital input function selection".

When using this function, the arrow-up and arrow-down keys can also be used directly on the inverter.

After power OFF or revoking the enable, the inverter operates according to the setting in *P2-36*.

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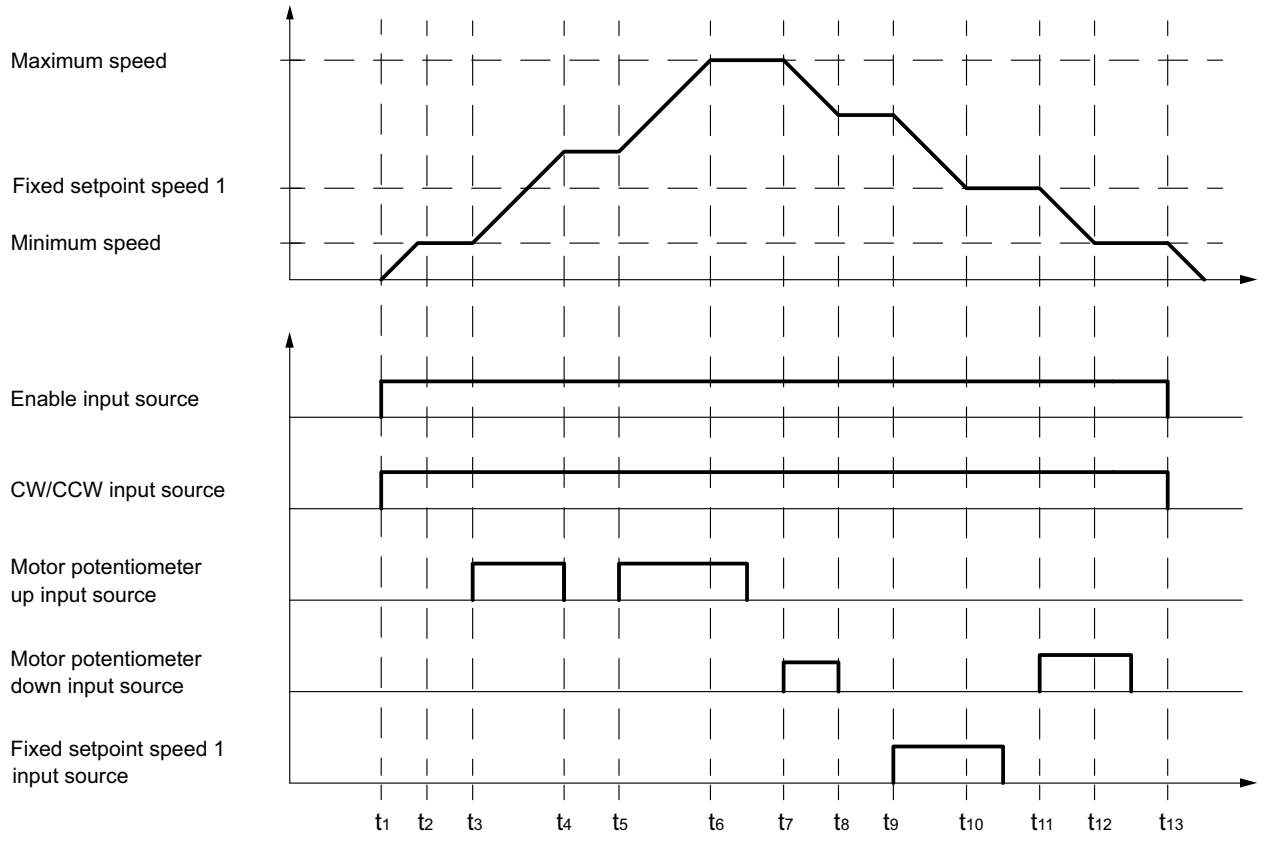
The following figure shows the basic function of the motor potentiometer.



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t_1 Inverter enable

t_1 - t_2 Motor accelerates to the set minimum speed (*P1-02*).

t_2 - t_3 Motor maintains minimum speed.

t_3 Motor potentiometer up is activated.

t_3 - t_4 As long as the signal "Motor potentiometer up" is present, the motor speed is increased along acceleration ramp *P1-03*.

t_4 - t_5 If the signal "Motor potentiometer up" is no longer present, the current speed is maintained.

t_5 Motor potentiometer up is activated.

t_5 - t_6 As long as the signal "Motor potentiometer up" is present, the motor speed is increased further along the acceleration ramp (*P1-03*) until it reaches maximum speed (*P1-01*).

t_6 - t_7 The maximum speed is not exceeded and is maintained, even if the signal "Motor potentiometer up" is no longer present.

t_7 "Motor potentiometer down" is activated.

t_7 - t_8 As long as the signal "Motor potentiometer down" is present, the motor speed is decreased along deceleration ramp *P1-04*.

t_8 - t_9 When signal "Motor potentiometer down" is no longer present, the current speed is maintained.

t_9 Fixed setpoint speed is activated.

t_9 - t_{11} As long as the signal is present at fixed setpoint speed, the motor speed is decreased along deceleration ramp *P1-04* until it reaches the fixed setpoint speed. This speed is then maintained.

t_{11} "Motor potentiometer down" is activated.

t_{11} - t_{12} As long as the signal "Motor potentiometer down" is present, the motor speed is decreased along deceleration ramp *P1-04* but not below the minimum speed *P1-02*.

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6.11 3-wire control

The function is activated via the digital input function selection *P1-15* = 21.

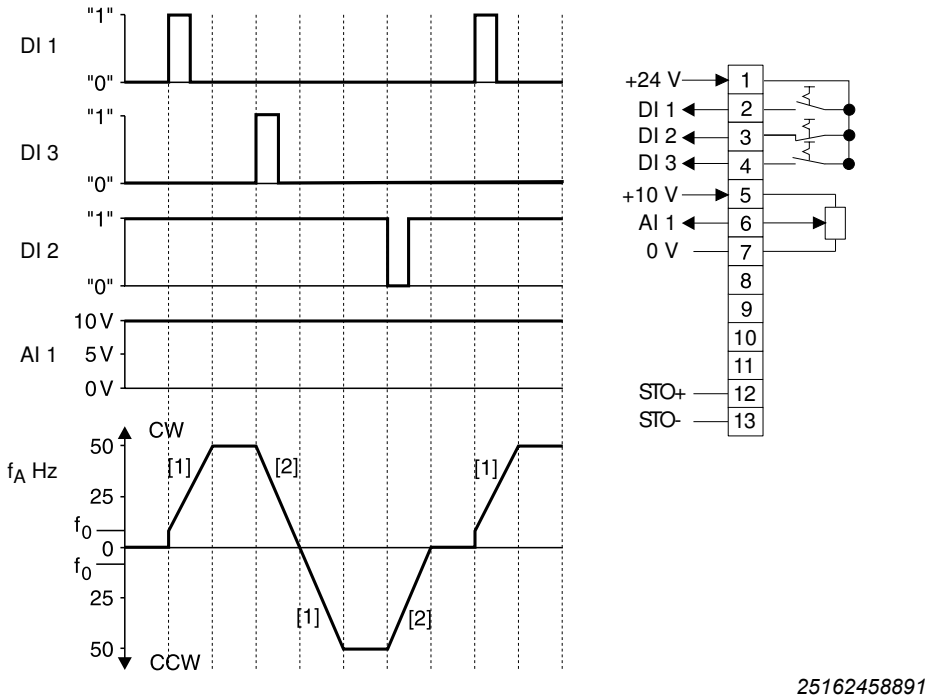
The 3-wire control principle determines the control.

The enable and direction of rotation signals of the inverter then respond in an edge-controlled way.

- Connect the Start key <CW> with NO contact to digital input DI1.
- Connect the Start key <CCW> with NO contact to digital input DI3.
- Connect the Stop key as NC contact to digital input DI2.

If you connect <CW> and <CCW> at the same time, the drive decelerates along the rapid stop ramp *P2-25*.

6.11.1 Control signal source 3-wire control



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DI 1	Right/stop	CW	Clockwise rotation
DI 3	Left/stop	CCW	Counterclockwise rotation
DI 2	Enable/stop	[1]	Ramp up (*P1-03*)
AI 1	Setpoint input AI	[2]	Ramp down (*P1-04*)
f_A	Output frequency		
f_0	Start/stop frequency		

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7 Operation

7.1 Inverter status

7.1.1 Static inverter status

The following list shows the status messages for a non-enabled inverter.

Message	Description
StoP	Power section of inverter disabled. This message is displayed when the motor is at standstill and no error is present. The inverter is ready for normal operation. The inverter is not enabled.
P-deF	Parameter factory settings have been loaded. This message appears when the user issues the command for loading the parameter factory settings. To put the inverter into operation again, press the <Stop/reset> key.
Standby	The inverter is in standby mode. This message is displayed when the inverter runs at the minimum speed for the time parameterized in *P2-27* and the speed setpoint is also 0.
Inhibit/ Inhibit	Is displayed when 24 V and/or GND are not present at the STO contacts. The output stage is inhibited.
ETL 24	External 24 V voltage supply is connected. The functions are limited, see also chapter "Connection of the 24 V backup voltage" (→ 🗎 38).

7.1.2 Operating state of the inverter

The following table shows the messages of the status for an enabled inverter.

You can toggle between displaying the output frequency, output current, output power, and speed by briefly pressing the <Navigate> key on the keypad.

Message 7-segment display	Message Full text display	Description
H xxx	xxx Hz	Output frequency of the frequency inverter (in Hz) This is displayed when the inverter is enabled.
A xxx	xxx A	Output current of the frequency inverter (in Ampere) This is displayed when the inverter is enabled.
P xxx	xxx kW	Output power of the motor (in kW) This is displayed when the inverter is enabled.
L xxx	A padlock appears in the full text display	The parameter is locked for changes. Please ensure that: • The parameter lock in *P2-39* is not activated. • The inverter is not enabled. • The inverter is supplied with line voltage.
xxxx	xxx rpm	Output speed of the inverter (in min^{-1}) If the inverter is enabled and a value of > 0 has been set in the parameter *P1-10*, this is displayed.
C xxx	Scaled value	This is the scaled value, depending on (*P2-21/P2-22*).

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Message 7-segment display	Message Full text display	Description
Auto-t	Auto tuning	An automatic measurement of the motor parameters is being performed. This process can take up to 2 minutes. As soon as the auto-tuning has completed, the display will revert to STOP.
. . . . . . (flashing dot)	OL (= Over-Load)	The output current of the inverter exceeds the current value entered in *P1-08*. The inverter monitors the extent and the duration of the overload. The inverter triggers error message "I.t-trP", depending on the overload.
. . (alternately flashing dots)	ML (=Main Loss)	Line phase failure or supply voltage outside of specification
FirE	Fire mode	Fire mode/emergency mode activated. The message is displayed alternately with the current operating state.
dELAy.t	Delay-t	Time-delayed reset for i.t-trP, O-I, hO-I, OI-b, see also error description O-I (→ 🗎 84)
	Select language	List to select one of the available languages. To select a language, use the <Navigate> key.
Ho-run	Ho-run	Reference travel started. Wait until the inverter has reached the reference position. After a successful reference travel, the display will show "stop".

7.1.3 Status displays of the parameter module

The parameter module status is displayed on the inverter.

Display	Description
PASS-r	The parameter module has successfully read/saved the inverter parameters.
OS-Loc	The parameter module is locked. Attempt to read parameter from the frequency inverter with activated parameter module lock.
FAiL-r	The parameter module could not read any parameters from the inverter.
PASS-t	The parameter module successfully transferred the parameters to the inverter. Writing of parameters to the inverter.
FAiL-P	The power ratings of the parameter stored in the parameter module do not match the power ratings of the inverter to be programmed.
FAiL-t	The parameter module could not transfer the parameter set to the inverter.
no-dAt	No parameter data was saved in the parameter module.
dr-Loc	The inverter parameters were locked. No new parameter settings could be transferred. Unlock the parameter set of the inverter.
dr-rUn	Inverter is running and cannot accept any new parameter settings. Stop the inverter before programming.
tyPE-E	The parameters for the inverter type that are saved in the parameter module do not match the inverter type to be programmed (write process only).
tyPE-F	The parameter module does not yet support the inverter type to be programmed.

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7.2 IT security

7.2.1 Hardening measures

Perform the following hardening measures:

- Regularly check if updates are available for your products.
- Report incidents concerning IT security by e-mail to cert@sew-eurodrive.com.
- Regularly check which Security Advisories are available in the Online Support of SEW-EURODRIVE.
- Evaluate the error memories and diagnostics information of your products regularly and check whether there are entries that affect IT security.

7.2.2 Guidelines for secure operation

The engineering protocol from SEW-EURODRIVE allows authorized personnel to activate various service accesses on the device. Authentication is implemented by using static access data. This data is not used to defend against attacks on IT security but to protect against unintentional modification. This is the reason why it cannot be changed.

To prevent misuse of these service accesses, network access must be restricted according to the state of the art. For more information, refer to section "It security of the environment".

7.2.3 Guidelines for user account management

The product uses an administrative service account. It is not relevant for operation and is only used for service purposes. The account is protected by static, device-specific access data.

7.3 Troubleshooting

Symptom	Cause and solution
Overload or overcurrent fault of the unloaded motor during acceleration	Check the star/delta terminal connection in the motor. The nominal operating voltage of motor and inverter must match. The delta connection always yields the lower voltage of a multi-voltage motor.
Overload or overcurrent – motor does not turn	Check whether the rotor is blocked. If a mechanical brake is installed, make sure that it is released.
No enable for the inverter – display remains at "StoP"	• Check whether the hardware enable signal is present at digital input 1. • Ensure proper +10 V user output voltage (between terminals 5 and 7). • If faulty, check the wiring of the user terminal strip. • Check *P1-12* for terminal mode/keypad mode. • If keypad mode is selected, press the "Start" key. • The line voltage must correspond with the specified values.
The inverter does not start at extremely cold ambient conditions	The inverter does not start if the ambient temperature is below the specified ambient temperature range (see chapter "Ambient conditions"). Under such conditions, provide an on-site heat source that keeps the ambient temperature above the specified temperature.

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Symptom	Cause and solution
No access to advanced menus	*P1-14* must be set to the advanced access code. The value is "101" unless the user has changed the code in *P2-40*.

7.4 Fault history

The parameter *P1-13* archives the last 4 faults. Each fault is displayed in abbreviated form. The most recent fault is shown first (when calling *P1-13*). The oldest fault will be deleted from the log.

The parameter *P0-13* archives the last 4 faults plus the timestamp in reference to the inverter runtime *P0-31*. The timestamp can only be seen in the LT Shell engineering software.

INFORMATION

If the last fault in the error log is an undervoltage fault, no further undervoltage faults will be saved in the error log. This prevents the error log from being filled with undervoltage faults that invariably occur on each shutdown of the inverter.

7.5 Fault reset

By pressing the <Stop> key or with a rising edge at digital input 1, you can reset an error in the event of a fault response; see chapter "Fault list" (→ 🗎 84).

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7.6 Fault list

Code (Inverter display)	Code (MotionStudio in P0-13)	Error code status word if Bit5 = 1	CANopen emergency code	Meaning	Measure
4-20 F	18	0x71	0x1012	Signal loss 4 to 20 mA (> 500 ms)	• Check whether the input current falls within the range defined in *P2-30* and *P2-33*. • Check the connection cable.
AtF-01	40	0x51	0x1028	The measured stator resistance fluctuates between the phases.	The measured stator resistance of the motor is unsymmetrical. Check to see whether: • The motor is connected and fault-free. • The windings have the correct resistance and symmetry.
AtF-02	41	0x51	0x1029	The measured stator resistance is too high.	The measured stator resistance of the motor is too high. Check to see whether: • The motor is connected and fault-free. • The motor's power rating is consistent with the power rating of the connected inverter.
AtF-03	42	0x51	0x102A	Measured motor inductance is too low.	The measured motor inductance is too low. Check whether the motor is connected correctly and if it is fault-free.
AtF-04	43	0x51	0x102B	Measured motor inductance is too high.	The measured motor inductance is too high. Check to see whether: • The motor is connected and fault-free. • The motor's power rating is consistent with the power rating of the connected inverter.
AtF-05	44	0x51	0x102C	Timeout of inductance measurement	The measured motor parameters are not convergent. Check to see whether: • The motor is connected and fault-free. • The motor's power rating is consistent with the power rating of the connected inverter.
dAtA-E	19	0x62	0x1013	Internal memory error (DSP)	Contact SEW-EURODRIVE Service.
dAtA-F	17	0x62	0x1011	Internal memory error (IO)	Contact SEW-EURODRIVE Service.
E-triP	11	0x1A	0x100B	External error at digital input 5.	NC contact was opened. • Check the motor thermistor (if connected).
Enc-01	30	0x0E	0x101E	Communication error between encoder card and inverter.	The encoder feedback is activated in *P6-05*, and no encoder card is plugged in or the encoder card is not recognized.
ENC02	31	0x0E	0x101F	Speed fault (*P6-07*)	The difference between the actual speed and setpoint speed is larger than the percentage value set in *P6-07*. This fault applies only to vector control or control with encoder feedback. Set a higher value in *P6-07*. If you wish to deactivate speed monitoring, set *P6-07* to 100%.
Enc-03	32	0x0E	0x1020	Incorrect PPR count parameterized.	Check the parameter settings in *P6-06* and *P1-10*.
Enc-04	33	0x0E	0x1021	Fault on encoder channel A	The A track of the encoder feedback is not present. Check the wiring.
Enc-05	34	0x0E	0x1022	Fault on encoder channel B	The B track of the encoder feedback is not present. Check the wiring.
Enc-06	35	0x0E	0x1023	Fault on encoder channels A and B	The A and B tracks of the encoder feedback are not present. Check the wiring.
Enc-07	36	0x0E	0x1024	RS485 data channel fault, HIPERFACE® data channel error	Communication error between encoder card and encoder. Check the encoder card for proper fit and contact.
Enc-08	37	0x0E	0x1025	HIPERFACE® IO communication channel error	Communication error between encoder card and inverter. Check the encoder card for proper fit and contact.

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Code (Inverter display)	Code (MotionStudio in P0-13)	Error code status word if Bit5 = 1	CANopen emergency code	Meaning	Measure
Enc-09	38	0x0E	0x1026	HIPERFACE® type is not supported.	During the use of Smart Servo Package, a wrong motor/inverter combination was used. Check to see whether: • The speed class of the CMP.. motor is 4500 min^{-1}. • The nominal motor voltage equals the nominal inverter voltage. • A HIPERFACE® encoder is being used.
Enc-10	39	0x0E	0x1027	Trigger: KTY	KTY has been triggered or is not connected.
Er-LED				Display error	Contact SEW-EURODRIVE Service.
Err-SC				The keypad lost the communication connection to the inverter.	
EtI-24				External 24 V supply.	Line voltage supply not connected. The inverter is externally supplied with 24 V.
FAULtY				The communication between the controller and the power section is interrupted	Contact SEW-EURODRIVE Service.
F-Ptc	21	0x1F	0x1015	Motor protection triggered	The connected motor protection sensor is defined in *P2-33* (PTC, TF, TH, KTY or PT1000) and connected to analog input 2 (terminal 10).
FAN-F	22	0x32	0x1016	Internal fan error.	Contact SEW-EURODRIVE Service.
FLt-dc	13	0x07	0x320D	DC link ripple is too high.	Check the current supply
Ho-trP	27	0x27	0x101B	Error during reference travel.	• Check reference cams • Check the connection of the limit switch • Check the setting of the reference travel type and the required parameters
Inhibit				STO safety circuit is open.	Check to see if the terminals 12 and 13 are connected correctly.
Lag-Er	28	0x2A	0x101C	Lag error	Check for: • The encoder connection • The wiring of encoder, motor, and line phases • Whether mechanical components can move freely and ensure that they not blocked. • Extend the ramps. • Set a higher P component. • Parameterize the speed controller again. • Extend the lag error tolerance. • Set PLC Prog Task Priority to 10 ms • The inverter is operated in the derating and can no longer provide the current for acceleration/constant travel.
I.t-trp	04	0x08	0x1004	Overload of inverter/motor (I2t error)	Make sure that: • The motor nameplate parameters are correctly inserted in *P1-07*, *P1-08*, and *P1-09*. • In vector mode (*P4-01* = 0 or 1), the motor power factor in P4-05 is correct. • Auto-tuning has been performed correctly. Check to see whether: • The decimals are flashing (inverter overloaded) and then increase the acceleration ramp (*P1-03*) or decrease the motor load. • The cable length corresponds to the requirements. • The load can be moved freely and there are no obstructions or other mechanical failures (check the load mechanically). • The thermal motor protection to UL508C is activated in P4-17. • See also "Fault reset delay in the case of an O-I and hO-I error"

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Code (Inverter display)	Code (MotionStudio in P0-13)	Error code status word if Bit5 = 1	CANopen emergency code	Meaning	Measure
IO DSP COMM loss				The communication between the controller and the power section is interrupted	Contact SEW-EURODRIVE Service.
ML				Line phase failure	Input phase missing or voltage is outside the specified range
O-I	03	0x01	0x2303	Short-term overcurrent at the inverter output. Strong overload on the motor.	**Fault during the stopping process:** Check for premature brake application. **Fault when enabling the inverter:** Check to see whether: • The motor nameplate parameters are correctly inserted in *P1-07*, *P1-08*, and *P1-09*. • In vector mode (*P4-01* = 0 or 1), the motor power factor in *P4-05* is correct. • Auto-tuning has been performed correctly. • The load can be moved freely and there are no obstructions or other mechanical failures (check the load mechanically). • A short circuit between the phases or a ground fault of a phase occurred at the motor and motor connection cable. • The brake is connected correctly, controlled correctly, and correctly released when the motor has a holding brake. • There is a dielectric breakdown on the motor between the motor phases or to the stator. Disconnect the motor cable directly at the inverter and measure using a high-voltage meter with at least 1000 V. **Fault during operation:** Check for: • Sudden overload or malfunction. • The cable connection between the inverter and motor. The acceleration/deceleration time might be too short and require too much power. If you cannot increase *P1-03* or *P1-04*, use a larger inverter. **Measures:** Reduce the setting of the voltage enhancement in *P1-11*. Set a longer run-up time in *P1-03*. Disconnect the motor from the inverter. Enable the inverter again. If this fault recurs, replace the inverter completely after you check the complete system. **Fault reset delay (dELAy.t)** If the fault occurs again directly after the O-I or hO-I error messages are reset, the following delay times result for repeated resetting: • First reset after 4 seconds • Second reset after 8 seconds • Third reset after 16 seconds • Fourth reset after 32 seconds • Further resets after 64 seconds The delay is reset to 4 seconds if no further fault occurs within the delay time.
hO-I	15	0x01	0x230F	Hardware overcurrent error at the inverter output (IGBT self-protection in case of overload).	
O-hEAt	23	0x7C	0x4117	Ambient temperature too high.	Check if the ambient conditions are within the range specified for inverters.
OL				Overload	The output current is higher than the nominal motor current
O-t	8	0x0B		Heat sink overtemperature	The heat sink temperature can be displayed via *P0-21*. A history log is saved in parameter *P0-38* in 30-sec. intervals before a switch off with error. This error message is displayed at a heat sink temperature of ≥90 °C. Check for: • The ambient temperature of the inverter. • The inverter cooling and housing dimensions. • The function of the internal cooling fan of the inverter. Reduce the settings of the effective clock frequency in parameter *P2-24*, or the load at the motor/inverter.

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Code (Inverter display)	Code (MotionStudio in P0-13)	Error code status word if Bit5 = 1	CANopen emergency code	Meaning	Measure
O-torq	24	0x34	0x1018	Upper torque limit for timeout.	Check the motor load. Set a higher value in *P6-17*, if necessary. If you wish to deactivate torque monitoring, set *P6-17* to 0.0 sec.
O-Volt	06	0x07	0x3206	Overvoltage in the DC link	The fault occurs if a high flywheel load or overhauling load is connected, and the excess regenerative energy is transferred back to the inverter. If a fault occurs while stopping or during deceleration, increase the deceleration ramp time *P1-04* or connect a suitable braking resistor to the inverter. The proportional gain in *P4-03* is reduced in vector mode. In PID control mode, ensure that the ramps are active by reducing *P3-11*. Additionally check if the supply voltage is within the specified range. Information: The value of the DC bus voltage can be displayed in *P0-20*. A history log is saved in parameter *P0-36* at 256-ms intervals prior to a switch off with error.
OI-b	01	0x04	0x2301	Overcurrent on the brake channel, braking resistor overload	Make sure that the connected braking resistor does not fall below the minimum value approved for the inverter (see technical data). Check the braking resistor and the cabling for possible short-circuits. See also fault reset delay for O-I and hO-I errors
OL-br	02	0x04	0x1002	Braking resistor overload	The thermal overload protection to protect the braking resistor is active (*P6-19* and *P6-20*). The protection function has detected an overload of the braking resistor. • Check the values in *P6-19* and *P6-20*. • Check if the calculated work cycle in *P0-56* corresponds to the project planning of the application. • Make sure that the braking resistor is operated within its physical limits. • To reduce the generator energy, you can, e.g. increase the deceleration ramp. • Alternatively, use a larger braking resistor or switch an additional braking resistor in parallel. Observe the minimum braking resistance value for the inverter.
OF-01	60	0x1C	0x103C	Internal connection to option module error.	Check if all optional fieldbus cards correspond to the same fieldbus type. Contact SEW-EURODRIVE Service
OF-02	61	0x1C	0x103D	Option module fault	Contact SEW-EURODRIVE Service.
Out-F	26	0x52	0x101A	Inverter output stage fault	• Motor phase failure detection: One or more motor phases were disconnected at the inverter output. Check the motor lead. • Check the EMC-compliant wiring of any external control cables. Use shielded cables. • As a test, use the internal 24 V supply directly at the digital inputs, to rule out errors in the signal cable. • As a test, use the internal 24 V supply directly at the STO inputs to rule out malfunctions at the STO circuit. • The safety relay at the STO inputs must not send pulsed signals. • Check STO for correct wiring. • As a test, disconnect the temperature sensor to rule out errors in the sensor cable. • As a test, disconnect the motor cable from the inverter to rule out errors originating in the inverter. • Contact SEW-EURODRIVE
P-LOSS	14	0x06	0x310E	Line phase failure	An input phase has been separated or interrupted at an inverter planned for a 3-phase supply.
P-dEF	10	0x09	0x100A	Factory settings have been applied.	

Code (Inverter display)	Code (MotionStudio in P0-13)	Error code status word if Bit5 = 1	CANopen emergency code	Meaning	Measure
Ph-Ib				Unequal voltage on the line phases	• Check the device input voltage. • Check the values in *P0-22, P0-23, P0-24*. The values may deviate by a maximum ±10%. Use an input choke if required.
Ph-SEq	45	0x51		Line phases confused	The inverter requires the correct line phase sequence for the internal control of the fan. Swap any two line phases.
PS-trP	05	0xC8	0x1005	Output stage error (IGBT self-protection in case of overload)	See error **O-I**.
SC-0b5	12	1D		Connection between inverter and control unit interrupted.	Check if there is a connection between the inverter and keypad.
SC-F01	50	0x2B	0x1032	Modbus communication error	Check the communication settings.
SC-F02	51	0x2F	0x1033	SBus/CANopen communication error	Check for: • The communication connection between inverter and external devices. • The assigned, unique address per inverter in the network.
SC-F03	52	0x29	0x1034	Fieldbus module communication error (fieldbus side)	Contact SEW-EURODRIVE Service.
SC-F04	53	0x29	0x1035	IO option card communication error	Contact SEW-EURODRIVE Service.
SC-F05	54	0x29	0x1036	LTX module communication error	Contact SEW-EURODRIVE Service.
SC-LoS				The communication between the controller and the power section is interrupted	Contact SEW-EURODRIVE Service.
SC-OBS				Communication failure with other devices	• A keypad has lost the communication connection to the inverter. • The communication connection has been disconnected in the master-slave network. • Check the addresses of all inverters in the network.
SF				Switching frequency decreased	The PWM frequency was automatically decreased due to the heat sink temperature.
SP-Err	31	0x0E	0x101F	Speed fault (*P6-07*)	The difference between the actual speed and setpoint speed is larger than the percentage value set in *P6-07*. This fault applies only to vector control or control with encoder feedback. Set a higher value in *P6-07*. If you wish to deactivate speed monitoring, set *P6-07* to 100%.
Sto-F	29	0x73	0x101D	STO circuit fault	The safety relay must not transmit test pulses. Check the voltage source. STO+ at terminal 12 must be > 18 V.
StoP				The inverter is not enabled.	Activate the enable command. Make sure that enable is activated after the STO is activated for the hoist function.
th-Flt	16	0x1F	0x1010	Defective thermistor on the heat sink.	Contact SEW-EURODRIVE Service.
type-f				Parameter module and inverter are not compatible.	The parameter module used is not of type LT BP C
U-dEF				User settings loaded.	The parameter set saved in *P6-26* has been restored.

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Code (Inverter display)	Code (MotionStudio in P0-13)	Error code status word if Bit5 = 1	CANopen emergency code	Meaning	Measure
U-torq	25	0x34	0x1019	Bottom torque limit for timeout (hoist).	The torque threshold has not been exceeded in time. Increase the time in *P4-16* according to the pre-magnetization time (*P7-12*). Check the torque limit in *P4-15*.
U-t	09	0x75	0x4209	Insufficient temperature	The ambient temperature is below the specified ambient temperature range ("10.2 Ambient conditions"). Provide a suitable heat source.
U-Volt	07	0xC6	0x3207	DC link undervoltage	Occurs routinely when switching off the inverter. Check the line voltage if this occurs while the inverter is running.
USr-cL				Parameter backup successfully deleted	The parameter set has been successfully deleted using *P6-26*.
USr-PS				Parameter backup has been completed successfully.	The parameter set has been successfully saved using *P6-26*.

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8 Service

To ensure fault-free operation, SEW-EURODRIVE recommends that you check the ventilation openings in the housing at regular intervals and clean them if necessary.

8.1 SEW-EURODRIVE Service

If you are unable to rectify a fault, contact SEW-EURODRIVE Service. For addresses, refer to www.sew-eurodrive.com.

When contacting SEW-EURODRIVE Service, always specify the following information so that our service personnel can assist you more effectively:

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

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8.2 Extended storage

If the device is in extended storage, connect it to the grid voltage for at least 5 minutes every 2 years. Otherwise, the device's service life may be reduced.

Procedure in the event of omitted maintenance:

Electrolytic capacitors are used in the inverters. They are subject to aging effects when de-energized. This effect can damage the capacitors if the device is connected directly to nominal voltage after a longer period of storage.

In the event of omitted maintenance, SEW-EURODRIVE recommends that you slowly increase the line voltage up to the maximum voltage. This can be done, for example, using a variable transformer whose output voltage is set according to the following overview.

The following graduations are recommended:

AC-200 to 240-V devices:

- Stage 1: AC 0 V to AC 170 V within a few seconds
- Stage 2: AC 170 V for 15 minutes
- Stage 3: AC 200 V for 15 minutes
- Stage 4: AC 240 V for 1 hour

AC-380 to 480-V devices:

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

AC 500 to 600-V devices:

- Stage 1: AC 0 V to AC 350 V within a few seconds
- Stage 2: AC 350 V for 15 minutes
- Stage 3: AC 420 V for 15 minutes
- Stage 4: AC 500 V for 15 minutes
- Stage 5: AC 600 V for 1 hour

AC-480 to 525-V devices:

- Stage 1: AC 0 V to AC 350 V within a few seconds
- Stage 2: AC 350 V for 15 minutes
- Stage 3: AC 420 V for 15 minutes
- Stage 4: AC 525 V for 1 hour

After this regeneration, the device can be used immediately or put back into storage with maintenance.

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8.3 Shutdown

⚠ WARNING

Risk of burns due to hot surfaces.

Severe injuries.

- Let the devices cool down before touching them.

⚠ WARNING

Electric shock caused by dangerous voltages in the connection box. Dangerous voltages can still be present for up to 5 minutes after disconnection from the power supply system.

Severe or fatal injuries.

- Before removing the electronics cover, de-energize the device via a suitable external disconnection device.
- Secure the device against unintended re-connection of the voltage supply.
- Secure the output shaft against rotation.
- Wait for at least the following time before removing the electronics cover: **5 minutes**

To shut down the device, de-energize the device using appropriate measures. Disconnect the 400 V line voltage and the 24 V backup voltage from the device.

8.4 IT security guidelines for secure disposal

8.4.1 Removing the product from its intended environment

If the data stored on the product is considered relevant for IT security, remove it as described in the section "Secure removal of data stored in the product." (→ 🗎 92)

8.4.2 Removing reference and configuration data in the environment

Reference files, configuration files, log files, and other data belonging to the product can be stored in the environment on other devices, such as a higher-level controller or a local OPC-UA client. If the stored data is considered relevant for IT security, remove it from the corresponding devices.

8.4.3 Secure removal of data stored in the product

You can reset the data saved in the product to the factory settings using the MOVISUITE® engineering software.

This encompasses the following data, if present on the device variant:

- Configuration of the device
- Scope recording of the device
- Fault memory
  - Fault number

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  - Timestamp
  - Fault code, subfault code, descriptive text
  - Process data
  - States of the digital inputs/outputs
  - Control word and status word
- Device name
- IP address
- Safety-relevant data

The following data is not reset with this procedure and can be changed individually, if present on the device variant:

- Enabled functions
- AS-Interface address
- Data set of the safety option
- EtherCAT® device designation
- PROFINET name
- Last detected options

8.4.4 Removing a customer data backup

The product does not create local customer data backups.

8.5 Waste disposal

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

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

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

- Oil and grease

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

Waste disposal according to WEEE Directive 2012/19/EU

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

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

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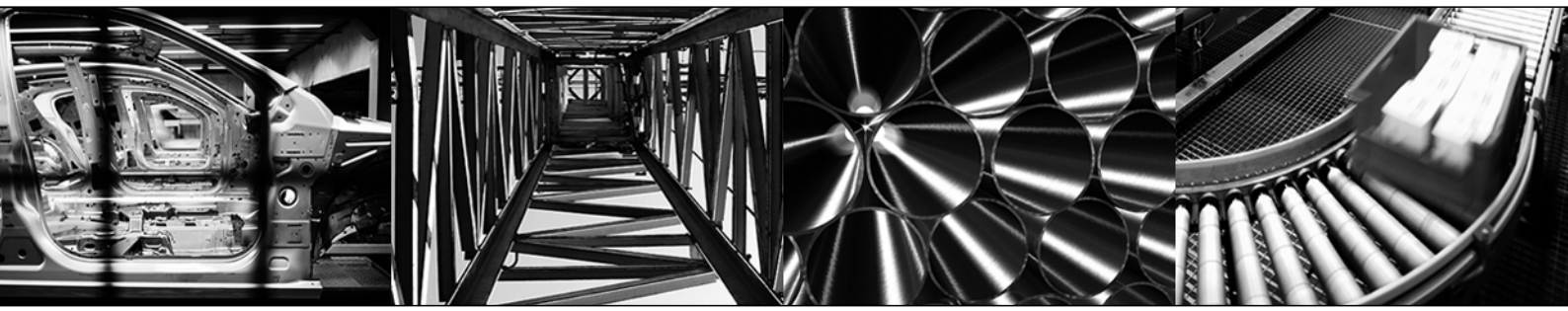

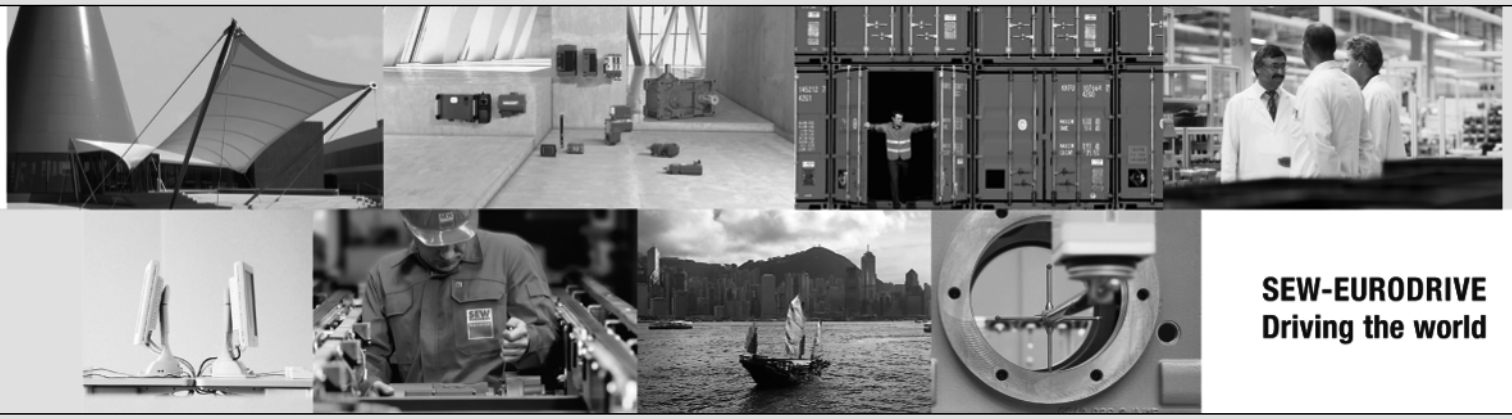

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Driving the world

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