SEW EURODRIVE

Operating Instructions

Standard Inverters

MOVITRAC® LTP-B

Edition 12/2018

25918672/EN

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1 General information

1.1 About this documentation

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

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

1.2 Structure of the safety notes

1.2.1 Meaning of signal words

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

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

1.2.2 Structure of section-related safety notes

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

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

SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

1.2.3 Structure of embedded safety notes

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

This is the formal structure of an embedded safety note:

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

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1.3 Rights to claim under limited warranty

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

1.4 Content of the documentation

The current version of the operating instructions is the original.

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

1.5 Exclusion of liability

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

1.6 Product names and trademarks

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

1.7 Copyright notice

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2 Safety notes

2.1 Preliminary information

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

2.2 Duties of the user

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

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

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

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

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

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

2.3 Target group

Specialist for mechanical work

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

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

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Specialist for electrotechnical work

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

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

Additional qualification

In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation. The persons must have the express authorization of the company to operate, program, parameterize, label, and ground units, systems, and circuits in accordance with the standards of safety technology.

Instructed persons

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

2.4 Designated use

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

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

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

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

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

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

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

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

2.4.1 Hoist applications

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

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

2.5 Functional safety technology

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

2.6 Transport

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

Observe the following notes when transporting the device:

- Ensure that the product is not subject to mechanical impact.
- Before transportation, cover the connections with the supplied protection caps.
- Only place the product on the cooling fins or on the side without connectors during transportation.
- Always use lifting eyes if available.

If necessary, use suitable, sufficiently dimensioned handling equipment.

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

2.7 Installation/assembly

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

Protect the product from excessive mechanical strain. The product and its mounted components must not protrude into the path of persons or vehicles. Ensure that components are not deformed and that insulation spaces are maintained, particularly during transportation. Electric components must not be mechanically damaged or destroyed.

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

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2.7.1 Restrictions of use

The following applications are prohibited unless explicitly permitted:

- Use in potentially explosive areas
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, and radiation
- Operation in applications with impermissibly high mechanical vibration and shock loads in excess of the regulations stipulated in EN 61800-5-1
- Operation at installation altitudes above 4000 m above sea level

The product can be used at altitudes above 1000 m asl up to 4000 m asl under the following conditions:

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

2.8 Electrical connection

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

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

Make sure that all required covers are installed correctly after electrical installation.

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

2.8.1 Required preventive measure

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

2.8.2 Stationary application

Necessary preventive measure for the product is:

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

2.9 Protective separation

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

2.10 Startup/operation

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

Make sure that the present transport protection is removed.

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

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

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

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

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

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

Do not separate the connection to the product during operation.

This may result in dangerous electric arcs damaging the product.

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

10 minutes.

Observe the corresponding information signs on the product.

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

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

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

Do not touch the product during operation.

Let the product cool down before touching it.

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3 Device structure

3.1 Nameplate

The following figure shows an example of a nameplate.

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3.2 Type designation

Example: MCLTP-B 0015-2B1-4-00 (60 Hz)		
Product name	MCLTP	MOVITRAC® LTP-B
Version	B	Version status of the device series
Recommended motor power	0015	0015 = 1.5 kW
Connection voltage	2	2 = 200 – 240 V 5 = 380 – 480 V 6 = 500 – 600 V
Interference suppression on the input	B	0 = Device without filter (without interference suppression) A = Class C2 B = Class C1
Connection type	1	1 = 1-phase 3 = 3-phase
Quadrants	4	4 = 4-Quadrant operation
Design	00	00 = Standard IP20 housing 10 = IP66/NEMA-4X housing 10 = IP55/NEMA-12K housing 15 = IP55/NEMA-12K / IP66 /NEMA-4X housing for operation on IT systems 40 = IP66/NEMA-4X housing with switch xH = High-frequency version

Country-specific design	(60 Hz)	60 Hz design

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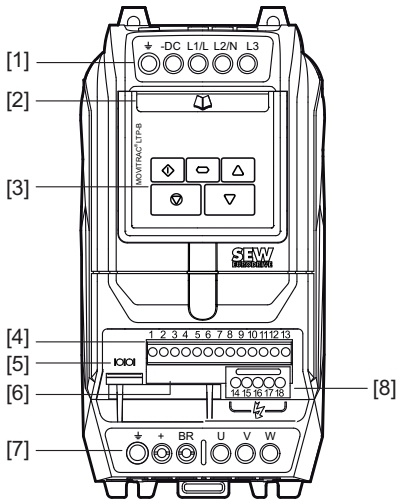
3.3 Device structure of the standard inverter

3.3.1 Inverters with degree of protection IP20/NEMA 1

The following inverters have the housing shown below:

Nominal line voltage	Power of the inverter
230 V	0.75 – 5.5 kW
400 V	0.75 – 11 kW
575 V	0.75 – 15 kW



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[1] Connecting terminal strip PE, -DC, L1/L, L2/N, L3

[2] Auxiliary card with terminal assignment and basic parameters

[3] Keypad with a 6-digit 7-segment display

[4] Control terminal strip (pluggable)

[5] RJ45 communication socket

[6] Option card slot

[7] Connecting terminal strip PE, +, BR, U, V, W

[8] Relay terminal strip (pluggable)

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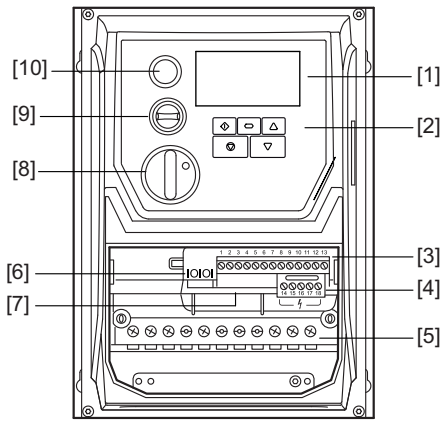
3.3.2 Inverters with degree of protection IP66/NEMA 4X

The following inverters have the housing shown below:

Nominal line voltage	Power of the inverter
230 V	0.75 – 4 kW
400 V	0.75 – 7.5 kW
575 V	0.75 – 11 kW



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[1] Full text display

[2] Keypad

[3] Control terminal strip (pluggable)

[4] Relay terminal strip (pluggable)

[5] Connecting terminal strip PE, L1/L, L2/N, L3, -DC, +, BR, U, V, W

[6] RJ45 communication socket

[7] Option card slot

The following items are only present in the unit design with switch option:

[8] Main switch for grid disconnection

[9] Rotary switch for direction of rotation CW/0/CCW

[10] Rotary potentiometer for speed

INFORMATION

The optional housing switches are already wired to the control terminal strip.

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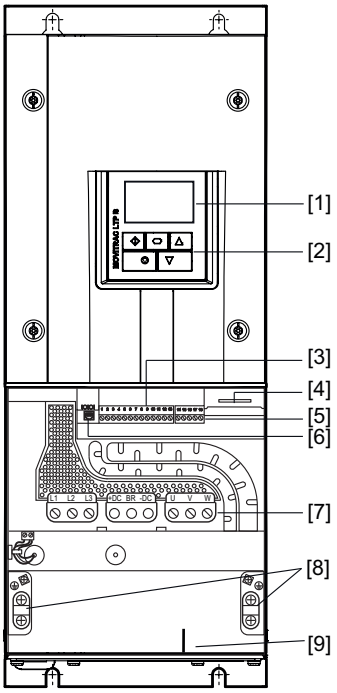
3.3.3 Inverters with degree of protection IP55/NEMA 12K

The following inverters have the housing shown below:

Nominal line voltage	Power of the inverter
230 V	5.5 – 75 kW
400 V	11 – 160 kW
575 V	15 – 110 kW



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[1] Full text display/6-digit 7-segment display

[2] Keypad

[3] Control terminal strip (pluggable)

[4] Option card slot

[5] Relay terminal strip (pluggable)

[6] RJ45 communication socket

[7] Connecting terminal strip PE, L1/L, L2/N, L3, -DC, +, BR, U, V, W

[8] Additional PE connections

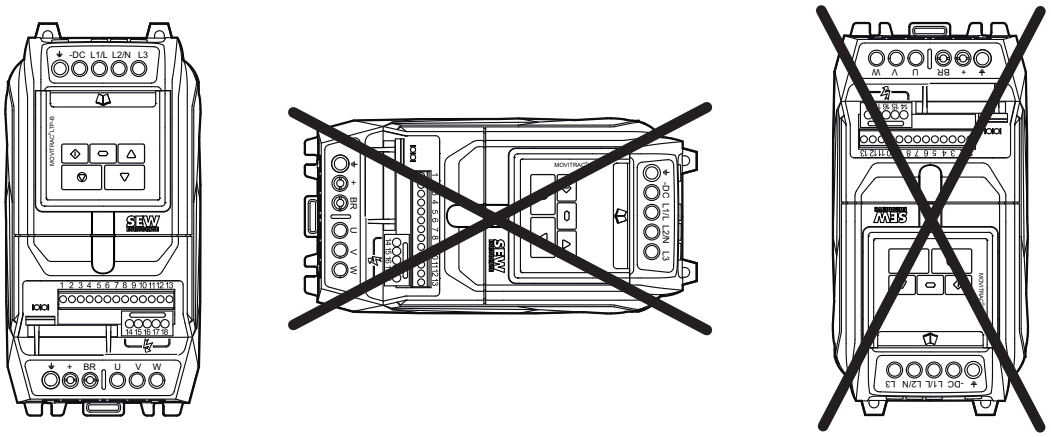
[9] Additional stud bolt on the cable entry plate for connection to the PE of the inverter

4 Installation

4.1 General information

- 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 substances 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" (→ 🗎 22).
- The permitted ambient temperatures are defined in chapter "Ambient conditions" (→ 🗎 175).
- The mounting rail installation is only possible for the following inverters with degree of protection IP20.
  - 230 V: 0.75 – 2.2 kW
  - 400 V: 0.75 – 4 kW
  - 575 V: 0.75 – 5.5 kW

  The mounting rail must have the dimensions 35 × 15 mm or 35 × 7.5 mm and be designed according to EN 50022.
- The inverter may only be installed as shown in the following figure:



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4.2 Permitted tightening torques

Power of the inverter	Tightening torque in Nm for inverter	
	Control terminals	Power terminals
Nominal line voltage 230 V		
0.75 – 2.2 kW	0.8	1
3 – 5.5 kW (IP20) 3 – 4 kW (IP66) 5.5 kW (IP66)		1 (IP20) 1 (IP66) 4 (IP66)
7.5 – 11 kW		4
15 – 18.5 kW		15
22 – 45 kW		20
55 – 75 kW		20
Nominal line voltage 400 V		
0.75 – 4 kW	0.8	1
5.5 – 11 kW (IP20) 5.5 – 7.5 kW (IP66) 11 kW (IP66)		1 (IP20) 1 (IP66) 4 (IP66)
15 – 22 kW		4
30 – 37 kW		15
45 – 90 kW		20
110 – 160 kW		20
Nominal line voltage 575 V		
0.75 – 5.5 kW	0.8	1
7.5 – 15 kW (IP20) 7.5 – 11 kW (IP66) 15 kW (IP66)		1 (IP20) 1 (IP66) 4 (IP66)
18.5 – 30 kW		4
37 – 45 kW		15
55 – 110 kW		20

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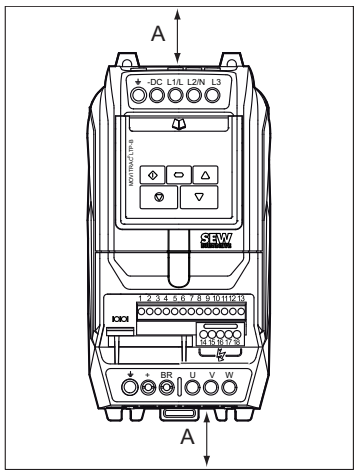
4.3 Mechanical installation

4.3.1 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 a heat conductive material unless it has forced cooling.
- When using a control cabinet with ventilation openings, the openings must be provided above and underneath the inverter to allow for unobstructed circulation of air. The air must be supplied underneath the inverter and dissipated above it.
- If the inverter is operated in environments with particles of dirt (such as dust), ventilation openings either have to be equipped with a suitable particle filter or forced cooling has to be used. The filter has to be serviced and cleaned.
- In environments with a high level of humidity, salt or chemicals, a suitable enclosed control cabinet (without ventilation openings) must be used.
- The inverters with degree of protection IP20 can be installed right next to each other without clearance.



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Power of the inverter	A in mm	Air flow rate per inverter
230 V: 0.75 kW, 1.5 kW **400 V**: 0.75 kW, 1.5 kW, 2.2 kW **575 V**: 0.75 – 5.5 kW	60	> 45 m^3/h
230 V: 2.2 kW	100	> 45 m^3/h
All other power ranges	100	> 80 m^3/h

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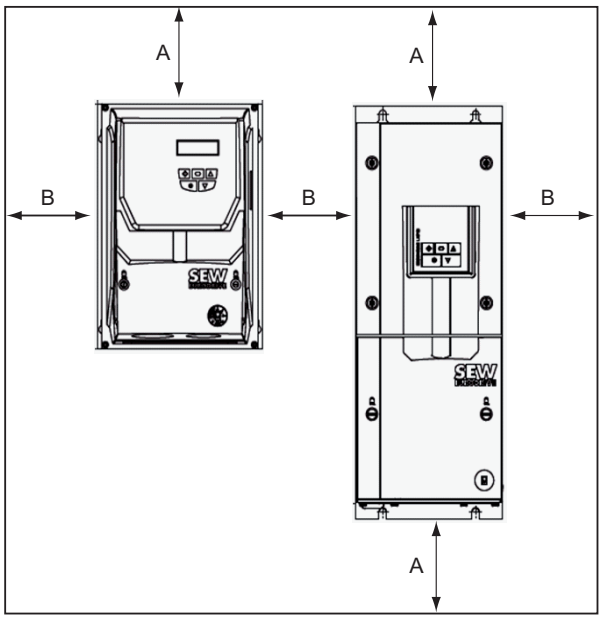
4.3.2 IP55/IP66 housing: Installation and control cabinet dimensions

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

In control cabinets or in field, the following minimum distances must not be underrun.



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Power of the inverter	A in mm	B in mm
230 V		
0.75 – 4 kW	100	10
5.5 – 75 kW	200	10
400 V		
0.75 – 7.5 kW	100	10
11 – 160 kW	200	10
575 V		
0.75 – 11 kW	100	10
15 – 110 kW	200	10

INFORMATION

If the IP55/IP66 inverter is installed in a control cabinet, a sufficient control cabinet ventilation must be ensured.

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4.4 Electrical installation

⚠ WARNING

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

Severe or fatal injuries.

- Wait 10 minutes after you have de-energized the inverter and have switched off the line voltage and the DC 24 V voltage. Do not start working on the device until you have made sure that it is de-energized.

⚠ WARNING

Danger of fatal injury due to falling hoist.

Severe or fatal injuries.

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

- The inverters may only be installed by electrical specialists in compliance with the applicable directives and regulations.
- The grounding cable must be designed for the maximum fault current of the voltage source that is usually limited by fuses or motor protection switches.
- The inverter has the degree of protection IP20. For a higher IP degree of protection, a suitable enclosure or the IP55/NEMA 12K or the IP66/NEMA 4X variant has to be used.
- Make sure the devices are properly grounded. Adhere to the wiring diagram in chapter "Connecting the inverter and motor" (→ 🗎 49).

4.4.1 Before installation

- Make sure that supply voltage, frequency, and number of phases (single- or three-phase) correspond with the nominal values of the inverter on delivery.
- A disconnecting switch or similar disconnecting element must be installed between voltage supply and inverter.
- Never connect the power supply to the output terminals U, V or W of the inverter.
- Do not install contactors between inverter and motor. Adhere to a minimum clearance of 100 mm at points where control cables and electric power lines are installed close to each other, and an angle of 90° for crossing cables.
- The cables are only protected by slow-blow, high-power fuses or a motor circuit breaker. For more information, refer to section "Permitted voltage supply systems" (→ 🗎 28).
- It is recommended that you use a 4-core PVC-insulated and shielded cable as the power cable. Route this cable according to the applicable national regulations of the industrial sector as well as the rule set and standards. Conductor end sleeves are required for connecting the power cables to the inverter.
- Make sure that shielding and sheaths of power cables are designed according to the wiring diagram in section "Wiring diagram" (→ 🗎 49).
- The grounding terminal of each inverter must be connected individually and **directly** to the ground busbar (mass) of the installation site (via filter, if available).

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- Do not loop the ground connections of the inverter from one inverter to the other. Neither route the ground connections to the inverters from other inverters.
- The impedance of the ground circuit must comply with the local safety regulations of the industrial sector.
- Make sure that all terminals are tightened to the respective tightening torques; see chapter Technical data.
- To comply with UL regulations, all earth connections must be designed with UL listed crimping ring cable lugs.

Unlike direct operation in the grid, inverters on the motor generate suitable 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.

INFORMATION

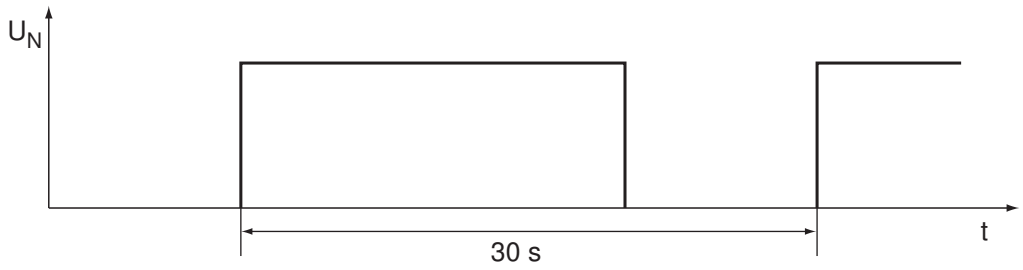
Make sure that the earth connections are properly connected. The inverter can generate leakage currents > 3.5 mA. The grounding cable must be sufficiently dimensioned to carry the maximum fault current of the voltage source that is usually limited by fuses or miniature circuit breakers.

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

4.4.2 Line contactors

Use only line contactors in utilization category AC-3 (EN 60947-4-1).

Make sure to wait at least 30 seconds between 2 switching cycles.



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4.4.3 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.

Residual current device

⚠ WARNING

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

Severe or fatal injuries.

- The product can cause direct current in the PE conductor. If a residual current device (RCD) or a residual current monitoring device (RCM) is used for protection in the event of a direct or indirect contact, only a type B RCD or RCM is permitted on the supply end of the product.

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

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4.4.4 Operation on an IT system

IP20 devices can be operated on the IT system as described below. The IT system version without Filter LTP-B...-15 should be used for the 3 × 380 – 480 V devices in the unit design IP55/IP66. Please contact SEW-EURODRIVE for all other devices.

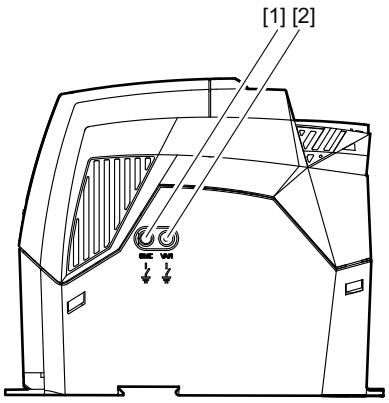
For operation on the IT system, the connection of the overvoltage protection and the EMC filter to PE has to be separated. Screw out the EMC and VAR screw on the side of the device.

⚠ WARNING

Danger of electric shock. Dangerous voltage levels may still be present inside the inverter and at the terminals up to 10 minutes after disconnection from the supply system.

Severe or fatal injuries.

- Disconnect the inverter from the power supply at least 10 minutes before you screw out the EMC and VAR screw.



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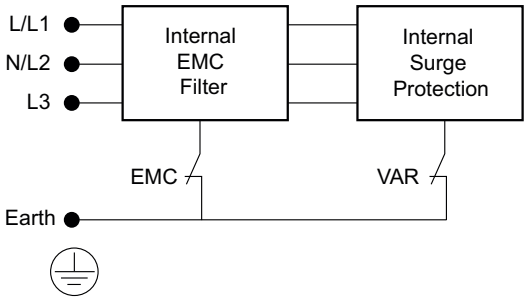
[1] EMC screw
[2] VAR screw



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

4.4.5 Permitted voltage supply systems

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

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

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

  Operation on voltage supply systems with a non-grounded star point (for example IT systems) is only permitted for inverters with IP20 degree of protection and inverters of device variant LTP-B...-15. See chapter "Operation on an IT system" (→ 🗎 27).

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

  On voltage supply systems, the inverters with all degrees of protection may only be operated with a maximum phase-to-ground AC voltage of 300 V.

4.4.6 Help card

The help card contains an overview of the terminal assignment and additionally an overview of the basic parameters of parameter group 1.

In the IP66 housing, the help card is attached behind the removable front cover.

In the IP20 housing, the help card is inserted in a slot above the display.

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4.4.7 Removing the terminal cover

The front cover of the inverter must be removed to access the terminals of inverters with degree of protection IP55/IP66. Only use cross-head or slot screwdrivers to open the terminal cover.

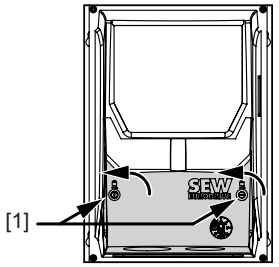
The terminals can be accessed when the marked screws on the front of the product are removed as shown below.

The front cover is attached by proceeding in reverse order.

Inverters with degree of protection IP66/NEMA 4X

The following inverters have the housing shown below:

Nominal line voltage	Power of the inverter
230 V	0.75 – 4 kW
400 V	0.75 – 7.5 kW
575 V	0.75 – 11 kW



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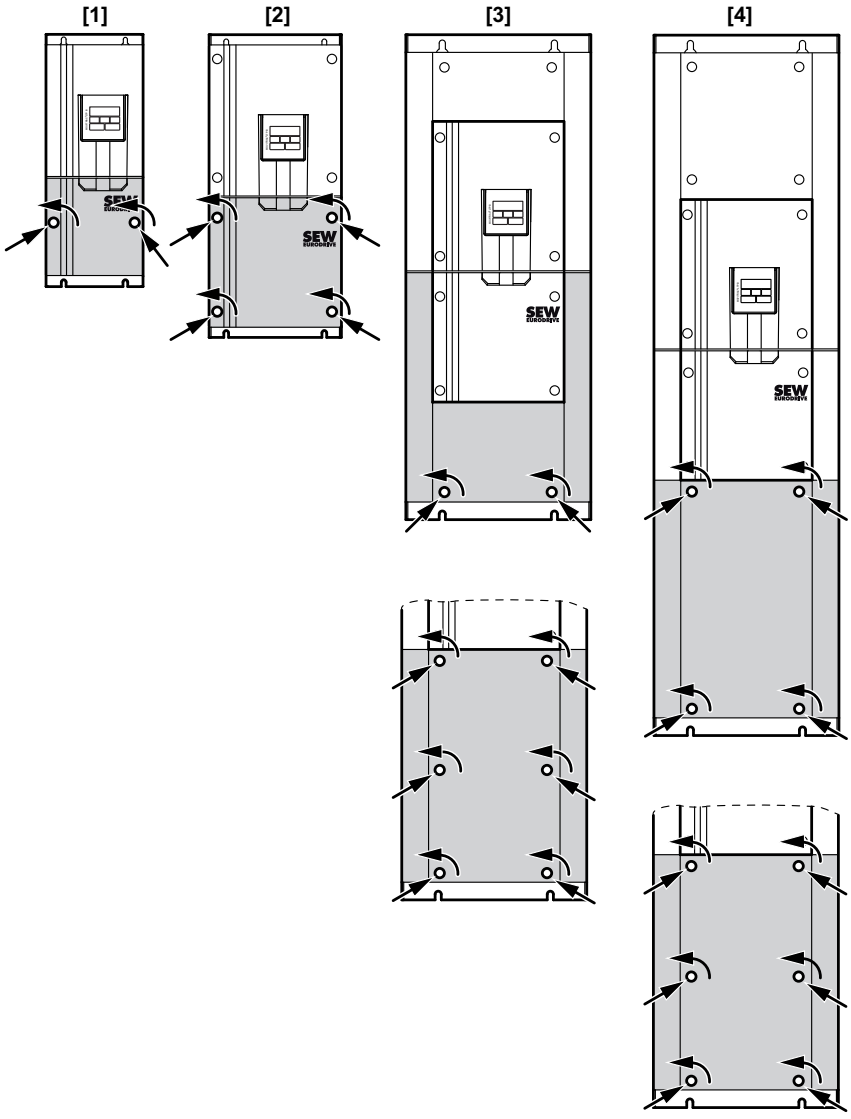
[1] Screws of the front cover

Inverters with degree of protection IP55/NEMA 12K

The following inverters have the housing shown below:

Nominal line voltage	Power of the inverter
230 V	5.5 – 75 kW
400 V	11 – 160 kW
575 V	15 – 110 kW



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[1]
- 230 V: 5.5 – 11 kW
- 400 V: 11 – 22 kW
- 575 V: 15 – 30 kW

[2]
- 230 V: 15 – 18.5 kW
- 400 V: 30 – 37 kW
- 575 V: 37 – 45 kW

[3]
- 230 V: 22 – 45 kW
- 400 V: 45 – 90 kW
- 575 V: 55 – 110 kW

[4]
- 230 V: 55 – 75 kW
- 400 V: 110 – 160 kW

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4.4.8 Connecting and installing the braking resistor

⚠ 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

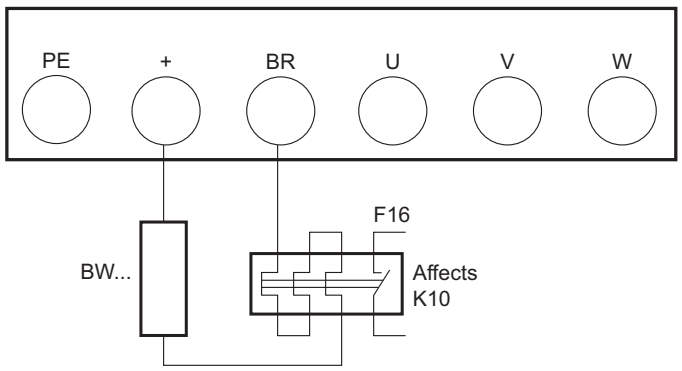
Risk of burns. The surfaces of the braking resistors get very hot when the braking resistors are loaded with P_N.

Minor injuries.

- Choose a suitable installation location.
- Do not touch the braking resistors.
- Install a suitable touch guard.

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

- Shorten the cables to the required length.
- Use 2 tightly twisted leads or a 2-core shielded power cable. The cable cross section must be dimensioned according to the tripping current I_F of F16, the cable's nominal voltage according to 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 in 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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4.4.9 Motor temperature protection TF, TH, KTY84, PT1000

Motors with internal temperature sensor (TF, TH, KTY84, PT1000 or similar) can be directly connected to the 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)

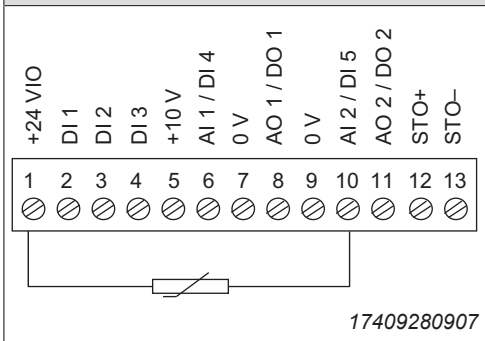
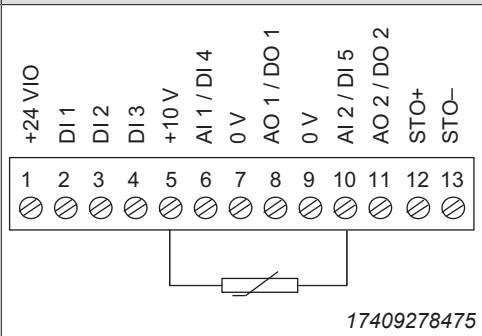
Use a shielded cable for the motor sensor lead.

The motor temperature can be read out using index 11234.

INFORMATION

First, configure the connected temperature sensor using parameter P2-33 before the temperature sensor is connected. 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 Bimetallic switch TH	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 thereby be assigned to input DI5/AI2.

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4.4.10 Multi-motor drive/group drive

- The total of the motor currents must not exceed the nominal current of the inverter. The maximum permitted cable length for the group is limited to the values of single connection. See chapter "Technical data" (→ 🗎 174).
- The motor group is limited to 5 motors and must not differ by more than 3 sizes.
- Multi-motor drive is only possible with AC asynchronous motors, 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 length of all motor lines connected in parallel (I_{tot}) must not exceed the maximum permitted motor cable length of the individual inverter (I_{max}).

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

3172400139

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

I_{max} = Maximum motor line length (see chapter "Technical data" (→ 🗎 174))

n = Number of motors connected in parallel.

Fusing

No additional fusing is required if the cross-section of the motor cable matches 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 on the corresponding cross-section. Motor circuit breakers are suitable for this purpose.

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

4.4.11 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.

4.4.12 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.

Branch Circuit Protection

1 × 200 – 240 V devices			
Devices	**Fuses or MCB (type B)**	**Max. supply short circuit current**	**Max. line voltage**
0008	15 A	100 kA rms (AC)	240 V
0015	20 A		
0022	25 A		

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3 × 200 – 240 V devices			
Devices	**Fuses or MCB (type B)**	**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	40 A		
0075	50 A		
0110	70 A		
0150	90 A		
0185	110 A		
0220	150 A		
0300	175 A		
0370	225 A		
0450	250 A		
0550	300 A		
0750	350 A		

3 × 380 – 480 V devices			
Devices	**Fuses or MCB (type B)**	**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	40 A		
0150	50 A		
0185	60 A		
0220	70 A		
0300	80 A		
0370	100 A		
0450	125 A		
0550	150 A		
0750	200 A		
0900	250 A		
1100	300 A		
1320	350 A		
1600	400 A		

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3 × 500 – 600 V devices			
Devices	**Fuses or MCB (type B)**	**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	70 A		
0370	80 A		
0450	100 A		
0550	125 A		
0750	150 A		
0900	175 A		
1100	200 A		

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4.4.13 Electromagnetic compatibility (EMC)

Inverters with EMC filters are designed for use in machines and drive systems. They meet the EMC product standard EN 61800-3 for drives with variable speed. Observe the specifications of Directive 2014/30/EU for EMC-compliant installation of the drive system.

Interference immunity

With regard to interference immunity, the inverter with EMC filter satisfies the limit values of standard EN 61800-3 and can therefore be used both in industrial and household applications (light industry).

Interference emission

With regard to interference emission, the inverter meets the EMC limit values of the standard EN 61800-3:2004. The inverters are suitable for industrial as well as household applications (light industry).

Install the inverters as specified in chapter Installation to ensure best possible electromagnetic compatibility. Ensure proper ground connections for the inverters. Use shielded motor cables to comply with the specifications on interference emission.

The conditions for use in drive applications are defined in the following table.

<table>
<tr><th rowspan="2">Inverter type</th><th>Cat. C1 (class B)</th><th>Cat. C2 (class A)</th><th>Cat. C3</th></tr>
<tr><th colspan="3">According to EN 61800-3</th></tr>
<tr><td>230 V, 1-phase
LTP-B xxxx 2B1-x-xx</td><td colspan="3">No additional filtering required.
Use a shielded motor cable.</td></tr>
<tr><td>230 V, 3-phase
LTP-B xxxx 2A3-x-xx
400 V, 3-phase
LTP-B xxxx 5A3-x-xx</td><td>Use an external filter of type NF LTxxx xxx.
Use a shielded motor cable.</td><td colspan="2">No additional filtering required.
Use a shielded motor cable.</td></tr>
<tr><td>575 V, 3-phase
LTP-B xxxx 603-x-xx</td><td colspan="3">The 575 V devices are not covered by the EMC standard.
Use an external line filter, if necessary, to minimize electromagnetic interference emissions.
However, compliance with the aforementioned limit classes cannot be guaranteed.
Use a shielded motor cable.</td></tr>
</table>

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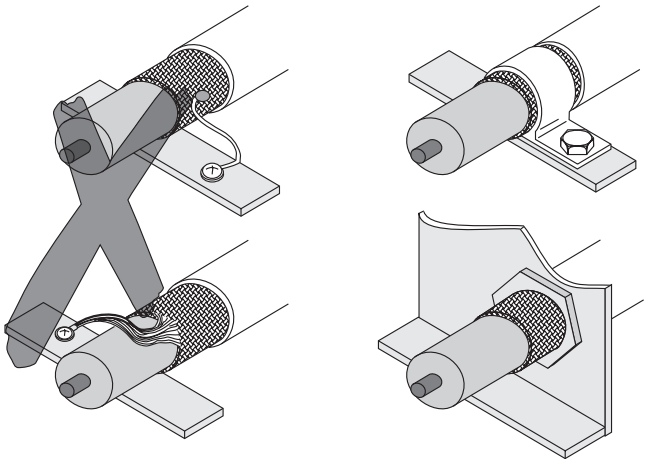
General information about connecting the motor shield

For all applications with a expectedly higher EMC load, using shielded cables is recommended. The shield must be connected as follows:

Connect the shield by the shortest possible route and make sure it is grounded over a wide area at both ends. This also applies to cables with several shielded core strands.



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Recommendation for applying the motor shield to inverter with IP20

Inverters with degree of protection IP20/NEMA 1

The following inverters have the housing shown below:

Nominal line voltage	Power of the inverter
230 V	0.75 – 5.5 kW
400 V	0.75 – 11 kW
575 V	0.75 – 15 kW

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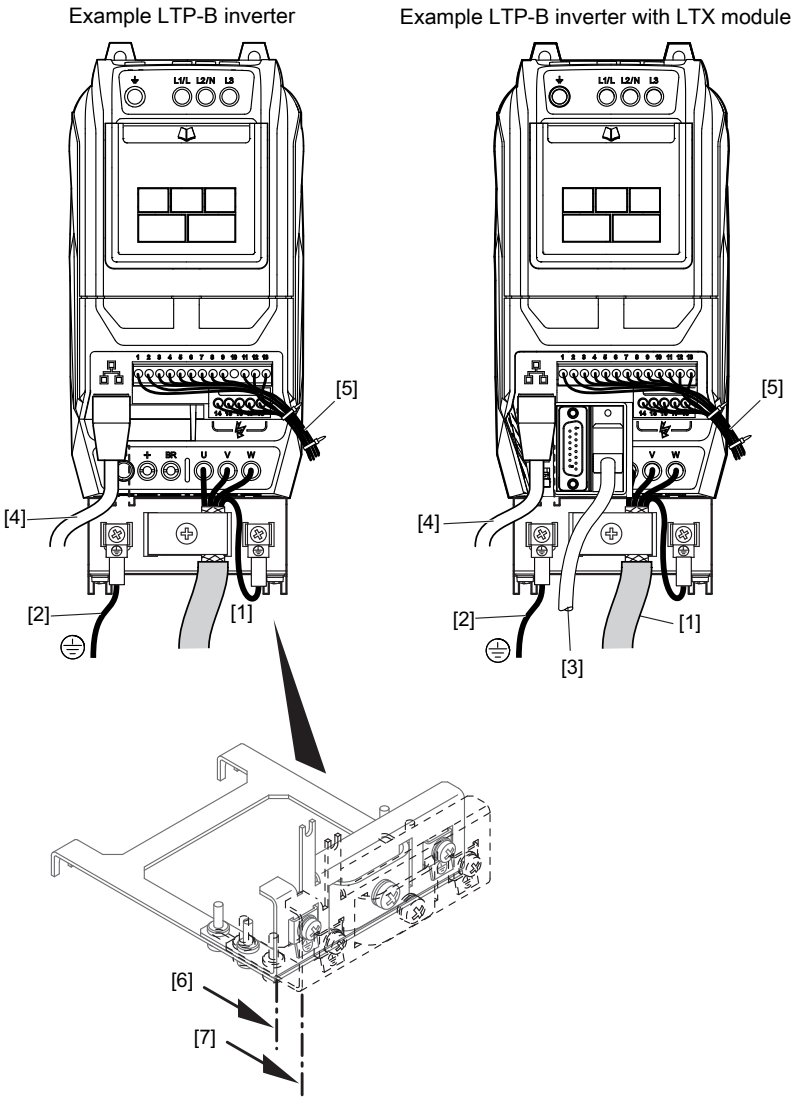

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[1] Motor cable
[2] Additional PE connection
[3] Encoder cable
[4] Communication cable RJ45
[5] Control cables
[6]
- 230 V: 0.75 – 2.2 kW
- 400 V: 0.75 – 4 kW
- 575 V: 0.75 – 5.5 kW

[7]
- 230 V: 3 – 5.5 kW
- 400 V: 5.5 – 11 kW
- 575 V: 7.5 – 15 kW

The shield plate can be used optionally for the inverters in IP20 design listed above. Proceed as follows to adjust:

1. Loosen the 4 screws on the slotted holes.
2. Move the sheet metal up to the stop according to the required size.
3. Tighten the screws again.

Make sure that the sheet metal is correctly attached to the PE connection.

Recommendation for applying the motor shield to inverters with IP55/IP66

The use of metal screw fittings is recommended to connect the motor shield to the device. For the inverters listed below, the threads must be at least 8 mm.

Inverters with degree of protection IP66/NEMA 4X

The following inverters have the housing shown below:

Nominal line voltage	Power of the inverter
230 V	0.75 – 4 kW
400 V	0.75 – 7.5 kW
575 V	0.75 – 11 kW

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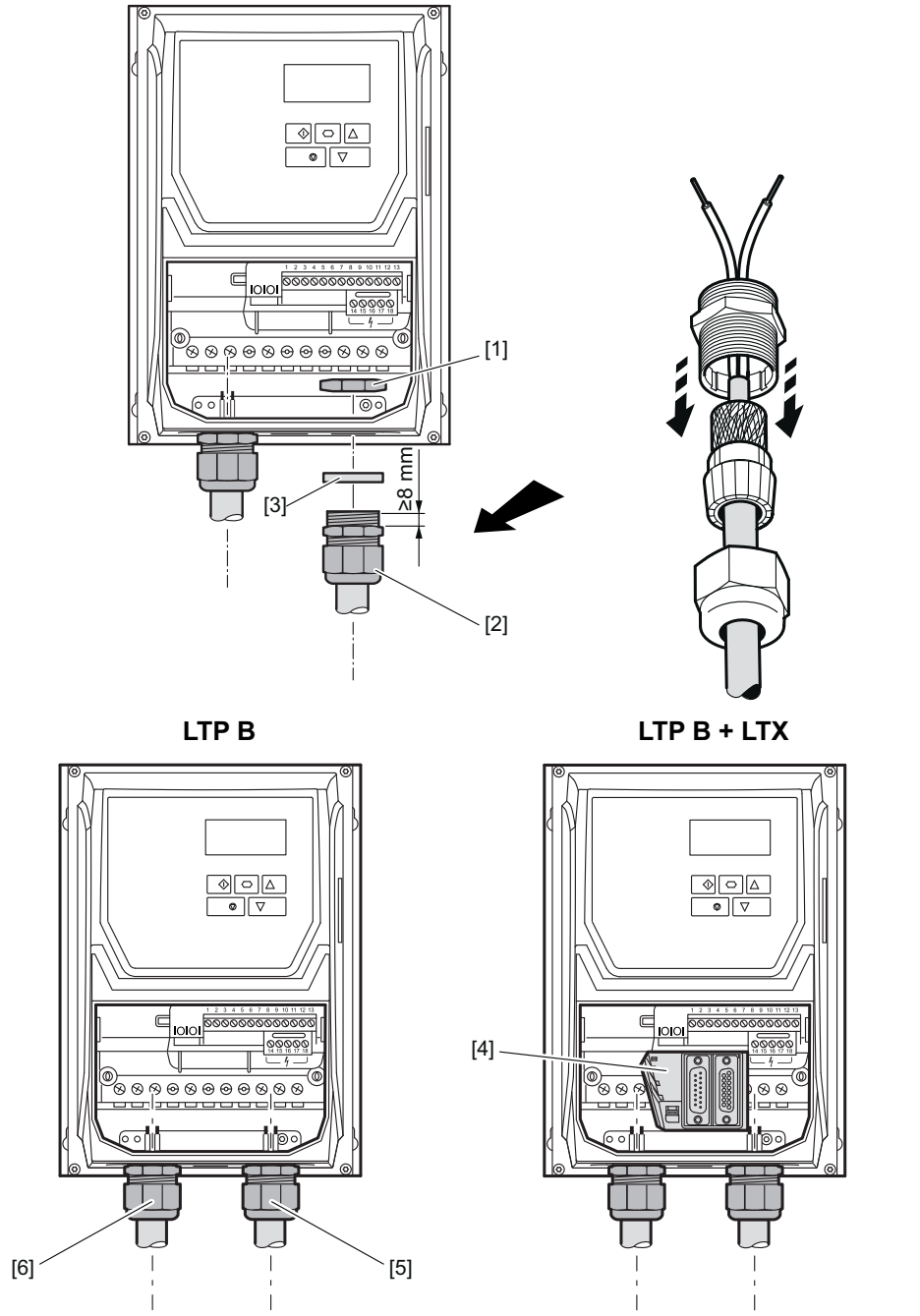

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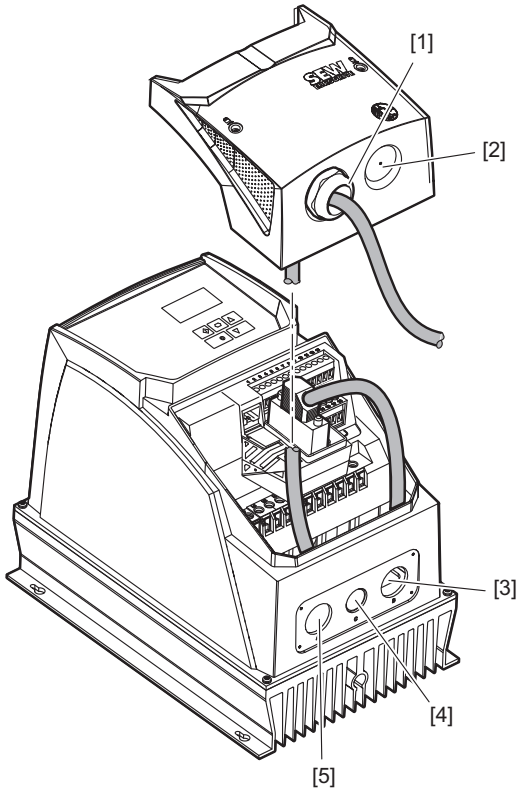
[1] Metal counter nut
[2] Metal cable gland
[3] Enclosed rubber gasket
[4] LTX module
[5] Motor cable
[6] Supply system cable

Recommendation for routing the encoder, control and communication cables



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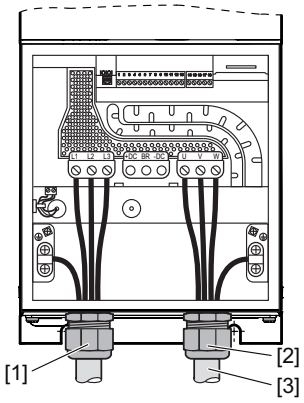
[1] Encoder cable, if LTX module
[2] Signal terminal/communication
[3] Motor cable
[4] Signal terminal/communication
[5] Supply system cable

Inverters with degree of protection IP55/NEMA 12K

The following inverters have the housing shown below:

Nominal line voltage	Power of the inverter
230 V	5.5 – 18.5 kW
400 V	11 – 37 kW
575 V	15 – 45 kW



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[1] Supply system cable
[2] Metal cable gland
[3] Motor cable

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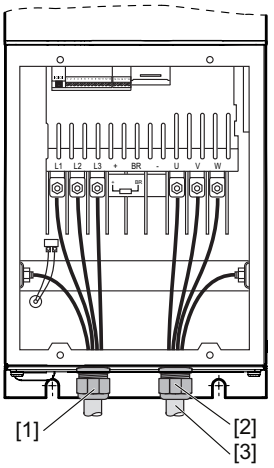
The following inverters have the housing shown below:

Nominal line voltage	Power of the inverter
230 V	22 – 75 kW
400 V	45 – 160 kW
575 V	55 – 110 kW



18243537675

[1] Supply system cable
[2] Metal cable gland
[3] Motor cable

4.4.14 Overview of signal terminals

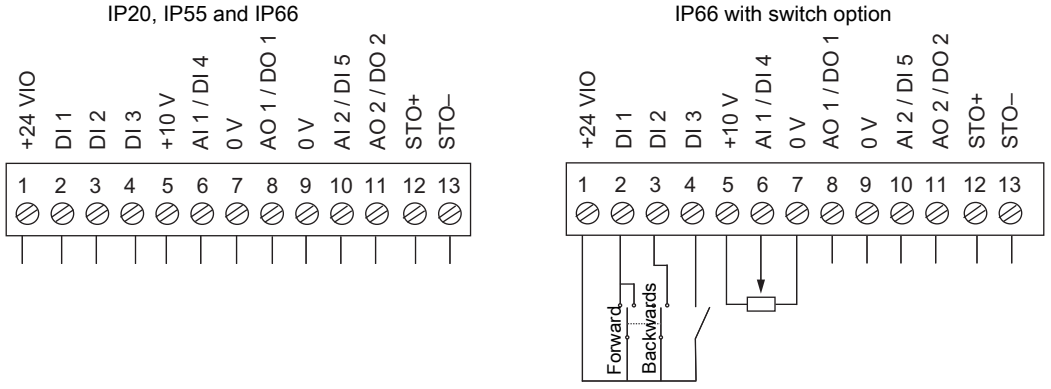
Main terminals

NOTICE

Applying voltages of more than 30 V to the signal terminals can damage the controller.

Possible damage to property.

- The voltage applied to the signal terminals must not exceed 30 V.



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INFORMATION

When the inputs of the inverter are supplied by an external 24 V voltage supply or PLC, the GND reference potential must be connected to terminals 7 and 9. The control electronics of the inverter operate isolated.

If the STO is driven by an external voltage supply, wire it according to the connection examples shown in chapter "Disconnection of a single drive" (→ 🗎 209)

The following switching thresholds apply to all digital and multi-functional inputs that are digitally operated:

Logic "1" input voltage range 8 – 30 V

Logic "0" input voltage range 0 – 2 V

The signal terminal block is equipped with the following connections:

Terminal no.	Signal	Port	Description
1	+24 VIO	+24 V: Reference voltage/ backup voltage	Reference voltage for controlling the digital inputs (max. 100 mA)[1)]
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 – 10 kΩ)
6	AI 1 / DI 4	Analog input 1 (12 bit) Digital input 4	analog: 0 – 10 V, 10 – 0 V, -10 – 10 V, 0 – 20 mA, 4 – 20 mA, 20 – 4 mA digital: 0/24 V
7	0 V	0 V: Reference potential	
8	AO 1 / DO 1	Analog output 1 (10 bit) Digital output 1	analog: 0 – 10 V, 10 – 0 V, 0 – 20 mA, 20 – 0 mA, 4 – 20 mA, 20 – 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 bit) Digital input 5 / thermistor contact	analog: 0 – 10 V, 10 – 0 V, PTC-th, 0 – 20 mA, 4 – 20 mA, 20 – 4 mA, KTY84, PT1000 digital: 0/24 V
11	AO 2 / DO 2	Analog output 2 (10 bit) Digital output 2	analog: 0 – 10 V, 10 – 0 V, 0 – 20 mA, 20 – 0 mA, 4 – 20 mA, 20 – 4 mA digital: 0 / 24 V, max.: 20 mA
12	STO+	Output stage enable	DC +24 V input, max. 100 mA current consumption STO safety contact, high = DC 18 – 30 V
13	STO-		GND reference potential for DC +24 V input STO safety contact

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

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The response time of the digital and analog inputs is less than 4 ms. The resolution of the analog inputs is 12 Bit at an accuracy of ±2% in reference to the set maximum scaling.

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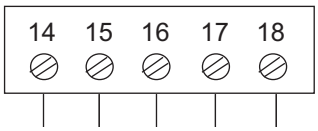
Relay terminals

NOTICE

Possible damage to property

Do not connect any inductive loads to the relay contact.



Terminal no.	Signal	Relay function selection	Description
14	Relay output 1 reference	*P2-15*	Relay contact (AC 250 V / DC 30 V, max. 5 A)
15	Relay output 1 NO contact		
16	Relay output 1 NC contact		
17	Relay output 2 reference	*P2-18*	
18	Relay output 2 NO contact		

4.4.15 Communication socket RJ45

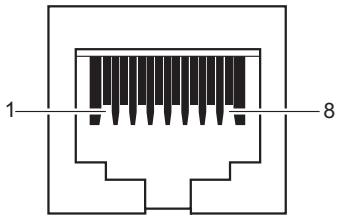
NOTICE

Voltage at socket not suitable for PCs.

Damage to PC when connected directly to RJ45 communication socket.

- Use the engineering adapters as described in chapter "Software LT Shell" (→ 🗎 55).

Socket at 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)

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4.4.16 24 V backup mode

24 V backup mode is not necessary for simple operation. Wiring is therefore not necessary. In order to ensure fieldbus communication via a fieldbus interface in the event of a power failure, back up the inverter externally with 24 V.

Requirements

Firmware version 1.20 (can be seen in P0-28).

Range of functions

- Parameter access (reading only, no writing)
- Fieldbus communication

Setting up 24 V backup mode

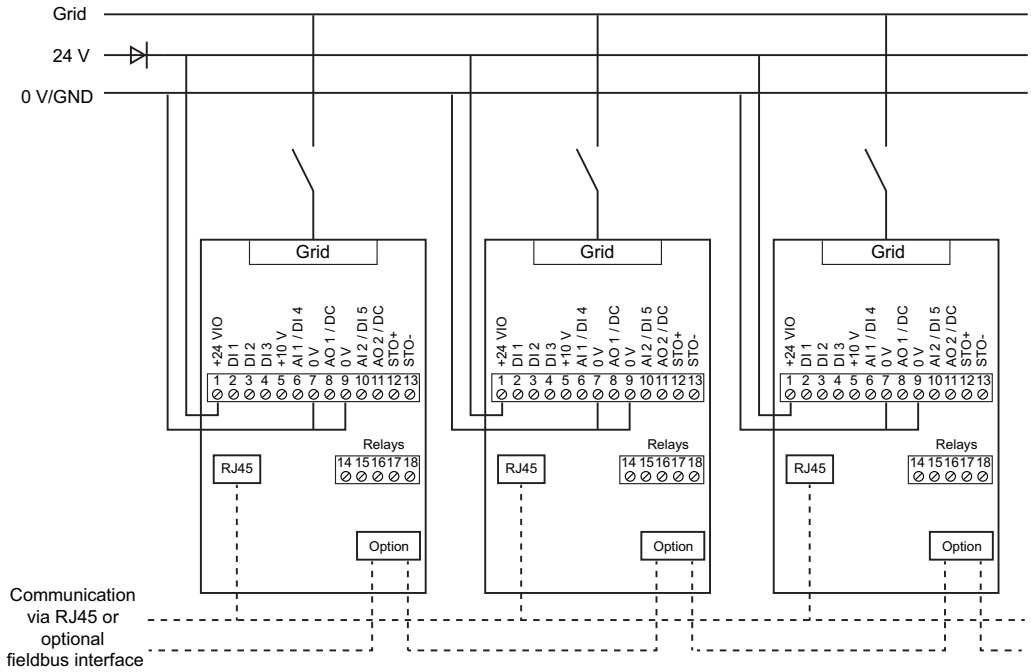
All inverters that are connected to each other in a communication network and use the 24 V backup mode have to be supplied simultaneously with external 24 V. Make sure that individual devices that are connected in the network are not separated from 24 V.

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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4.4.17 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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4.5 Wiring diagram

⚠ WARNING

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

Severe or fatal injuries.

- Adhere to the following.

In the following applications, always cut-off the brake in the AC and DC circuits:

- All lifting applications.
- 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.
  - 230 V: 0.75 – 4 kW
  - 400 V: 0.75 – 7.5 kW
  - 575 V: 0.75 – 11 kW

  The following inverters with degree of protection IP55/NEMA 12K are equipped with a metal entry board. The user has the possibility to drill the cable entries according to their requirements.
  - 230 V: 5.5 – 75 kW
  - 400 V: 11 – 160 kW
  - 575 V: 15 – 110 kW
- Connect the brake rectifier using a separate supply system cable.
- Supply via the motor voltage is not permitted!

INFORMATION

In case of a new device, the terminal slots DC-, + (DC+) and BR have a cover installed that can be broken out if required.

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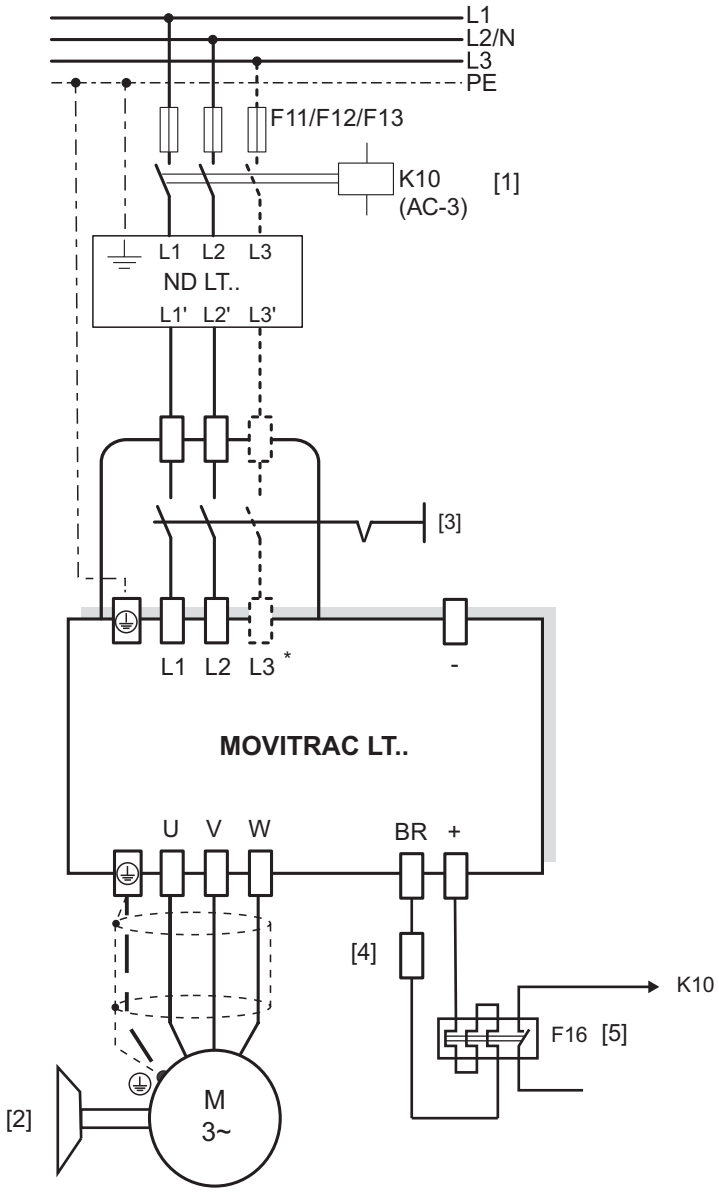

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[1] Line contactor between grid and inverter.
[2] Brake
[3] Main switch (only for unit design IP66/NEMA 4x housing with switch (MC LTP-B..-40))
[4] Connection of BW../BW..T braking resistor
[5] Bimetallic relay for protection of the braking resistor

* not with 1-phase 230 V

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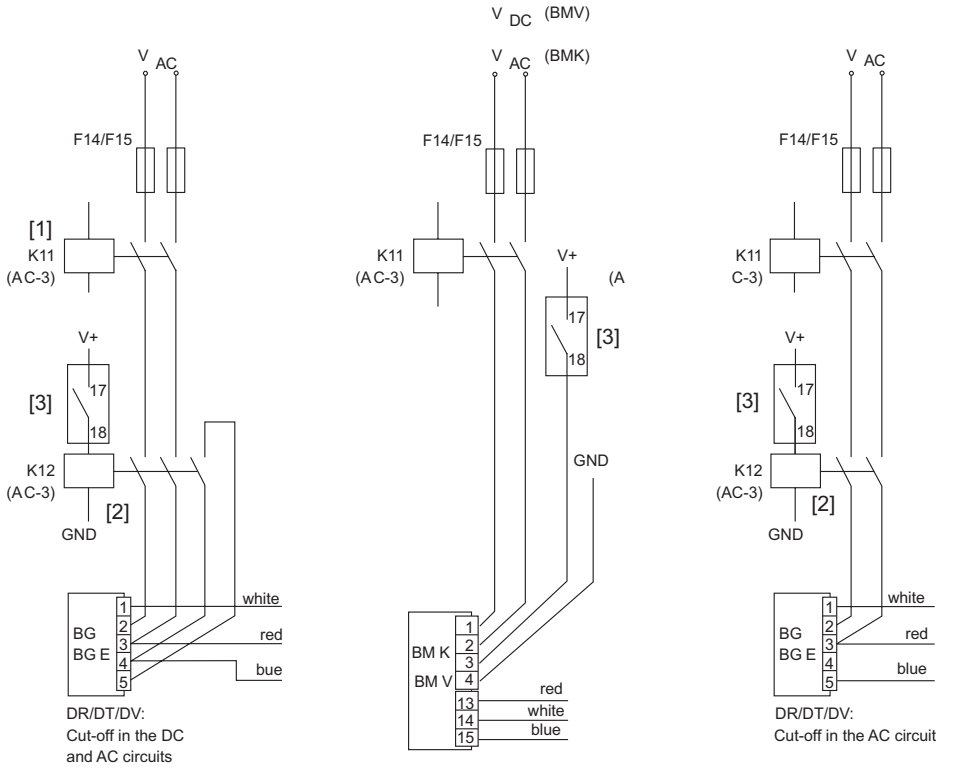
4.5.1 Brake control



18475023883

[1] Power supply of the brake rectifier, switched simultaneously via K10.

[2] Control contactor/control relay, is powered by 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 Startup

5.1 User interface

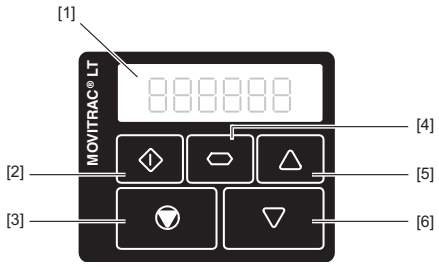
5.1.1 Keypads

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.

Standard keypad



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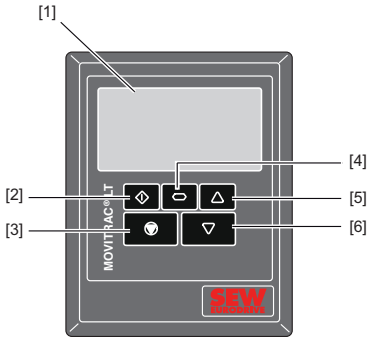
[1]	6-digit 7-segment display	[4]	Navigate button
[2]	Start button	[5]	Up button
[3]	Stop/Reset button	[6]	Down button

Keypad with full text display



18364520203

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

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Operation

Both keypads have 5 keys with the following functions:

Key 	Start [2]	• Enable drive • Changing the direction of rotation
Key 	Stop [3]	• Stop drive • Acknowledge error
Key 	Navigate [4]	• Switch 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 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.

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.

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5.1.2 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.

5.1.3 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".

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5.1.4 Software LT Shell

The LT Shell software enables an easy and quick startup of the inverters. It is available for download on the SEW-EURODRIVE website. After the installation, perform software updates on a regular basis.

In combination with the engineering package (cable set C) and the USB11A interface adapter, the inverter can be connected to the software.

Maximum 63 inverters can be connected to an LT Shell in a network.

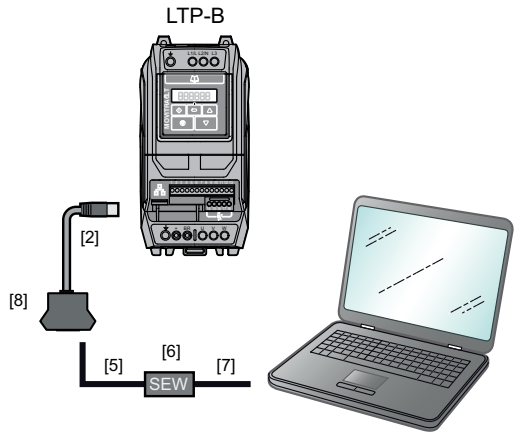
The software can be used to carry out the following tasks:

- Observe, upload and download parameters.
- Save parameter settings.
- 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.

Connection to LT Shell

The connection is performed via an RS485 interface (USB11A + PC engineering package) or via Bluetooth® (parameter module).

RS485



9288836235

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

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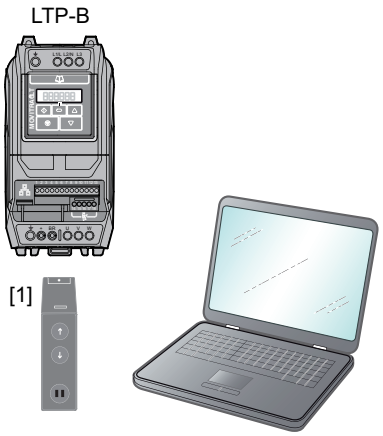
Bluetooth®



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[1] Parameter module

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5.1.5 MOVITOOLS® MotionStudio engineering software

The software can be connected to the inverter as follows:

- Via an SBus-connection between PC and inverter. A CAN dongle is required. A prefabricated cable is not available and must be manufactured according to the RJ45 assignment and the inverter interface.
- Via a connection of the PC with a gateway or a MOVI-PLC®. The connection between PC and gateway/MOVI-PLC® is possible via USB11A, USB or Ethernet.

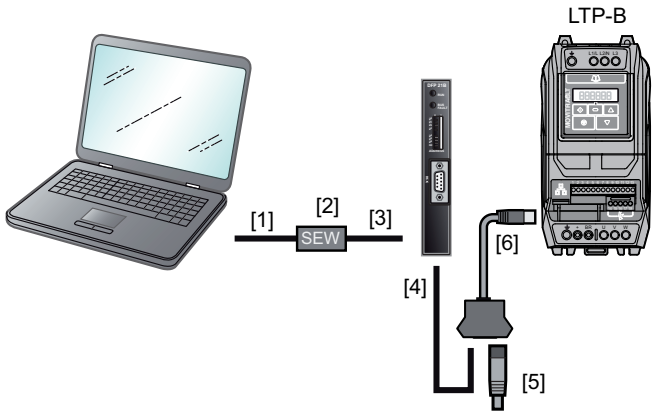
The following functions are available in MOVITOOLS® MotionStudio:

- Observe, upload and download parameter
- Save parameter settings
- Monitor the state of the inputs/outputs and the motor.

Connection to MOVITOOLS® MotionStudio

The connection can be set up indirectly via SEW-EURODRIVE gateway or SEW-EURODRIVE controller.

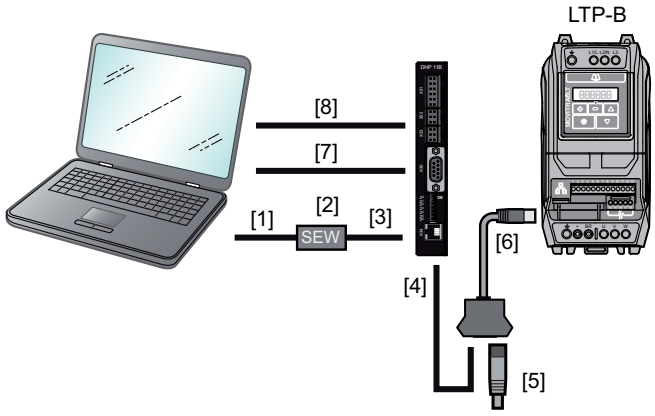
Gateway



17186235147

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

Controller



17186293003

[1]	Cable USB A-B	[5]	Terminating connector (120 Ω)

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[2] USB11A
[3] RJ10 to RJ10 cable
[4] RJ45 cable with open end
[6] Cable splitter
[7] Cable USB A-B
[8] RJ45 Ethernet cable

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5.2 Automatic measuring procedure "Auto tune"

With the automatic measuring procedure, the inverter can measure almost any motor to determine the motor data.

- After a reset to the factory settings, the measuring procedure starts automatically after the first enable and takes up to 2 minutes depending on the control type. Do not interrupt the measuring procedure.
- You can also start the automatic measuring procedure "Auto tune" manually with the parameter *P4-02* after entering the motor data. Only enable the inverter after you have entered all motor data correctly in the parameters.
- For STO, the terminals 12 and 13 have to be supplied with voltage. Enable is not required. "Stop" has to be displayed.

INFORMATION

Perform an automatic measuring procedure "Auto tune" after the initial startup or after changing the control mode in *P4-01* when the motor is cold. You can also start auto-tuning manually via the parameter *P4-02* at any time.

5.3 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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5.3.1 Startup with asynchronous motors with V/f 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
     - Value = 0: Slip compensation deactivated
     - Value ≠ 0: Slip compensation activated
   - *P1-14* = 201 (Extended parameter menu)
   - *P4-01* = 2 (V/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 automatic motor measurement procedure "Auto Tune" as described in chapter "Auto Tune" (→ 🗎 59).

5.3.2 Startup with asynchronous motors with VFC speed control

1. Connect the motor to the inverter. During the connection, adhere to 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* = 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 automatic motor measurement procedure "Auto Tune" as described in chapter "Auto Tune" (→ 🗎 59).
6. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

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5.3.3 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 automatic motor measurement procedure "Auto Tune" as described in chapter "Auto Tune" (→ 🗎 59).
6. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

Example

The following example shows analog input 2 as torque reference source, analog input 1 sets the speed:

- *P1-15* = 3 (Input terminal assignment)
- *P4-06* = 2 (Torque reference via analog input 2)
- *P6-17* = 0 (Switching off the torque timeout threshold)
  = >0 (Adjusting the timeout time for the maximum torque limit)

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5.3.4 Starting with synchronous motors without encoder feedback (PMVC control)

The synchronous motors are permanent magnet motors.

INFORMATION

The operation of synchronous motors without encoder must be checked in a test application. Stable operation in this operating mode cannot be ensured for all application cases. Using this operating mode is thus in the sole responsibility of the user.

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* = Internal voltage at nominal 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 8−16 kHz).
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 automatic motor measurement procedure "Auto Tune" as described in chapter "Auto Tune" (→ 🗎 59).
6. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

In case of unexpected motor control mode problems, check or set the following:

- To achieve a higher torque in the lower speed range, both parameters *P7-14* and *P7-15* must be increased. Note that the motor may heat up significantly due to the increased current flow.
- Sometimes, it may be required to align the rotor of motors with higher inertia before the start. To that end, the premagnetization time *P7-12* as well as the field strength during the premagnetization time can be adjusted slightly up or down in *P7-14*.

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.

No repeated measuring procedure is required:

- *P7-01* = Stator resistance of the motor ($R_{Phase-Phase}$ or $2 \times R_{1\ (20\ °C)}$)
- *P7-02* = 0 (Rotor resistance of the motor)
- *P7-03* = Stator inductance (Lsd)
- *P7-06* = Stator inductance (Lsq).

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5.3.5 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, adhere to the nominal motor voltage.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = Internal voltage at nominal 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* to 300 1/min.
4. Set the acceleration and deceleration ramps using *P1-03* and *P1-04*.
5. Start the automatic motor measurement procedure "Auto Tune" as described in chapter "Auto Tune" (→ 🗎 59).
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*.

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5.3.6 Startup with synchronous reluctance motors (SYN-R 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* = 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 automatic motor measurement procedure "Auto Tune" as described in chapter "Auto Tune" (→ 🗎 59).
6. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

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5.3.7 Startup with brushless DC motors (BLDC 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* = Internal voltage at nominal 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 automatic motor measurement procedure "Auto Tune" as described in chapter "Auto Tune" (→ 🗎 59).
6. In case of insufficient control performance, the control behavior can be optimized via the parameter *P7-10*.

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5.3.8 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[1)]	gF-2c
MGF..4-DSM-C[1)]	gF-4c
MGF..4-DSM-C/XT[1)]	gF4cHt

1) In preparation

Sequence

- 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)" (→ 🗎 131)

Example

Example: 50S 4b		
CMP.. size	50S	40M, 50S, 50M, 50L, 63S, 63M, 63L, 71S, 71M, 71L
Motor system voltage	4	• 2 = 230 V • 4 = 400 V
Brake motors	b	b = flashes for brake motors

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

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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 "Motor temperature protection TF, TH, KTY84, PT1000" (→ 🗎 32).

- A detailed list can be found in chapter "Parameter group 1: Servo-specific parameters (level 1)" (→ 🗎 131).

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5.4 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.

5.4.1 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" (→ 🗎 126).
- Connect a switch between terminals 1 and 2 on the user terminal block.
- Connect a potentiometer (5 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" (→ 🗎 209).
- Enable the inverter by establishing a connection between terminals 1 and 2.
- Set the speed using the potentiometer.

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

For operation in keypad mode:

- Set *P1-12* to "1" (uni-directional) or "2" (bi-directional).
- Connect a jumper or switch between terminals 1 and 2 on the terminal block to enable the inverter.
- Connect the terminals 12 and 13 of the STO input according to chapter "Disconnection of a single drive" (→ 🗎 209).
- Press the <Start> key. The inverter is enabled with 0.0 Hz.
- To increase the speed, press the <Up> key. To decrease the speed, press the <Down> key.
- To stop the inverter, press the <Stop/reset> key.
- To resume to the original speed, press the "Start" key again. If bi-directional mode is enabled (*P1-12* = 2), the direction is reversed by pressing the <Start> key again.

INFORMATION

You can preset the required target speed by pressing the <Stop/reset> key at standstill. Pressing the <Start> key then moves the drive along the preset ramp until it has reached the required speed.

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

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

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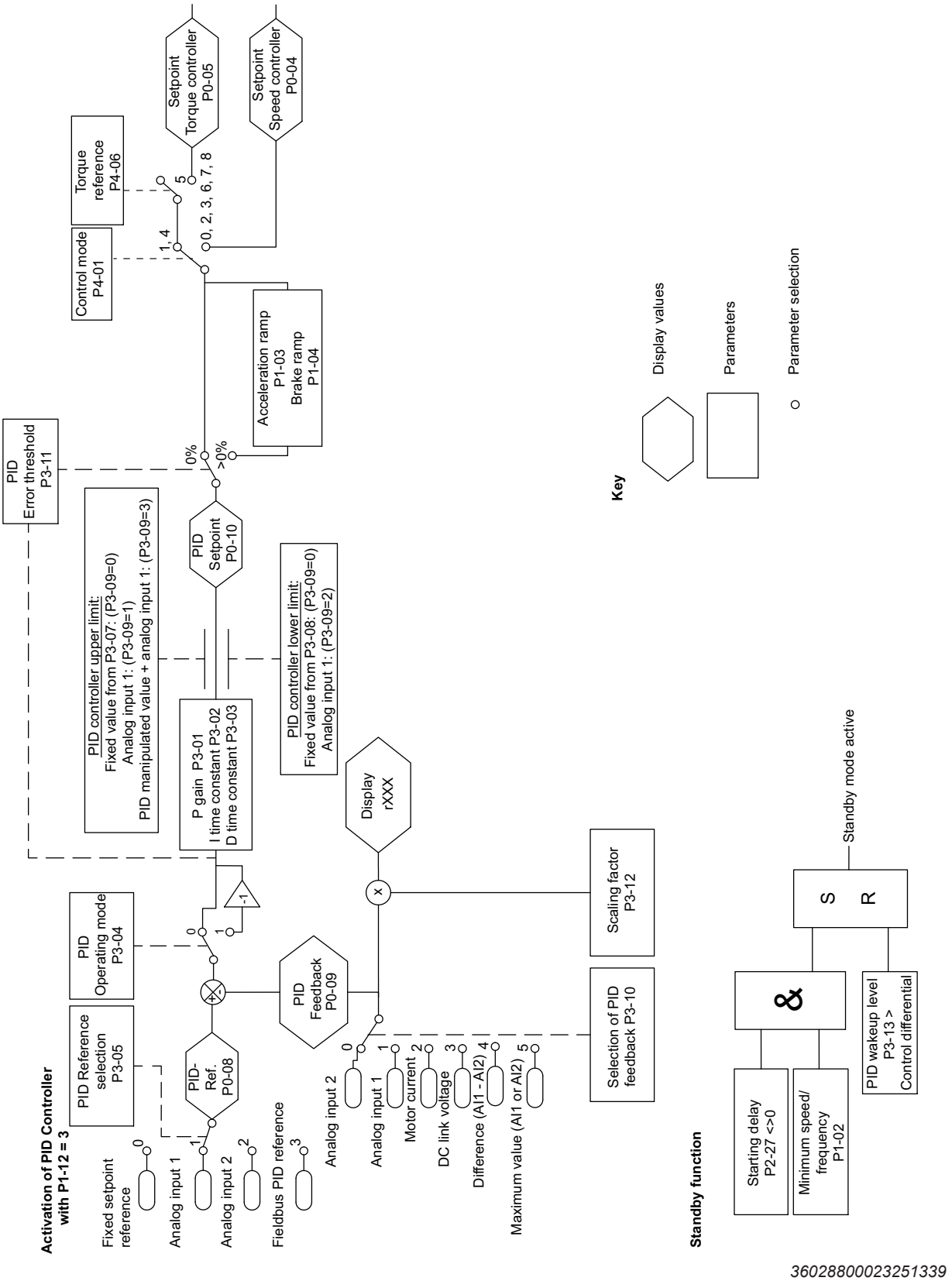
The following figure shows the configuration options for the PID controller.



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General information on the use

Connect the sensor for the controlled variable to analog input 1 or 2 depending on *P3-10*. You can scale the sensor value using parameter *P3-12* in such a way that the value is indicated on the inverter display with the proper quantity, for example 0 – 10 bar.

You can set the target reference for the PID controller 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 – 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 another value 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*

Fieldbus PID reference

The following parameters must be set in the inverter:

- *P1-12* = 5 (e.g. control signal source SBus)
- *P1-14* = 201 (extended parameter menu)
- *P1-15* = 0 (free function selection of the digital inputs)
- *P3-05* = 3 (PID reference via the fieldbus)
- *P5-09 – 11* = 4 (selection of the process output data word for the PID reference)
- *P9-01* = Selection of the digital input for enabling the inverter
- *P9-10* = PID (speed source of the inverter)

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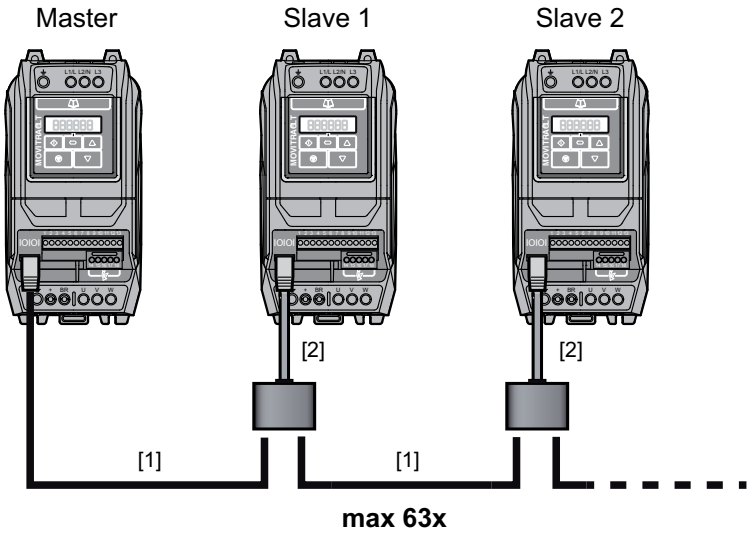
5.4.4 Master-slave mode (*P1-12* = 4)



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

The inverter has an integrated master-slave function.

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 frequency 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.

Configuration for speed synchronism

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

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Parameter description	Master settings	Slave settings
P2-28 (speed scaling)	–	User-defined
P2-29 (Scaling factor)	–	User-defined

Configuration for load distribution

Load distribution is supported only with the following operating modes/motor controls:

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

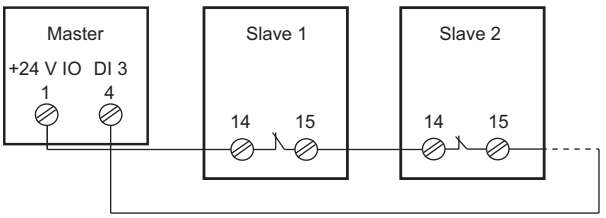
Parameter description	Master settings	Slave settings
P1-03 Acceleration ramp	User-defined	0.1 sec.[1)]
P1-04 Deceleration ramp		
P1-12 (Control signal source)	0, 1, 2, 3, 5, 6, 7, 8	4
P1-14 (Extended parameter menu)	201	201
P4-06 (Torque reference/limit value source)	0, 1, 2, 3, 5	4
P4-19 (Master-slave torque reference)	1	0
P5-01 (Inverter address communication)	1	2 – 63

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

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 error input". They must be connected as follows:

In the following example, DI3 is used with the function selection *P1-15* = 6, 7, 16 or 17.



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

See chapter "Fieldbus mode" (→ 🗎 95).

5.4.6 MultiMotion mode (P1-12 = 8)

See "Addendum to the MOVITRAC® LTX operating instructions".

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5.5 Hoist function

The inverter is equipped with a hoist function. When the hoist function is active, all relevant parameters and functions are activated and locked, if necessary. For proper functioning, a correct motor startup has to be performed as described in chapter "Startup for hoist function" (→ 🗎 75).

Also observe the following points in particular:

- The motor brake control has to performed by the inverter. Connect a brake rectifier between inverter relay 2 (terminal 17 and 18) and brake, see chapter "Electrical installation" (→ 🗎 24).
- Use a sufficiently dimensioned braking resistor.
- SEW-EURODRIVE recommends not to run the motor in very low speed ranges or to keep the load at zero speed without application of the brake.
- If you need sufficient torque, operate the motor within its nominal range.

To ensure safe operation when the hoist function is active, the following parameters are preset or ignored by the firmware in case of changes:

- *P1-06*: Energy-saving function is deactivated.
- *P2-09/P2-10*: Skip frequencies are ignored.
- *P2-26*: The flying start function is deactivated.
- *P2-27*: The standby mode is deactivated.
- *P2-36*: The start mode is edge-triggered (Edgr-r).
- *P2-38*: Voltage failure results in coast to a stop.
- *P4-06/P4-07*: Maximum torque limits are set to the maximum values.
- *P4-08*: Minimum torque limits are set to "0".
- *P4-09*: The upper limit for the regenerative torque is set to the maximum permitted value.

The following hoist parameters are already preset for motors of the same performance class. However, they can be changed at any time to optimize the system:

- *P2-07*: Fixed setpoint speed 7 is the brake release speed (≥ slip speed of the motor).
- *P2-08*: Fixed setpoint speed 8 is the brake application speed (≥ slip speed of the motor).
- *P2-23*: Zero speed holding time.
- *P4-13*: Release time of the motor brake.
- *P4-14*: Application time of the motor brake.
- *P4-15*: Torque threshold for the brake release.
- *P4-16*: Torque threshold timeout.

The following parameters are locked:

- *P2-18*: Relay contact 2 for controlling the brake rectifier.

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5.5.1 General information

- Clockwise rotating field of the motor corresponds to upward direction.
- Counterclockwise rotating field of the motor corresponds to downward direction.
- Stop the motor to reverse the direction of rotation. To do so, activate the brake. Set the controller inhibit before you reverse the direction of rotation.

5.5.2 Startup for hoist function

Refer to the following section for recommendations for the startup.

Motor data:

- *P1-03/04*: Ramp time as short as possible
- *P1-07*: Nominal motor voltage
- *P1-08*: Nominal motor current
- *P1-09*: Rated motor frequency
- *P1-10*: Nominal motor speed

Parameter activation:

- *P1-14* = 201 (extended parameter menu)

Motor control:

- *P4-01* = 0 (VFC speed control)
- *P4-05* = Cos φ

In VFC operation, the automatic measuring procedure has to be performed. To do so, the motor has to be as cold as possible.

Hoist parameter:

P4-12 = 1 (hoist function activated)

Thermal braking resistor protection:

If no sensor is used for protecting the braking resistor, the following parameters can be used 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 power

INFORMATION

When hoist mode is activated, the inverter has to be started with the enable. If the enable is set at the same time or prior to STO, the inverter stays in "STOP" mode.

To ensure fault-free operation, a braking resistor has to be installed.

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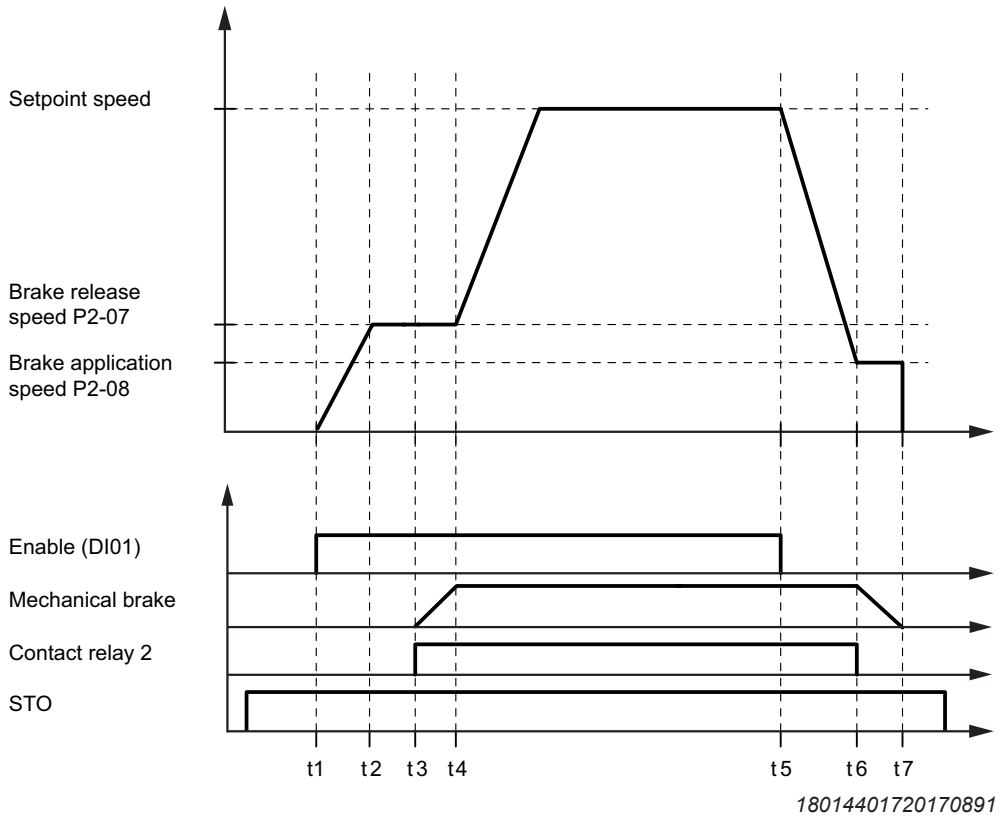
5.5.3 Hoisting mode

The following diagram shows hoisting 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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5.5.4 Troubleshooting and optimizing the hoist function

SP-Err / ENC02:

Increase the speed error window in *P6-07* if this error message appears.

In case of problems such as sagging of the hoist, check the following parameters and/or adapt:

P1-03/04	=	Reduce ramp times, pass through slow speed ranges as quickly as possible.
P7-10	=	Adjustment of the stiffness, higher values increase the stiffness of the application.
P4-15	=	Increase torque threshold to brake release.
P7-14/15	=	In case of sagging of the hoist, it is recommended to increase the boost parameters.
P7-07	=	Set this parameter to 1.

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5.6 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 errors and ignores all setpoints, control signal sources and shutdowns (e.g.: External error 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.

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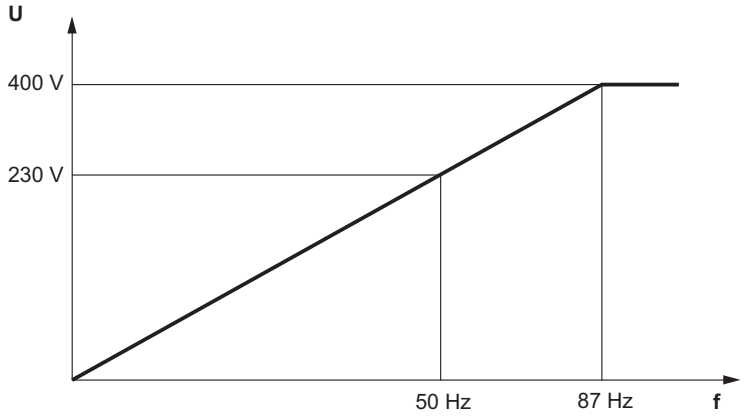
5.7 Operation at the 87 Hz characteristic (50 Hz motors)

The V/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).
- 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)".
- Set the cos phi in *P4-05*

Example for 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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5.8 Examples of analog input scaling and offset setting

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

Inverter setting:

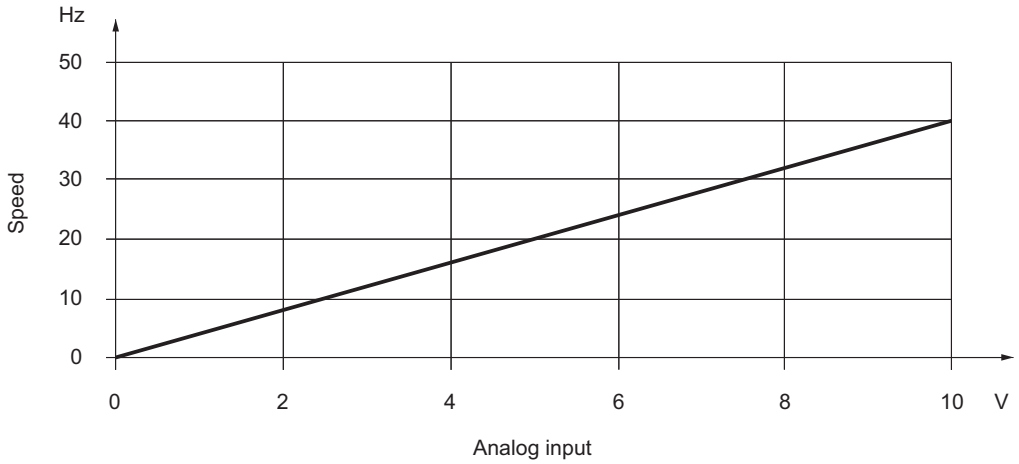
P1-01 = 50 Hz

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

13624278667

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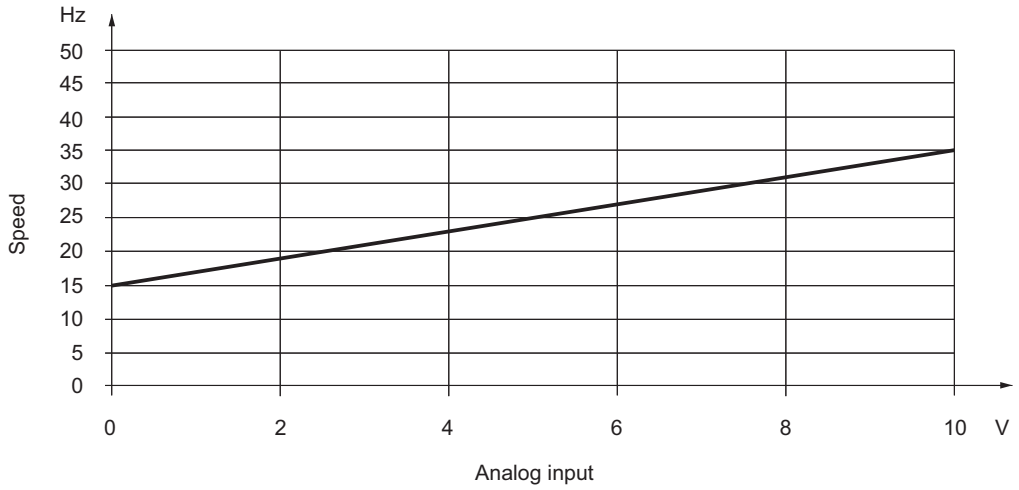
5.8.2 Example 2: Analog input offset

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%



13627144971

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

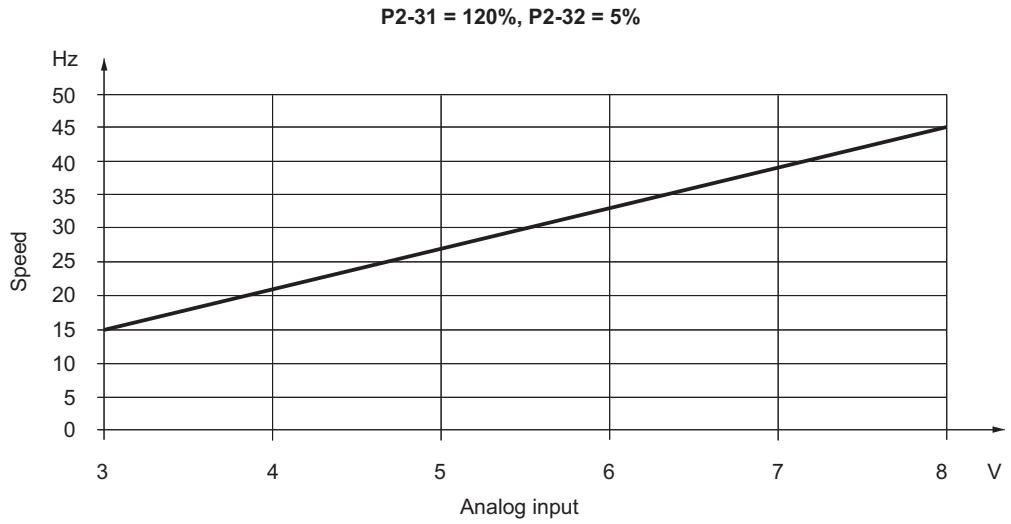
13624281611

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

13624284555

5.8.3 Example 3: Analog input scaling and offset

Control 15 - 45 Hz with analog input 3 - 8 V:



18364553227

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

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

$$P2-31 = 120\%$$

18364558219

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

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

$$P2-32 = 5\%$$

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5.9 Fans and pumps

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

- Voltage increase/boost (*P1-11*)
- Adjustment of the V/f characteristic curve (*P4-10, P4-11*)
- Energy-saving function (*P1-06*)
- Flying start function (*P2-26*)
- 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)" (→ 🗎 143)
- Fire mode/emergency mode, see "Fire mode/emergency mode" (→ 🗎 78)
- Deactivating slip compensation via rated motor speed (*P1-10*)

5.10 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" (→ 🗎 126).

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

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

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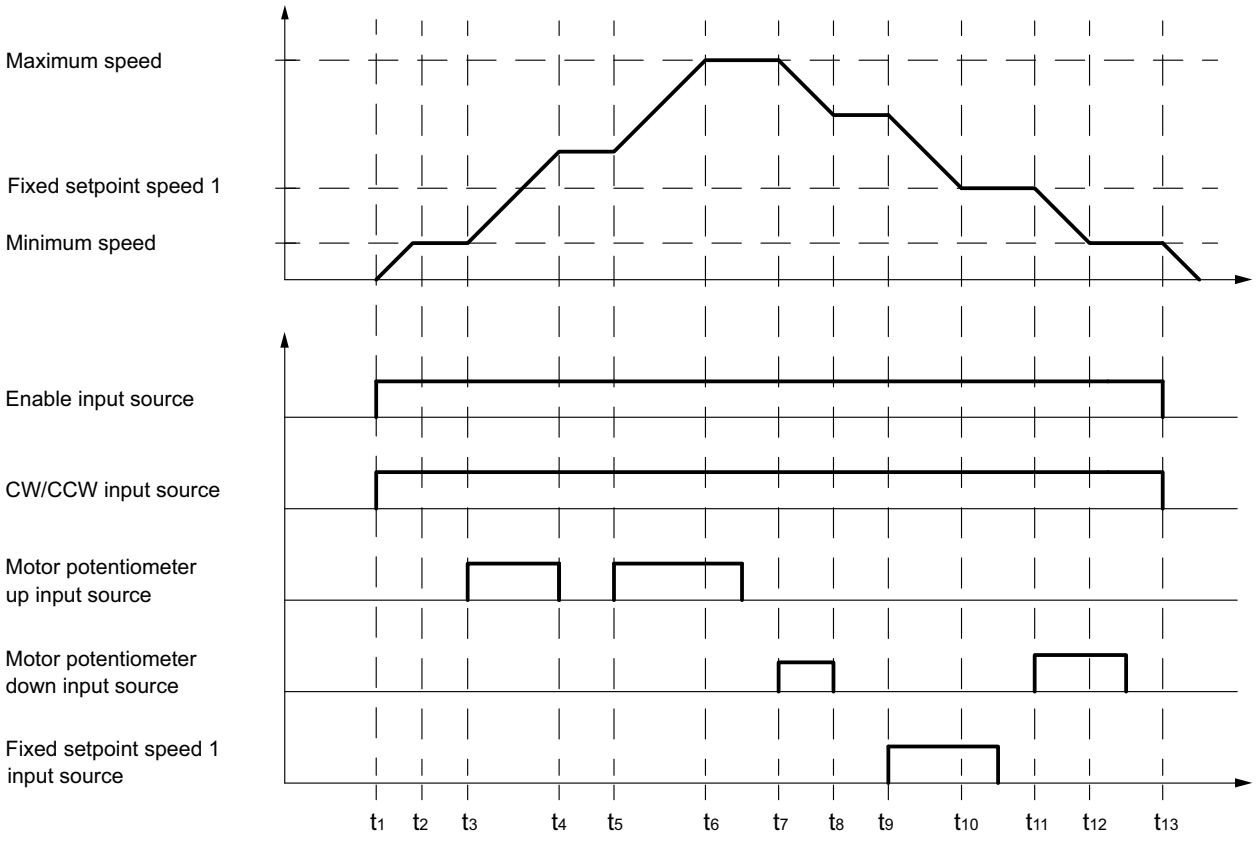
The following figure shows the basic function of the motor potentiometer.



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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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5.11 3-wire control

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

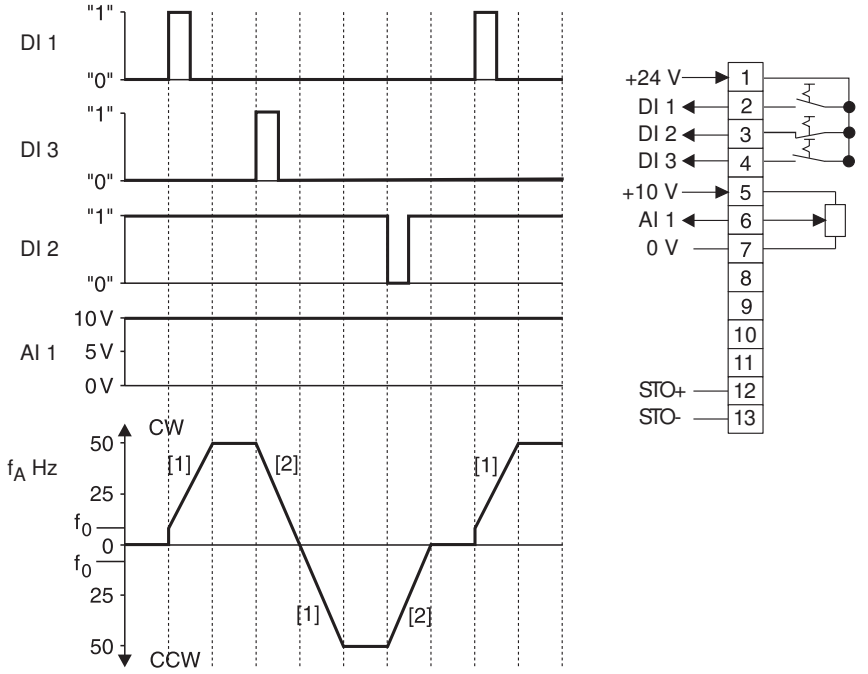
The 3-wire control principle determines the control.

The enable and direction of rotation signals of the inverter then react edge controlled.

- Connect start key <CW> with NO contact to digital input DI1.
- Connect start key <CCW> with NO contact to digital input DI3.
- Connect 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*.

5.11.1 Control signal source 3-wire control



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

6 Operation

6.1 Inverter status

6.1.1 Static inverter status

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

Message	Description
StoP	Power stage of inverter deactivated. This message is displayed when the motor is at an idle state 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 locked.
ETL 24	External 24 V voltage supply is connected. The functions are limited, see also chapter "24 V backup mode" (→ 🗎 47).

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6.1.2 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. Make sure that: • The parameter lock in *P2-39* is not activated. • The inverter is not enabled. • The inverter is supplied with line voltage.
xxxx	xxx min^{-1}	Output speed of the inverter (in min^{-1}) This display appears when the inverter is enabled and a value > 0 has been entered in parameter *P1-10*.
C xxx	Scaled value	This is the scaled value, depending on (*P2-21/P2-22*).
Auto-t	Auto-tuning	An automatic measurement of the motor parameters is being performed. This process can take up to 2 minutes.
. . . . . . (Flashing dots)	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)	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; see also error description O-I (→ 🗎 90)
	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 successful reference travel, "Stop" appears on the display.

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6.1.3 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.

6.1.4 Fault reset

In the event of an error response, see section Error codes, the error can be reset by pressing the <Stop> key or by opening or closing digital input 1.

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6.2 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. Make sure that the mechanical brake is released (if installed).
No enable for the inverter – display shows "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 might not start at ambient temperatures below –10 °C Under such conditions, provide an on-site heat source that keeps the ambient temperature above -10 °C.
No access to extended 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*.

6.3 Error history

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

- **INFORMATION**

  If the last error in the error history is an undervoltage fault, no further undervoltage faults will be saved in the error history. This is to prevent the error history from being filled with undervoltage faults, which occur every time the inverter is switched off.

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6.4 Error list

Code (inverter display)	Code (MotionStudio in P0-13)	Fault code status word if Bit5 = 1	CANopen Emergency Code	Meaning	Measure
4-20 F	18	0x71	0x1012	Signal loss 4 – 20 mA (> 500 ms)	• Check whether the input current lies 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 asymmetrical. Check to see, if: • The motor is connected correctly and without error. • 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, if: • The motor is connected correctly and without error. • The power rating of the motor corresponds 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. Make sure that the motor is connected correctly and without error.
AtF-04	43	0x51	0x102B	Measured motor inductance is too high.	The measured motor inductance is too high. Check to see, if: • The motor is connected correctly and without error. • The power rating of the motor corresponds 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, if: • The motor is connected correctly and without error. • The power rating of the motor corresponds with the power rating of the connected inverter.
dAtA-E	19	0x62	0x1013	Internal memory error (DSP)	Contact the SEW-EURODRIVE Service.
dAtA-F	17	0x62	0x1011	Internal memory error (IO)	Contact the SEW-EURODRIVE Service.
E-triP	11	0x1A	0x100B	External fault at digital input 5.	NC contact was opened. • Check 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 error (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 parameterization.	Check the parameter settings in *P6-06* and *P1-10*.
Enc-04	33	0x0E	0x1021	Encoder channel A fault	The A track of the encoder feedback is not present. Check the wiring.
Enc-05	34	0x0E	0x1022	Encoder channel B error	The B track of the encoder feedback is not present. Check the wiring.
Enc-06	35	0x0E	0x1023	Encoder channel A or B error	The A and B track of the encoder feedback are not present. Check the wiring.
Enc-07	36	0x0E	0x1024	RS485 data channel fault, HIPERFACE® data channel fault	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)	Fault 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, if: • 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 the SEW-EURODRIVE Service.
Err-SC				The keypad lost the communication connection to the inverter.	
Etl-24				External 24 V supply.	Line voltage supply not connected. The inverter is externally supplied with 24 V.
FAULtY				The communication between controller and power section is interrupted	Contact the 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 the SEW-EURODRIVE Service.
FLt-dc	13	0x07	0x320D	DC link ripple too high.	Check the current supply
Ho-trP	27	0x27	0x101B	Error during reference travel.	• Check reference cams • Check limit switch connection • Check reference travel type setting and the parameters required for it
Inhibit				STO safety circuit open.	Check to see if the terminals 12 and 13 are connected correctly.
Lag-Er	28	0x2A	0x101C	Lag error	Check: • The encoder connection • The wiring of encoder, motor and line phases • If the mechanical components can move freely and are 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 Derating and can no longer provide the current for acceleration/constant travel.
I.t-trp	04	0x08	0x1004	Overload of inverter/motor (I2t fault)	Make sure that: • The motor nameplate parameters are correctly entered 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 Tune has correctly been performed. Check to see, if: • The decimals flash (inverter overloaded), increase the acceleration ramp (*P1-03*) or decrease the motor load. • The length of the cable meets the requirements. • The load can move freely and there are no blockages or other mechanical failures (mechanically check the load). • The thermal motor protection to UL508C is activated in P4-17.
ML				Phase failure	Input phase missing or voltage is outside the specified range

Code (inverter display)	Code (MotionStudio in P0-13)	Fault code status word if Bit5 = 1	CANopen Emergency Code	Meaning	Measure
O-I	03	0x01	0x2303	Short-term overcurrent at the inverter output. High motor overload.	**Fault during stop procedure:** Check for premature brake application. **Fault when enabling the inverter:** Check to see, if: • The motor nameplate parameters are correctly entered 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 Tune has correctly been performed. • The load can move freely and there are no blockages or other mechanical failures (mechanically check the load). • 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 releases when the motor has a holding brake. **Fault during operation:** Check: • For sudden overload or malfunction. • The cable connection between inverter and motor. The acceleration/deceleration time is too short and requires too much power. If you cannot increase *P1-03* or *P1-04*, use a larger inverter. **Measures:** Reduce the settings of the voltage gain 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 occurs again, check the entire system and completely replace the inverter. **Fault reset delay** If the fault occurs again directly after the O-I or hO-I fault messages are reset, the following delay times result for repeated resetting: • First reset after 2 seconds • Second reset after 4 seconds • Third reset after 8 seconds • Fourth reset after 16 seconds • Fifth reset after 32 seconds • Further resets after 64 seconds
hO-I	15	0x01	0x230F	Hardware overcurrent fault 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				Overloads	The output current is higher than the nominal motor current
O-t	8	0x0B		Heat sink overtemperature	The heat sink temperature can be displayed in *P0-21*. A historical protocol is saved in parameter *P0-38* in 30-sec. intervals prior to a switch off with error. This fault message is displayed at a heat sink temperature of ≥90 °C. Check: • 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.
O-torq	24	0x34	0x1018	Maximum torque limit 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.

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Code (inverter display)	Code (MotionStudio in P0-13)	Fault code status word if Bit5 = 1	CANopen Emergency Code	Meaning	Measure
O-Volt	06	0x07	0x3206	DC link overvoltage	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. Note: The value of the DC bus voltage can be displayed on *P0-20*. A historical protocol is saved in parameter *P0-36* in 256 ms intervals prior to a switch off with error.
OI-b	01	0x04	0x2301	Brake channel overcurrent, 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.
OL-br	02	0x04	0x1002	Braking resistor overload	The software detected an overload at the braking resistor and switches off to protect the resistor. Make sure that the braking resistor is operated within the planned parameters before performing any changes to parameters or system. To reduce the load at the resistor, increase the deceleration time, reduce the load's mass moment of inertia, or connect additional braking resistors in parallel. Note the minimum resistor values for the used inverter.
OF-01	60	0x1C	0x103C	Internal connection to option module error.	Contact the SEW-EURODRIVE Service.
OF-02	61	0x1C	0x103D	Option module fault	Contact the 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. Contact the SEW-EURODRIVE Service.
P-LOSS	14	0x06	0x310E	Input 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 are restored.	
Ph-Ib				Unequal voltage at the input phases	• Check the device input voltage. • Check the values in *P0-22, P0-23, P0-24*. The values may deviate maximum ±10 %. Use an input choke if required.
PS-trP	05	0xC8	0x1005	Output stage fault (IGBT self-protection in case of overload)	See fault **O-I**.
SC-0b5	12	1D		Connection between inverter and keypad interrupted.	Check if there is a connection between the inverter and keypad.
SC-F03	52	0x29	0x1034	Fieldbus module communication error (fieldbus side)	Contact the SEW-EURODRIVE Service.
SC-F04	53	0x29	0x1035	Communication error IO option card	Contact the SEW-EURODRIVE Service.
SC-F05	54	0x29	0x1036	LTX module communication error	Contact the SEW-EURODRIVE Service.
SC-F01	50	0x2B	0x1032	Modbus communication error	Check the communication settings.

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Code (inverter display)	Code (MotionStudio in P0-13)	Fault code status word if Bit5 = 1	CANopen Emergency Code	Meaning	Measure
SC-F02	51	0x2F	0x1033	SBus/CANopen communication error	Check: • The communication connection between inverter and external devices. • The clearly assigned address per inverter in the network.
SC-LoS				The communication between controller and power section is interrupted	Contact the SEW-EURODRIVE Service.
SC-OBS				The keypad lost the communication connection to the inverter.	Press the <Stop> key to reset. Check the address of the inverter.
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. Make sure that the enable is switched on after the STO for the hoist function.
th-Flt	16	0x1F	0x1010	Faulty thermistor at heat sink.	Contact the SEW-EURODRIVE Service.
type-f				Parameter module and inverter are not compatible.	The used parameter module is not of type LT BP C
U-dEF				User settings loaded.	The parameter set saved in *P6-26* has been restored.
U-torq	25	0x34	0x1019	Minimum torque limit timeout (hoist).	The torque threshold has not been exceeded in time. Increase the time in *P4-16* or the torque limit in *P4-15*.
U-t	09	0x75	0x4209	Undertemperature	Occurs at an ambient temperature below -10 °C. Increase the temperature to above -10 °C to start the inverter.
U-Volt	07	0xC6	0x3207	DC link undervoltage	Occurs routinely when switching off the inverter. Check line voltage if this occurs while the inverter is running.
USr-cL				Parameter backup successfully deleted	The parameter set was successfully deleted using *P6-26*.
USr-PS				Parameter backup successfully completed.	The parameter set was successful saved using *P6-26*.

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7 Fieldbus mode

A bus system makes it possible to adapt electronic drive technology components to the particulars of the machinery within wide limits. There is a risk that a change of parameters that cannot be detected externally may result in unexpected (but not uncontrolled) system behavior and may have a negative impact on operational safety, system availability, or data security. Ensure that unauthorized access is prevented, especially with respect to Ethernet-based networked systems and engineering interfaces. Use IT-specific safety standards to increase access protection to the ports. For a port overview, refer to the respective technical data of the device in use.

7.1 General information

Maximum possible number of process data words:

- SEW controller (S-Bus 3PD)
- SEW gateway (S-Bus 3PD)
- Modbus RTU 4PD
- CANOpen 4PD
- Optional fieldbus interfaces 4PD

7.1.1 Structure and settings of process data words

Control and status word have a fixed assignment. All the other process data words can be freely configured as required using parameter group *P5-xx*.

The structure of process data words is identical for SBus/Modbus RTU/CANopen, as well as with inserted communication card.

	High byte	Low byte
Bit	15 – 8	7 – 0

Process output words

Description		Bit		Settings
PA1	Control word	0	Output stage inhibit (the motor coasts to a stop), for brakemotors the brake is applied immediately.	0: Start 1: Stop
		1	Rapid stop along the second deceleration ramp/rapid stop ramp (*P2-25*)	0: Rapid stop 1: Start
		2	Stop along process ramp *P1-03* / *P1-04* or PO3	0: Stop 1: Start
		3 – 5	Reserved	0
		6	Error reset	Edge 0 set to 1 = error reset
		7 – 15	Reserved	0
PO2	Setpoint speed in % (default setting), freely configurable via *P5-09*			
PO3	No function, freely configurable via *P5-10*			

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Description		Bit		Settings	Byte
PO4	No function, freely configurable via *P5-11*				

Process input words

Description		Bit		Settings	Byte
PI1	Status word	0	Output stage enable	0: Locked 1: Enabled	Low byte
		1	Inverter ready	0: Not ready for operation 1: Ready	
		2	PO data enabled	1, if *P1-12* = 5	
		3 – 4	Reserved		
		5	Fault/warning	0: No fault 1: Error	
		6	Positive limit switch active (limit switch assignment can be set in *P1-15* or via *P9-30/P9-31*).[1)]	0: Locked 1: Enabled	
		7	Negative limit switch active (limit switch assignment can be set in *P1-15* or via *P9-30/P9-31*)[1)].	0: Locked 1: Enabled	
		8 – 15	Inverter status if bit 5 = 0 0x01 = STO – Safe Torque Off active 0x02 = No enable 0x05 = Speed control 0x06 = Torque control 0x0A = Technology function 0x0C = Reference travel		High byte
			Inverter status if bit 5 = 1		
PE2	Actual speed	Freely configurable with *P5-12*			
PI3	Actual current	Freely configurable with *P5-13*			
PI4	No function, freely configurable with *P5-14*				

1) Refer to the addendum to the operating instructions "MOVITRAC® LTX Servo Module for MOVITRAC® LTP-B".

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7.1.2 Communication example

The following information is sent to the inverter if:

- The digital inputs have been configured and wired properly to enable the inverter.

Description		Value	Description
PO1	Control word	0x0000	Stop along the second deceleration ramp (*P2-25*).
		0x0001	Coasting
		0x0002	Stop along the process ramp (*P1-04)* or (PA3).
		0x0003 - 0x0005	Reserved
		0x0006	Accelerate along a ramp (*P1-03*) or (PO3) and run at setpoint speed (PO2).
PO2	Setpoint speed	0x4000	= 16384 dec = maximum speed, e.g. 50 Hz (*P1-01*) CW
		0x2000	= 8192 dec = 50% of the maximum speed, e.g., 25 Hz CW
		0xC000[1)]	= 16384 dec = maximum speed, e.g. 50 Hz (*P1-01*) CCW
		0x0000	= 0 dec = minimum speed, set in *P1-02*
		0xDFFF[1)]	= -8192 dec = 50% of the maximum speed, e.g. 25 Hz CCW

1) Representation in two's complement

The process data sent by the inverter should look as follows during operation:

Description		Value	Description
PI1	Status word	0x0407	Status = running, output stage enabled; inverter ready, PO data enabled
PE2	Actual speed	Should correspond to PO2 (setpoint speed)	
PI3	Actual current	Depends on speed and load	

7.1.3 Parameter settings for the inverter

- Put the inverter into operation as described in chapter "Simple startup" (→ 🗎 59).
- Set the following parameters depending on the bus system used:

Parameter	SBus/CANopen	Modbus RTU[1)]	Fieldbus via option card
P1-12 (Control signal source)	SBus: 5 CANopen: 6	7	
P1-14 (Extended parameter access)	201		
P1-15 (Digital input function selection)	1[2)]		
P5-01 (Inverter address)	1-63		--[3)]
P5-02 (SBus/CANopen baud rate)	Baud rate	--	--
P5-03 (Modbus baud rate)	--	Baud rate	--
P5-04 (Modbus data format)	--	Data format	--
P5-05[4)] (Response to communication failure)	0-1-2-3		--[3)]
P5-06[4)] (Communication failure timeout)	SBus: 0.0 – 5.0 sec. CANopen: [5)]	0.0 – 5.0 sec.	--[3)]
P5-07[4)] (Ramp specified via fieldbus)	0 = Specified via *P1-03/04* 1 = Specified via fieldbus[6)]		
P5-XX (Fieldbus parameter)	Additional setting options[7)]		

1) is not available when the LTX encoder module is installed.
2) Default setting; for more setting options, refer to the description of parameter P1-15.
3) This setting is dependent on the fieldbus system. See "Option cards" manual.
4) These parameters can remain set to their default values for the time being.
5) The CANOpen function "Node guarding" must be used for communication monitoring. The timeout time is thereby defined via the guard time (0x100C) and the lifetime factor (0x100D).
6) For ramp specification via fieldbus, P5-10=3 must be set (PA3 = ramp time).
7) Additional fieldbus settings and the detailed definition of the process data can be made in parameter group P5-xx, see chapter "Parameter group 5".

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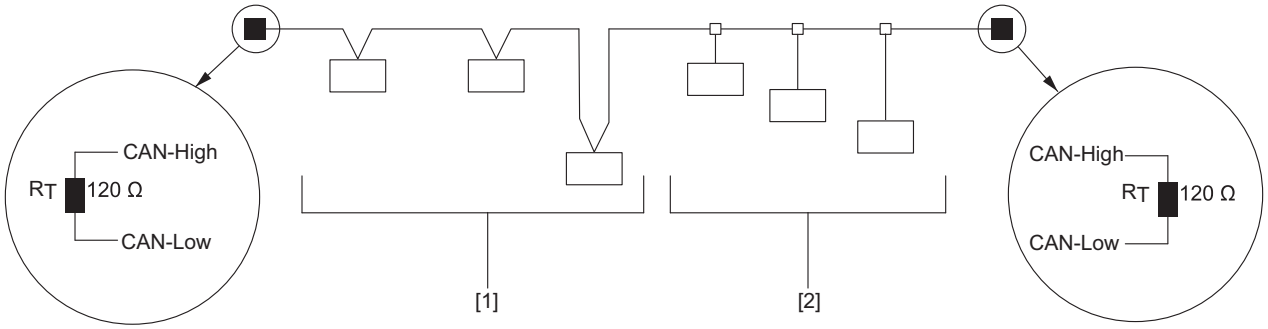
7.1.4 Connecting the signal terminals at the inverter

For bus mode, you can connect the signal terminals using the default setting of *P1-15* as described in chapter "Overview of signal terminals" (→ 🗎 43). When the DI3 signal level changes, the system toggles between the speed setpoint source fieldbus (low) and fixed setpoint 1 (high).

7.1.5 Establishing a CANopen/SBus network

A CAN network as depicted in the figure below should always have a linear bus structure without stub lines [1] or only with very short ones [2]. The network must have exactly one terminating resistor R_T = 120 Ω installed on both ends of the bus. The cable sets described in the "MOVITRAC® LTP-B" catalog are available for easily establishing such a network.



7338031755 *7338031755*

Cable length

The permitted total cable length depends on the baud rate set in parameter *P5-02*:

- 125 kBd: 500 m (1640 ft)
- 250 kBd: 250 m (820 ft)
- 500 kBd: 100 m (328 ft)
- 1000 kBd: 25 m (82 ft)

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7.2 Connecting a gateway or controller (SBus MOVILINK®)

7.2.1 Specification

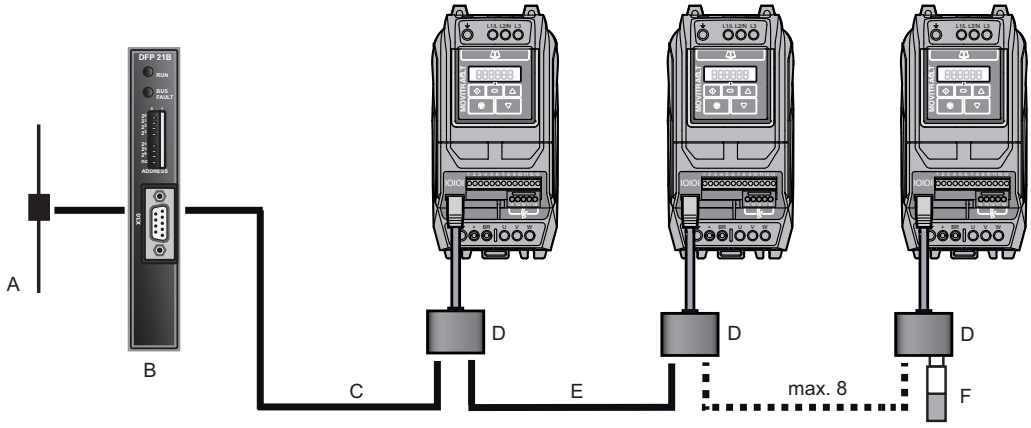
The MOVILINK® profile via CAN/SBus is an application profile from SEW-EURODRIVE specifically adjusted to SEW inverters. For detailed information, refer to the "MOVIDRIVE® MDX60B/61B Communication and Fieldbus Device Profile" manual.

For using SBus, configure the inverter as described in chapter "Parameter settings for the inverter" (→ 🗎 97). Status and control word are fixed, all other process data words can be configured as required in parameter group *P5-xx*.

For detailed information on the structure of process data words, refer to chapter Structure of process data words of inverters with factory setting. You find a detailed list of all parameters including the necessary indexes as well as the scaling in chapter "Parameter register" (→ 🗎 118).

7.2.2 Electrical installation

Connecting gateway and MOVI-PLC®.



9007206593403147

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

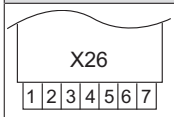
INFORMATION

As of firmware version 1.20, a backup mode for maintaining communication in the event of a power failure is possible, for older versions this is not possible. Please also observe chapter "24 V backup mode" (→ 🗎 47).

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, you can use the Y adapter of engineering cable set C. This set also includes a terminating resistor. You find detailed information on cable sets in the "MOVITRAC® LTP-B" catalog.

Wiring from the control to the "communication socket RJ45" (→ 🗎 46) of the inverter:

Side view	Designation	Terminal at CCU/PLC	Signal	RJ45 socket[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		
	Third party controller	X:?[2]	Modbus RTU+	8	RS485+ (Modbus RTU)
		X:?[2]	Modbus RTU-	7	RS485- (Modbus RTU)
		X:?[2]	DGND	3	GND

1) Please observe: The terminal assignment for the socket of the inverter, not the connector, is specified above.

2) Assignment depends on the third-party controller.

7.2.3 Startup at gateway

- Connect the gateway as described in chapter "Electrical installation" (→ 🗎 99).
- Reset all settings of the gateway to the factory setting.
- If required, set all connected inverters to SBus MOVILINK® mode as described in chapter "Parameter settings for the inverter" (→ 🗎 97). Assign unique SBus addresses (≠ 0!) and set a baud rate matching the gateway (default = 500 kBaud).
- Set DIP switch AS (auto-setup) on the DFx/UOH gateway from "OFF" to "ON" to perform an auto-setup for the fieldbus gateway.

  The "H1" LED on the gateway lights up repeatedly and then goes off completely. When the "H1" LED is lit, the gateway or one of the inverters at the SBus has not been wired properly or has not been taken into operation properly.
- Refer to the relevant DFx manual for information on how to establish fieldbus communication between DFx/UOH gateway and bus master.

Monitoring sent data

The data sent via gateway can be monitored as follows:

- Using MOVITOOLS® MotionStudio via the X24 engineering interface of the gateway or optionally via Ethernet.
- Via the website of the gateway, for example to the DFE3x Ethernet gateway.
- You can check which process data are transferred with the respective parameters in parameter group 0.

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7.2.4 Startup at a CCU

Before taking the inverter into operation with "Drive Startup" in MotionStudio, you have to set the following parameters directly on the inverter:

- Set parameter *P1-14* to "1" to obtain access to the LTX-specific parameter group *P1-01 – P1-20*.
- If a HIPERFACE® encoder is connected to the encoder card, then *P1-16* must indicate the proper motor type. If not, select the proper motor type using the <Up> and <Down> keys.
- Assign a unique inverter address in *P1-19*. Changing these parameters will directly affect parameters *P5-01* and *P5-02*.
- Set the SBus baud rate (*P1-20*) to 500 kBaud.

7.2.5 MOVI-PLC® motion protocol (*P1-12 = 8*)

If you operate the inverter with or without LTX encoder module, with MOVI-PLC® or CCU, the following parameters have to be set on the inverter:

- Set *P1-14* to "1" for access to the LTX-specific parameter group. Parameters *P1-01 – P1-20* are then visible.
- If a HIPERFACE® encoder is connected to the encoder card, then *P1-16* indicates the proper motor type. If not, select the respective motor type using the "Up" and "Down" keys.
- Assign a unique inverter address in *P1-19*.
- Set the SBus baud rate (*P1-20*) to "1000 kBaud".
- Perform a Drive Startup with the MOVITOOLS® MotionStudio software.

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7.3 Modbus RTU

The inverters support communication via Modbus RTU. The "Read Holding Register (03)" function is used for reading and the "Write Single Register (06)" function for writing. The "Write Multiple Register (16)" function is also available for PA data word 1-5. To use Modbus RTU, configure the inverter as described in chapter "Parameter settings for the inverter" (→ 🗎 97).

7.3.1 Specification

Protocol	Modbus RTU
Error checking	CRC
Baud rate	9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps (default)
Data format	1 start bit, 8 data bits, 1 stop bit, no parity
Physical format	RS485 2 core
User interface	RJ45

7.3.2 Electrical installation

The structure is the same as for the CAN/SBus network. The maximum number of bus nodes is 32. The permitted cable length depends on the baud rate. With a baud rate of 115200 bps and a 0.5 mm^2 cable, the maximum cable length is 1200 m. For the connection assignment for the RJ45 communication socket, refer to chapter "RJ45 communication socket" (→ 🗎 46).

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7.3.3 Register allocation of the process data words

The process data words are allocated to the Modbus registers shown in the table. The status and control words have a fixed allocation. The other process data words can be freely configured in parameter group *P5-xx*.

The table shows the standard assignment of process data words. All other registers are usually allocated in such a way that they correspond to the parameter number (101 = *P1-01*). However, this does not apply to parameter group 0.

Tabs	Upper byte	Lower byte	Com-mand	Type
1	PO1 control word (fixed)		03, 06, 16	Read/Write
2	PO2 (default setting in *P5-09 =1*; speed setpoint)		03, 06, 16	Read/Write
3	PO3 (default setting in *P5-10 =7*; no function)		03, 06, 16	Read/Write
4	PO4 (default setting in *P5-11 =7*; no function)		03, 06, 16	Read/Write
5	Reserved	-	03	Read
6	PE1 status word (fixed)		03	Read
7	PE2 (default setting in *P5-12 =1*; actual speed)		03	Read
8	PE3 (default setting in *P5-13 =2*; actual current)		03	Read
9	PE4 (default setting in *P5-14 =4*; power)		03	Read
…	For more registers, see chapter "Parameter registers" (→ 🗎 118).			

The complete allocation of parameters and registers as well as the scaling of data can be found in the memory allocation plan of chapter "Parameter registers" (→ 🗎 118).

INFORMATION

Many bus masters address the first register as register 0. It might therefore be necessary to deduct the value "1" from the register number given below to obtain the correct register address.

7.3.4 Data flow example

In this example, the following parameters are read by the controller (PLC address base = 1):

- *P1-07* (rated motor voltage, modbus register 107)
- *P1-08* (rated motor current, modbus register 108).

Reading register information

Request master → slave (Tx)

Address	Function	Data				CRC check
		Start address		Number of registers		
	Read	High byte	Low byte	High byte	Low byte	crc16
01	03	00	6A	00	02	E4 17

Response slave → master (Rx)

Address	Function	Data				CRC check
		Number of data bytes (n)		Information n/2 register		
	Read	High byte	Low byte	Register 107 / 108		crc16
01	03	04		00 E6	00 2B	5B DB

Explanation to the communication example:

Tx = Send from perspective of the bus master.

Address	Device address 0x01 = 1
Function	03 read/06 write
Start address	Register start address = 0x006A = 106
Number of registers	Number of requested registers from start address (register 107/108).
2 × CRC bytes	CRC_high, CRC_low

Rx = Received from perspective of the bus master.

Address	Device address 0x01 = 1
Function	03 read/06 write
Number of data bytes	0x04 = 4
Register 108 high byte	0x00 = 0
Register 108 low byte	0x2B = 43% of the nominal inverter current
Register 107 high byte	0x00 = 0
Register 107 low byte	0xE6 = 230 V
2 × CRC bytes	CRC_high, CRC_low

The following example describes the second process data word of the inverter (PLC address base = 1):

Process output data word 2 = modbus register 2 = setpoint speed.

Sending register information

Request master → slave (Tx)

Address	Function	Data				CRC check
		Start address		Information		
	Write	High byte	Low byte	High byte	Low byte	crc16
01	06	00	01	07	00	DB 3A

Response slave → master (Rx)

Address	Function	Data				CRC check
		Start address		Information		
	Write	High byte	Low byte	High byte	Low byte	crc16
01	06	00	01	07	00	DB 3A

Explanation to the communication example:

Tx = Send from perspective of the bus master.

Address	Device address 0x01 = 1
Function	03 read/06 write

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Start address	Register start address =0x0001 = 1 (first register to be written on = 2 PA2)
Information	0700 (setpoint speed)
2 × CRC bytes	CRC_high, CRC_low

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7.4 CANopen

The inverters support communication via CANopen. For using CANopen, configure the inverter as described in chapter "Parameter settings for the inverter" (→ 🗎 97).

Following a general overview of how to establish a communication connection via CANopen and the process data communication. The CANopen configuration is not described.

For detailed information on the CANopen profile, refer to the "MOVIDRIVE® MDX60B/61B Communication and Fieldbus Unit Profile" manual.

7.4.1 Specification

CANopen communication is implemented according to the specification DS301 version 4.02 of CAN in automation (see www.can-cia.de). A specific device profile, such as DS402, is not implemented.

7.4.2 Electrical installation

See chapter "Establishing a CANopen/SBus network" (→ 🗎 98).

7.4.3 COB IDs and functions in the inverter

The CANopen profile provides the following COB ID (Communication Object Identifier) and functions.

Messages and COB IDs		
Type	**COB ID**	**Function**
NMT	000h	Network management
Sync	080h	Synchronous message with dynamically configurable COB ID
Emergency	080h + device address	Emergency message with dynamically configurable COB ID
PDO1[1] (Tx)	180h + device address	PDO (Process Data Object) PDO1 is pre-mapped and activated by default. PDO2 is pre-mapped and activated by default. Transmission mode (synchronous, asynchronous, event), COB ID and mapping can be configured as required.
PDO1 (Rx)	200h + device address	
PDO2 (Tx)	280h + device address	
PDO2 (Rx)	300h + device address	
SDO (Tx)[2]	580h + device address	SDO channel for parameter data exchange with the CANopen master
SDO (Rx)[2]	600h + device address	
Error control	700h + device control	Guarding and heartbeat functions are supported. COB ID can be set to another value.

1) The inverter supports up to 2 process data objects (PDO). All PDOs are pre-mapped and active with transmission mode 1 (cyclical and synchronous). This means that the Tx-PDO is sent after every SYNC pulse regardless of whether the content of the Tx-PDO has changed or not.

2) The inverter SDO channel supports only expedited transmission. The SDO mechanisms are described in detail in the CANopen specification DS301.

INFORMATION

Transmitting speed, current or similar values that change quickly via Tx-PDO results in a very high load on the bus.

To limit the bus load to predictable values, you can use the inhibit time, see section "Inhibit time" in the "MOVIDRIVE® MDX60B/61B Communication and Fieldbus Device Profile" manual.

- Tx (transmit) and Rx (receive) are depicted from perspective of the slave.

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7.4.4 Supported transmission modes

The various transmission types can be selected for every process data project (PDO) in the network management (NMT).

The following transmission types are supported for Rx-PDOs:

Rx PDO transmission mode		
Transmission type	**Mode**	**Description**
0 – 240	Synchronous	The received data are transmitted to the inverter as soon as the next synchronization message is received.
254, 255	Asynchronous	The received data are transmitted to the inverter without delay.

The following transmission types are supported for Tx PDOs:

Tx PDO transmission mode		
Transmission type	**Mode**	**Description**
0	Acyclic synchronous	Tx PDO is only transmitted if the process data have changed and a SYNC object was received.
1 – 240	Cyclic synchronous	Tx PDOs are transmitted synchronously and cyclically. The transmission type indicates the number of the SYNC object required for triggering transmission of the Tx PDO.
254	Asynchronous	Tx PDOs are only transmitted when the corresponding Rx PDO has been received.
255	Asynchronous	Tx PDOs are always transmitted as soon as the PDO data has changed.

7.4.5 Default allocation plan of process data objects (PDO)

The following table shows the default mapping of the PDOs:

PDO default mapping					
	Object no.	**Mapped object**	**Length**	**Mapping with default setting**	**Transmission type**
Rx PDO1	1	2001h	Unsigned 16	PO1 control word (fixed)	1
	2	2002h	Integer 16	PO2 (default setting in *P5-09* =1; speed setpoint)	
	3	2003h	Unsigned 16	PO3 (default setting in *P5-10* =7; no function)	
	4	2004h	Unsigned 16	PO4 (default setting in *P5-11* =7; no function)	
Tx PDO1	1	2101h	Unsigned 16	PI1 status word (fixed)	1
	2	2102h	Integer 16	PI2 (default setting in *P5-12* =1; actual speed)	
	3	2103h	Unsigned 16	PI3 (default setting in *P5-13* =2; actual current)	
	4	2104h	Integer 16	PI4 (default setting in *P5-14* =4; power)	
Rx PDO 2	1	2016h	Unsigned 16	Fieldbus analog output 1	1
	2	2017h	Unsigned 16	Fieldbus analog output 2	
	3	2015h	Unsigned 16	Fieldbus PID reference	
	4	0006h	Unsigned 16	Dummy	
Tx PDO2	1	2118h	Unsigned 16	Analog input 1	1
	2	2119h	Integer 16	Analog input 2	
	3	211Ah	Unsigned 16	State of inputs and outputs	
	4	2116h	Unsigned 16	Inverter temperature	

INFORMATION

Tx (transmit) and Rx (receive) are depicted from perspective of the slave.

Note: Modified default settings are lost after power off and on again. This means the settings are restored to default values after power off.

7.4.6 Data flow example

Process data communication example with default setting:

				Word 1		Word 2		Word 3		Word 4		
	COB ID	D	DB	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 5	Byte 6	Description
1	0x701	Tx	1	"00"	-	-	-	-	-	-	-	BootUpMessage
2	0x000	Rx	2	"01"	"01"	-	-	-	-	-	-	Node Start (operational)
3	0x201	Rx	8	"06"	"00"	"00"	"20"	"00"	"00"	"00"	"00"	Enable + setpoint speed
4	0x080	Rx	0	-	-	-	-	-	-	-	-	SYNC telegram
5	0x181	Tx	8	"C7"	"05"	"00"	"20"	"A2"	"00"	"28"	"00"	Process data object 1
6	0x281	Tx	8	"29"	"09"	"00"	"00"	"01"	"1F"	"AC"	"0D"	Process data object 2

After a byte swap, the table looks as follows:

				Word 4		Word 3		Word 2		Word 1		
	COB ID	D	DB	Byte 8	Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Description
1	0x701	Tx	1	-	-	-	-	-	-		"00"	BootUpMessage
2	0x000	Rx	2	-	-	-	-	-	-	"01"	"01"	Node Start (operational)
3	0x201	Rx	8	"00"	"00"	"00"	"00"	"20"	"00"	"00"	"06"	Enable + setpoint speed (byte swap)
4	0x080	Rx	0	-	-	-	-	-	-	-	-	SYNC telegram
5	0x181	Tx	8	"00"	"28"	"00"	"A2"	"20"	"00"	"05"	"C7"	Process data object 1
6	0x281	Tx	8	"0D"	"AC"	"1F"	"01"	"00"	"00"	"09"	"29"	Process data object 2

Explanation of the data:

			Word 4		Word 3		Word 2		Word 1	
	COB ID	Explanation of the COB ID	Byte 8	Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1
1	0x701	BootUp message + device address 1	-	-	-	-	-	-	-	Place-holder
2	0x000	NMT service	-	-	-	-	-	-	Bus status	Device address
3	0x201	Rx-PDO1 + device address 1	-	-	Ramp specification		Setpoint speed		Control word	
4	0x080	SYNC telegram	-	-	-	-	-	-	-	-
5	0x181	Tx PDO1 + device address	Output power		Output current		Actual speed		Status word	
6	0x281	Tx PDO2 + device address	Inverter temperature		IO status		Analog input 2		Analog input 1	

Example of reading the index allocation by means of service device object (SDO):

Request controller → inverter (index: 1A00h)

Response inverter → controller: 10 00 01 21h → byte swap: 2101 00 10 h.

Explanation of the response:

→ 2101 = index in the manufacturer-specific object table

→ 00h = subindex

→ 10h = data width = 16 bit x 4 = 64 bit = 8 byte mapping length.

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7.4.7 Table of CANopen-specific objects

CANopen-specific objects						
Index	**Sub index**	**Function**	**Access**	**Type**	**PDO map**	**Default value**
1000h	0	Device type	RO	Unsigned 32	N	0
1001h	0	Error register	RO	Unsigned 8	N	0
1002h	0	Manufacturer status register	RO	Unsigned 16	N	0
1005h	0	COB-ID Sync	RW	Unsigned 32	N	00000080h
1008h	0	Manufacturer device name	RO	String	N	LTPB
1009h	0	Manufacturer hardware version	RO	String	N	x.xx (e.g. 1.00)
100Ah	0	Manufacturer software version	RO	String	N	x.xx (e.g. 1.12)
100Ch	0	Guard time [1 ms]	RW	Unsigned 16	N	0
100Dh	0	Life time factor	RW	Unsigned 8	N	0
1014h	0	COB-ID EMCY	RW	Unsigned 32	N	00000080h+Node ID
1015h	0	Inhibit time emergency [100 µs]	RW	Unsigned 16	N	0
1017h	0	Producer heart beat time [1 ms]	RW	Unsigned 16	N	0
1018h	0	Identity object no. of entries	RO	Unsigned 8	N	4
	1	Vendor ID	RO	Unsigned 32	N	0x00000059
	2	Product code	RO	Unsigned 32	N	Depends on inverter
	3	Revision number	RO	Unsigned 32	N	x.xx (IDL version: 0.33)
	4	Serial number	RO	Unsigned 32	N	e.g. 1234/56/789 [1]
1200h	0	SDO parameter no. of entries	RO	Unsigned 8	N	2
	1	COB-ID client -> server (Rx)	RO	Unsigned 32	N	00000600h+Node ID
	2	COB-ID server -> client (Tx)	RO	Unsigned 32	N	00000580h+Node ID
1400h	0	Rx PDO1 comms param no. of entries	RO	Unsigned 8	N	2
	1	Rx PDO1 COB-ID	RW	Unsigned 32	N	00000200h+Node ID
	2	Rx PDO1 transmission type	RW	Unsigned 8	N	1
1401h	0	Rx PDO2 comms param no. of entries	RO	Unsigned 8	N	2
	1	Rx PDO2 COB-ID	RW	Unsigned 32	N	00000300h+Node ID
	2	Rx PDO2 transmission type	RW	Unsigned 8	N	1
1600h	0	Rx PDO1 mapping / no. of entries	RW	Unsigned 8	N	4
	1	Rx PDO1 1st mapped object	RW	Unsigned 32	N	20010010h
	2	Rx PDO1 2nd mapped object	RW	Unsigned 32	N	20020010h
	3	Rx PDO1 3rd mapped object	RW	Unsigned 32	N	20030010h
	4	Rx PDO1 4th mapped object	RW	Unsigned 32	N	20040010h
1601h	0	Rx PDO2 mapping / no. of entries	RW	Unsigned 8	N	4
	1	Rx PDO2 1st mapped object	RW	Unsigned 32	N	20160010h
	2	Rx PDO2 2nd mapped object	RW	Unsigned 32	N	20170010h
	3	Rx PDO2 3rd mapped object	RW	Unsigned 32	N	20150010h
	4	Rx PDO2 4th mapped object	RW	Unsigned 32	N	00060010h
1800h	0	Tx PDO1 comms param no. of entries	RO	Unsigned 8	N	3
	1	Tx PDO1 COB-ID	RW	Unsigned 32	N	40000180h+Node ID
	2	Tx PDO1 transmission type	RW	Unsigned 8	N	1
	3	Tx PDO1 inhibit time [100µs]	RW	Unsigned 16	N	0
1801h	0	Tx PDO2 comms param no. of entries	RO	Unsigned 8	N	3
	1	Tx PDO2 COB-ID	RW	Unsigned 32	N	40000280h+Node ID
	2	Tx PDO2 transmission type	RW	Unsigned 8	N	1
	3	Tx PDO2 inhibit time [100µs]	RW	Unsigned 16	N	0
1A00h	0	Tx PDO1 mapping / no. of entries	RW	Unsigned 8	N	4
	1	Tx PDO1 1st mapped object	RW	Unsigned 32	N	21010010h
	2	Tx PDO1 2nd mapped object	RW	Unsigned 32	N	21020010h
	3	Tx PDO1 3rd mapped object	RW	Unsigned 32	N	21030010h
	4	Tx PDO1 4th mapped object	RW	Unsigned 32	N	21040010h

CANopen-specific objects						
Index	**Sub index**	**Function**	**Access**	**Type**	**PDO map**	**Default value**
1A01h	0	Tx PDO2 mapping / no. of entries	RW	Unsigned 8	N	4
	1	Tx PDO2 1st mapped object	RW	Unsigned 32	N	21180010h
	2	Tx PDO2 2nd mapped object	RW	Unsigned 32	N	21190010h
	3	Tx PDO2 3rd mapped object	RW	Unsigned 32	N	211A0010h
	4	Tx PDO2 4th mapped object	RW	Unsigned 32	N	21160010h

1) Output of the last 9 numbers of the serial number.

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7.4.8 Table of manufacturer-specific objects

The manufacturer-specific objects of the inverter are defined as follows:

Manufacturer-specific objects						
Index	**Sub index**	**Function**	**Access**	**Type**	**PDO map**	**Note**
2000h	0	Reserved / no function	RW	Unsigned 16	Y	Read as 0, writing not possible
2001h	0	PO1	RW	Integer 16	Y	Defined as command
2002h	0	PO2	RW	Integer 16	Y	Configured by *P5-09*
2003h	0	PO3	RW	Integer 16	Y	Configured by *P5-10*
2004h	0	PO4	RW	Integer 16	Y	Configured by *P5-11*
2010h	0	Control command register	RW	Unsigned 16	Y	
2011h	0	Speed reference (RPM)	RW	Integer 16	Y	1 = 0.2 RPM
2012h	0	Speed reference (percentage)	RW	Integer 16	Y	4000HEX = 100% *P1-01*
2013h	0	Torque reference	RW	Integer 16	Y	1000DEC = 100%
2014h	0	User ramp reference	RW	Unsigned 16	Y	1 = 1 ms (reference to 50 Hz)
2015h	0	Fieldbus PID reference	RW	Integer 16	Y	1000HEX = 100%
2016h	0	Fieldbus analog output 1	RW	Integer 16	Y	1000HEX = 100%
2017h	0	Fieldbus analog output 2	RW	Integer 16	Y	1000HEX = 100%
2100h	0	Reserved / no function	RO	Unsigned 16	Y	Read as 0
2101h	0	PI1	RO	Integer 16	Y	Defined as status
2102h	0	PI2	RO	Integer 16	Y	Configured by *P5-12*
2103h	0	PI3	RO	Integer 16	Y	Configured by *P5-13*
2104h	0	PI4	RO	Integer 16	Y	Configured by *P5-14*
2110h	0	Drive status register	RO	Unsigned 16	Y	
2111h	0	Speed reference (RPM)	RO	Integer 16	Y	1 = 0.2 RPM
2112h	0	Speed reference (percentage)	RO	Integer 16	Y	4000HEX = 100 % *P1-01*
2113h	0	Motor current	RO	Integer 16	Y	1000DEC = rated inverter current
2114h	0	Motor torque	RO	Integer 16	Y	1000DEC = rated motor torque
2115h	0	Motor power	RO	Unsigned 16	Y	1000DEC = inverter nominal power
2116h	0	Inverter temperature	RO	Integer 16	Y	1DEC = 0.01 °C
2117h	0	DC bus value	RO	Integer 16	Y	1DEC = 1 V
2118h	0	Analog input 1	RO	Integer 16	Y	1000HEX = entire range
2119h	0	Analog input 2	RO	Integer 16	Y	1000HEX = entire range
211Ah	0	Digital input & output status	RO	Unsigned 16	Y	LB= input, HB = output
211Bh	0	Analog output 1	RO	Integer 16	Y	
211Ch	0	Analog output 2	RO	Integer 16	Y	
2121h	0	Scope channel 1	RO	Unsigned 16	Y	
2122h	0	Scope channel 2	RO	Unsigned 16	Y	
2123h	0	Scope channel 3	RO	Unsigned 16	Y	
2124h	0	Scope channel 4	RO	Unsigned 16	Y	
2AF8h[1)]	0	SBus parameter start index	RO	-	N	11000d
…	0	SBus parameters	RO/RW	-	N	…
2C6F	0	SBus parameter end index	RW	-	N	11375d

1) Objects 2AF8h – 2C6EF correspond with SBus parameter indexes 11000d – 11375d, some of them are read-only.

7.4.9 Emergency code objects

See chapter Error codes.

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 Electronics Service by SEW-EURODRIVE

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

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

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

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8.2 Extended storage

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

Procedure when maintenance has been neglected:

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 the nominal voltage after a longer period of storage.

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

The following graduations are recommended:

AC 230 V devices:

- Stage 1: AC 170 V for 15 minutes
- Stage 2: AC 200 V for 15 minutes
- Stage 3: AC 240 V for 1 hour

AC 400 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 575 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 3: AC 500 V for 15 minutes
- Stage 4: AC 600 V for 1 hour

After you have completed the regeneration process, the device can be used immediately or stored again for an extended period with maintenance.

8.3 Waste disposal

Please observe current regulations. Dispose of the following materials in accordance with the regulations in force:

- Electronics scrap (printed circuit boards)
- Plastic (housing)
- Sheet metal
- Copper
- Aluminum

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9 Parameters

9.1 Overview of parameters

9.1.1 Parameters for realtime monitoring (read only)

Parameter group 0 gives access to internal inverter parameters for monitoring purposes. These parameters cannot be changed.

Parameter group 0 is visible if *P1-14* is set to "101" or "201".

Parameter	CANopen/SBus index	Modbus register	Description	Indicating range	Explanation
P0-01	11210	20	Value of analog input 1	0 – 100%	Index value 1000 = 100% ≙ max. input voltage or current.
P0-02	11211	21	Value of analog input 2	0 – 100%	Index value 1000 = 100% ≙ max. input voltage or current.
P0-03	11212	11	Digital input connection	Binary value	Status of the digital inputs of the basic device and option DI8*; DI7*; DI6*; DI5; DI4; DI3; DI2; DI1 * Only available with the matching option module.
P0-04	11213	22	Speed controller setpoint	*P1-02 – P1-01*	Speed display in Hz when *P1-10* = 0, otherwise in min^{-1}
P0-05	11214	41	Torque controller setpoint	0 – 500%	Torque display in %, depending on the setting in *P4-06* 100% = nominal motor torque
P0-06	11215		Digital speed setpoint in keypad mode	*-P1-01 – P1-01*	Speed display in Hz when P1-10 = 0, otherwise in min^{-1}
P0-07	11216		Speed setpoint via communication connection	*-P1-01 – P1-01*	Speed display in Hz when P1-10 = 0, otherwise in min^{-1}
P0-08	11217		PID reference	0 – 100%	
P0-09	11218		Actual PID value	0 – 100%	
P0-10	11219		PID output	0 – 100%	
P0-11	11270		Present motor voltage	AC 0 – 600 V	Inverter output voltage rms value
P0-12	11271		Motor torque	0 – 500%	
P0-13	11272 – 11281		Error log	4 values	Shows the last 4 errors. You can toggle between sub-items by pressing the <Up>/<Down> keys.
P0-14	11282		Magnetizing current (Id)	A	
P0-15	11283		Torque-forming current (Iq)	A	
P0-16	11284		Magnetic field strength	0 – 100%	
P0-17	11285		Reserved		
P0-18	11286		Reserved		
P0-19	11287		Reserved		
P0-20	11220	23	DC link voltage ($U_{DC\ link}$)	DC 0 – 1000 V	
P0-21	11221, 11222	24	Power electronics/heat sink temperature	°C	40 = 40 °C
P0-22	11288		DC link voltage ripple	0 – 1000 V	
P0-23	11289, 11290		Total runtime over 85 °C (power electronics / heat sink)	Hours and minutes	
P0-24	11237, 11238		Total runtime above 60 °C (control electronics)	Hours and minutes	
P0-25	11291		Rotor speed (calculated via motor model)	Hz / min^{-1}	Speed display in Hz when *P1-10* = 0, otherwise in min^{-1}
P0-26	11292, 11293	30	kWh counter (can be reset via *P6-23*)	0.0 – 999.9 kWh	100 = 10.0 kWh (cumulative energy consumption)
		32	kWh COUNTER		
P0-27	11294, 11295	31	MWh counter	0.0 – 65535 MWh	100 = 10.0 MWh (cumulative energy consumption)
		33	MWh counter (can be reset via *P6-23*)		

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Parameter	CANopen/SBus index	Modbus register	Description	Indicating range	Explanation
P0-28	11247 – 11250		Firmware version and check sum	e.g. "1 1.00", "1 4F3C" "2 1.00", "2 Ed8A"	Firmware and check sum of the control electronics and power section
P0-29	11251 – 11254		Inverter type	e.g. "HP 2", "2 400", "3-PhASE"	Power/connection and voltage/motor connection
P0-30	11255	25	Inverter serial number 4	000000 – 000000 (SN grp 1) 000-00 – 999-99 (SN grp 2, 3)	31 → 561723/01/**031**
		26	Inverter serial number 3		1 → 561723/**01**/031
		27	Inverter serial number 2		1723 → 56**1723**/01/031
		28	Inverter serial number 1		56 → **56**1723/01/031
P0-31	11296, 11297	34, 35	Operating hours counter (Inverter enabled)	Value 1: Hours Value 2: Minutes, seconds	Total enable time of the inverter since manufacturing. Value cannot be reset
P0-32	11298, 11299		Runtime since the last fault (1)	Hour/min/sec.	Operating time since last error or power OFF. The timer is reset at the next enable or mains OFF.
P0-33	11300, 11301		Runtime since the last error (2)	Hour/min/sec.	Operating time since the last error. The time will be reset the next time that an enable or power off occurs.
P0-34	11302, 11303	36, 37	Inverter runtime since last enable	Value 1: Hours Value 2: Minutes, seconds	The value is reset at each enable
P0-35	11304, 11305		Runtime of the internal inverter fan	Hour/min/sec.	The internal inverter fan is installed only on IP55/ IP66 devices.
P0-36	11306 – 11313		DC link voltage protocol	0 – 1000 V	Protocol of the last 8 values prior to an error. Sampling cycle 256 ms
P0-37	11314 – 11321		Protocol of DC link voltage ripple	0 – 1000 V	Protocol of the last 8 values prior to an error. Sampling cycle 20 ms
P0-38	11322 – 11329		Power electronics/heat sink temperature protocol (*P0-21*)	°C	Protocol of the last 8 values prior to an error. Sampling cycle 30 sec.
P0-39	11239 – 11246		Control electronics temperature protocol (*P0-72*)	°C	Protocol of the last 8 values prior to an error. Sampling cycle 30 sec.
P0-40	11330 – 11337		Motor current protocol	A	Protocol of the last 8 values prior to an error. Sampling cycle 256 ms
P0-41	11338		Counter for overcurrent faults: O-I	–	see "Error list" (→ 🗎 90)
P0-42	11339		Counter for overvoltage faults: O-Volt	–	see "Error list" (→ 🗎 90)
P0-43	11340		Counter for undervoltage faults: U-Volt	–	see "Error list" (→ 🗎 90)
P0-44	11341		Counter for overtemperature faults: O-T	–	see "Error list" (→ 🗎 90)
P0-45	11342		Counter for braking resistor overcurrent/overload: OI-b	–	see "Error list" (→ 🗎 90)
P0-46	11343		Counter for overtemperature faults: O-heat	–	see "Error list" (→ 🗎 90)
P0-47	11223		Counter for internal I/O communication errors	0 – 65535	–
P0-48	11344		Counter for internal DSP communication errors	0 – 65535	–
P0-49	11224		Counter for Modbus communication errors	0 – 65535	–
P0-50	11225		Counter for CAN bus communication errors	0 – 65535	–
P0-51	11256 – 11258		Incoming process data PE1, PE2, PE3, PE4	Hex value	4 entries; incoming process data from the perspective of the control.
P0-52	11259 – 11261		Outgoing process data PA1, PA2, PA3, PA4	Hex value	4 entries; outgoing process data from the perspective of the control.
P0-53			Current voltage offset – phase U	Internal value	Entry 1: Reference value Entry 2: Current measured value
P0-54			Current voltage offset – phase V	Internal value	Entry 1: Reference value Entry 2: Current measured value

Parameter	CANopen/SBus index	Modbus register	Description	Indicating range	Explanation
P0-55			Current voltage offset – phase W	Internal value (availability depends on power output)	Entry 1: Reference value Entry 2: Current measured value
P0-56			Max. power-applied hours and working cycle of the brake chopper	Internal value	Entry 1: Maximum power-applied hours Entry 2: Working cycle
P0-57			Ud/Uq	Internal value	2 entries
P0-58	11345		Encoder speed	Hz, min^{-1}	Display in Hz when *P1-10* = 0, otherwise in min^{-1}
P0-59	11226		Setpoint speed	Hz, min^{-1}	Display in Hz when *P1-10* = 0, otherwise in min^{-1}
P0-60	11346		Calculated slip speed value	min^{-1}	Only with V/f control and activated slip compensation (*P1-10* > 0)
P0-61	11227		Value for speed hysteresis/ relay control	Hz, min^{-1}	Display of the percentage hysteresis band set in *P6-04*. Display in Hz when *P1-10* = 0, otherwise in min^{-1}
P0-62	11347, 11348		Droop speed/load distribution	Hz, min^{-1}	Current speed reduction, depending on the setting in *P6-09*. Display in Hz when *P1-10* = 0, otherwise in min^{-1}
P0-63	11349		Speed setpoint (ramp generator output, speed setpoint input)	Hz, min^{-1}	Display in Hz when *P1-10* = 0, otherwise in min^{-1}
P0-64	11350		Current PWM frequency	4 – 16 kHz	The PWM frequency displayed can differ from the setting in *P2-24* due to derating. 0 = 2 kHz 1 = 4 kHz 2 = 6 kHz 3 = 8 kHz 4 = 12 kHz 5 = 16 kHz
P0-65	11351, 11352		Operating hours counter (inverter on line voltage)	Value 1: Hours Value 2: Minutes, seconds	Inverter on power supply since manufacture. Value cannot be reset.
P0-66	11353		I.t_trip counter	0 – 100%	The value increases as soon as the i.t model is effective. When reaching 100%, the inverter switches off with "I.t_trp".
P0-67	11228		Fieldbus torque setpoint/ limit value	Internal value	4096 = 100% nominal motor torque
P0-68	11229		Fieldbus speed ramp setpoint	Second	
P0-69	11230		Counter for I^2C errors		Internal bus error
P0-70	11231		Module identification code		PL-HFA: Hiperface® encoder module PL-Enc: Encoder module PL-EIO: IO expansion module PL-BUS: HMS fieldbus module PL-UnF: no module connected PL-UnA: unknown module connected
P0-71			Fieldbus module ID / fieldbus module status		N.A.: no fieldbus module connected. Prof-b: PROFIBUS module connected. dE-nEt: DeviceNet™ module connected. Eth-IP: EtherNet/IP™ module connected. CAN-OP: CANopen module connected. SErCOS: Sercos-III module connected. bAc-nt: BACnet module connected. nu-nEt: Module of a new type (not detected). Eth-cAt: EtherCAT® module connected PrF-nEt: PROFINET module connected Po-Lin: PowerLink module connected Modbus: Modbus TCP module connected.
P0-72	11232	39	Control electronics temperature	°C	40 = 40 °C

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Parameter	CANopen/SBus index	Modbus register	Description	Indicating range	Explanation
P0-73	11354		Encoder status / error codes		For incremental encoders: • 1=EnC-04 Signal A/A error • 2=EnC-05 Signal B/B error • 3=EnC-06 Signal A+B error For LTX HIPERFACE® encoders: • 1=EnC-04 analog signal error (sin/cos) • 2=EnC-07 RS485 communication error • 4=EnC-08 IO communication error • 8=EnC-09 encoder type not supported • 16=EnC-10 KTY error • 32=Wrong motor combination • 64=System referenced • 128=System ready
P0-74			L1 input voltage		
P0-75			L2 input voltage		
P0-76			L3 input voltage	Internal value	
P0-77	11262 11263		Position feedback	Internal value	Position feedback 11262: High word 11263: Low word
P0-78			Position reference	Internal value	Position reference
P0-79	11355, 11356		IO version and DSP bootloader version for motor control	Example: L 4.71 Example: b 1.00	Entry 1: lib version of the motor controller Entry 2: DSP bootloader version
P0-80	11233, 11357		Code for valid motor data Servo module version		Entry 1: 1 = Valid motor data available. 0 = Motor data invalid Entry 2: Firmware version of the LTX encoder card
	11234		Temperature KTY84/ PT1000	-40 °C - 215 °C	• Temperature KTY84 = value/2 • Temperature Pt1000 = value
	11358		Fire mode/emergency mode start time		Time stamp related to (P0-65) at the time of activation of the fire mode/emergency mode
	11359		Fire mode/emergency mode		Runtime in minutes how long the fire mode/emergency mode was active
		10	Output power		100 = 1.00 kW
		18	Scope channel 1		Selected channel assignment LT shell scope (permanent).
		19	Scope channel 2		Selected channel assignment LT shell scope (permanent).
		29	Status relay output		− ; − ; − ; RL5; RL4; RL3; RL2; RL1 The relay status is also displayed without relay option depending on the setting in *P5-15* to *P5-20*.

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9.1.2 Parameter register

The following table lists all parameters together with their factory settings (indicated in bold). Numerical values are displayed with the complete setting range.

Parameter	CANopen/ SBus index	Modbus register	Description	Setting range Factory setting
P1-01	11020	101	Maximum speed (→ 123)	*P1-02* – **50.0 Hz** – 5 × *P1-09*
P1-02	11021	102	Minimum speed (→ 123)	**0** – P1-01 Hz
P1-03	11022	103	Acceleration ramp time (→ 123)	See parameter description
P1-04	11023	104	Deceleration ramp time (→ 123)	See parameter description
P1-05	11024	105	Stop mode (→ 124)	**0: Stop ramp**/1: Coasting
P1-06	11025	106	Energy-saving function (→ 124)	**0: OFF**/1: ON
P1-07	11012	107	Nominal motor voltage (→ 124)	230 V inverter: 20 – **230** − 250 V 400 V inverter: 20 – **400** – 500 V 575 V inverter: 20 – **575** – 600 V
P1-08	11015	108	Rated motor current (→ 124)	20 − 100%
P1-09	11009	109	Rated motor frequency (→ 125)	25 – **50/60** – 500 Hz
P1-10	11026	110	Rated motor speed (→ 125)	**0** – 30000 min^{-1}
P1-11	11027	111	Voltage increase, boost (→ 125)	0 – 30% (power-dependent)
P1-12	11028	112	Control signal source (→ 126)	**0** – 8
P1-13	11029	113	Error log (→ 126)	Protocol of the last 4 errors
P1-14	11030	114	Extended parameter access (→ 126)	**0** – 30000
P1-15	11031	115	Digital input function selection (→ 126)	0 – **1** – 26
P1-16	11006	116	Motor type (→ 131)	In-Syn
P1-17	11032	117	Servo module function selection (→ 132)	0 – **1** – 8
P1-18	11033	118	Motor thermistor selection (→ 132)	**0: Deactivated**
P1-19	11105	119	Inverter address (→ 132)	0 – **1** – 63
P1-20	11106	120	SBus baud rate (→ 132)	125, 250, **500**, 1000 kBaud
P1-21	11017	121	Stiffness (→ 132)	0.50 – **1.00** – 2.00
P1-22	11034	122	Inertia ratio between motor and load (→ 132)	0 – **1** – 30
P2-01	11036	201	Fixed setpoint speed 1" " (→ 133)	-P1-01 – **5.0 Hz** – P1-01
P2-02	11037	202	Fixed setpoint speed 2 (→ 133)	-P1-01 – **10.0 Hz** – P1-01
P2-03	11038	203	Fixed setpoint speed 3 (→ 133)	-P1-01 – **25.0 Hz** – P1-01
P2-04	11039	204	Fixed setpoint speed 4 (→ 133)	-P1-01 – **50.0 Hz** – P1-01
P2-05	11040	205	Fixed setpoint speed 5 (→ 133)	-P1-01 – **0.0 Hz** – P1-01
P2-06	11041	206	Fixed setpoint speed 6 (→ 134)	-P1-01 – **0.0 Hz** – P1-01
P2-07	11042	207	Fixed setpoint speed 7 (→ 134) /Brake release time	-P1-01 − 0.0 Hz − P1-01
P2-08	11043	208	Fixed setpoint speed 8 (→ 134) /Brake application time	-P1-01 − 0.0 Hz − P1-01
P2-09	11044	209	Skip frequency (→ 134)	P1-02 – P1-01
P2-10	11045	210	Skip frequency band (→ 134)	**0.0 Hz** – P1-01
P2-11	11046	211	Analog output 1 function selection (→ 135)	0 – **8** – 13
P2-12	11047	212	Analog output 1 format (→ 135)	**0 – 10 V**
P2-13	11048	213	Function selection analog output 2 (→ 135)	0 – **9** – 13
P2-14	11049	214	Analog output 2 format (→ 135)	**0 – 10 V**
P2-15	11050	215	User relay output 1 function selection (→ 136)	0 – **1** – 11
P2-16	11051	216	Upper user relay limit 1: Analog output (→ 136)	0.0 – **100.0** – 200.0%
P2-17	11052	217	Lower user relay limit 1: Analog output (→ 136)	**0.0** – P2-16
P2-18	11053	218	User relay output 2 function selection (→ 136)	0 – **3** – 11
P2-19	11054	219	Upper user relay limit 2: Analog output 2 (→ 137)	0.0 – **100.0** – 200.0%

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Parameter	CANopen/ SBus index	Modbus register	Description	Setting range Factory setting
P2-20	11055	220	Lower user relay limit 2: Analog output 2 (→ 🗎 137)	**0.0** – P2-19
P2-21	11056	221	Display of scaling factor (→ 🗎 137)	-30000 – **0.000** – 30000
P2-22	11057	222	Display of scaling source (→ 🗎 137)	0 − 2
P2-23	11058	223	Zero speed holding time (→ 🗎 137)	0.0 – **0.2** – 60.0 sec.
P2-24	11003	224	PWM switching frequency (→ 🗎 137)	2 – 16 kHz (power-dependent)
P2-25	11059	225	Second deceleration ramp, rapid stop ramp (→ 🗎 137)	See parameter description
P2-26	11060	226	Flying start function enable (→ 🗎 138)	**0: Deactivated**
P2-27	11061	227	Standby mode (→ 🗎 138)	**0.0** – 250 sec.
P2-28	11062	228	Slave speed scaling (→ 🗎 138)	**0: Deactivated**
P2-29	11063	229	Slave speed scaling factor (→ 🗎 138)	-500 – **100** – 500%
P2-30	11064	230	Analog input 1 format (→ 🗎 138)	**0 – 10 V**
P2-31	11065	231	Analog input 1 scaling (→ 🗎 138)	0 – **100** – 500%
P2-32	11066	232	Analog input 1 offset (→ 🗎 139)	-500 – **0** – 500%
P2-33	11067	233	Analog input 2 format / motor protection (→ 🗎 139)	**0 – 10 V**
P2-34	11068	234	Analog input 2 scaling (→ 🗎 140)	0 – **100** – 500%
P2-35	11069	235	Analog input 2 offset (→ 🗎 140)	-500 – **0** – 500%
P2-36	11070	236	Start mode selection (→ 🗎 140)	**Auto – 0**
P2-37	11071	237	Keypad restart speed (→ 🗎 141)	0 – **1** – 7
P2-38	11072	238	Power failure stop control (→ 🗎 142)	**0** – 3
P2-39	11073	239	Parameter lock (→ 🗎 142)	**0: Deactivated**
P2-40	11074	240	Advanced parameter access code definition (→ 🗎 142)	0 – **101** – 9999
P3-01	11075	301	PID proportional gain (→ 🗎 143)	0.0 – **1.0** – 30
P3-02	11076	302	PID-integrating time constant (→ 🗎 143)	0.0 – **1.0** – 30 sec.
P3-03	11077	303	PID-differentiating time constant (→ 🗎 143)	**0.00** – 1.00 sec.
P3-04	11078	304	PID operating mode (→ 🗎 143)	**0: Direct operation**
P3-05	11079	305	PID reference selection (→ 🗎 143)	**0** – 4
P3-06	11080	306	PID fixed setpoint reference 1 (→ 🗎 143)	**0.0** – 100.0%
P3-07	11081	307	PID controller upper limit (→ 🗎 143)	P3-08 – **100.0%**
P3-08	11082	308	PID controller lower limit (→ 🗎 143)	**0.0%** – P3-07
P3-09	11083	309	PID correcting variable limitation (→ 🗎 144)	**0** – 3
P3-10	11084	310	PID feedback selection (→ 🗎 144)	**0** – 5
P3-11	11085	311	PID control difference threshold for ramp activation (→ 🗎 144)	**0.0** – 25.0%
P3-12	11086	312	PID actual value display scaling factor (→ 🗎 144)	**0.000** – 50.000
P3-13	11087	313	PID control difference wake-up level (→ 🗎 144)	**0.0** – 100.0%
P3-14	11088	314	PID fixed setpoint speed 2 (→ 🗎 144)	**0.0** – 100.0%
P3-15	11376	315	PID fixed setpoint speed 3 (→ 🗎 144)	**0.0** – 100.0%
P3-16	11377	316	PID fixed setpoint speed 4 (→ 🗎 145)	**0.0** – 100.0%
P4-01	11089	401	Operating mode/motor controller (→ 🗎 145)	0 – **2** – 6
P4-02	11090	402	"Auto tune" (→ 🗎 146)	**0: Locked**
P4-03	11091	403	Speed controller proportional gain (→ 🗎 146)	0.1 – **50** – 400%
P4-04	11092	404	Speed controller integrating time constant (→ 🗎 146)	0.010 – **0.100** – 1.000 sec.
P4-05	11093	405	Motor power factor (→ 🗎 147)	0.50 – 0.99 (power-dependent)
P4-06	11094	406	Torque reference/limit value source (→ 🗎 147)	**0: Fixed torque reference/limit value**
P4-07	11095	407	Max. torque limit (→ 🗎 149)	P4-08 – **200** – 500%
P4-08	11096	408	Min. torque limit (→ 🗎 149)	**0.0%** – P4-07
P4-09	11097	409	Upper limit of regenerative torque (→ 🗎 150)	P4-08 – **200** – 500%

Parameter	CANopen/ SBus index	Modbus register	Description	Setting range Factory setting
P4-10	11098	410	V/f characteristic adjustment frequency (→ 🗎 150)	**0.0** – 100.0% of P1-09
P4-11	11099	411	V/f characteristic adjustment voltage (→ 🗎 151)	**0.0** – 100.0% of P1-07
P4-12	11100	412	Motor brake control (→ 🗎 151)	**0: Deactivated**
P4-13	11101	413	Brake release time (→ 🗎 151)	0.0 – 5.0 sec.
P4-14	11102	414	Brake application time (→ 🗎 151)	0.0 – 5.0 sec.
P4-15	11103	415	Torque threshold for brake release (→ 🗎 151)	0.0 – 200%
P4-16	11104	416	Hoist torque threshold timeout (→ 🗎 151)	0.0 – 25.0 sec.
P4-17	11357	417	Thermal motor protection to UL508C (→ 🗎 151)	**0: Deactivated**
P4-18	11379	418	Overload management (→ 🗎 152)	**0** – 1
P4-19	11380	419	Master/slave torque reference (→ 🗎 152)	**0** – 1
P5-01	11105	501	Inverter address (→ 🗎 152)	0 – **1** – 63
P5-02	11106	502	SBus/CANopen baud rate (→ 🗎 152)	125 – **500** – 1000 kBd
P5-03	11107	503	Modbus RTU baud rate (→ 🗎 152)	9.6 – **115.2 / 115200 Bd**
P5-04	11108	504	Modbus RTU data format (→ 🗎 153)	**n-1: no parity, 1 stop bit**
P5-05	11109	505	Reaction to communication failure/timeout (→ 🗎 153)	**2: Stop ramp (without fault)**
P5-06	11110	506	Timeout communication failure for SBus and Modbus (→ 🗎 153)	0.0 – **1.0** – 5.0 sec.
P5-07	11111	507	Ramp specified via fieldbus (→ 🗎 153)	**0: Deactivated**
P5-08	11112	508	Synchronization duration (→ 🗎 153)	**0**, 5 – 20 ms
P5-09	11369	509	Fieldbus PO2 definition (→ 🗎 154)	0 – 7
P5-10	11370	510	Fieldbus PO3 definition (→ 🗎 154)	0 – 7
P5-11	11371	511	Fieldbus PO4 definition (→ 🗎 154)	0 – 7
P5-12	11372	512	Fieldbus PE2 definition (→ 🗎 155)	0 – 11
P5-13	11373	513	Fieldbus PE3 definition (→ 🗎 155)	0 – 11
P5-14	11374	514	Fieldbus PE4 definition (→ 🗎 155)	0 – 11
P5-15	11360	515	Expansion relay 3 function selection (→ 🗎 155)	0 – 10
P5-16	11361	516	Relay 3 maximum limit (→ 🗎 155)	0.0 – **100.0** – 200.0%
P5-17	11362	517	Relay 3 minimum limit (→ 🗎 155)	**0.0** – 200.0%
P5-18	11363	518	Expansion relay 4 function selection (→ 🗎 155)	as *P5-15*
P5-19	11364	519	Relay 4 maximum limit (→ 🗎 155)	0.0 – **100.0** – 200.0%
P5-20	11365	520	Relay 4 minimum limit (→ 🗎 156)	**0.0** – 200.0%
P6-01	11115	601	Firmware upgrade activation (→ 🗎 156)	**0: Deactivated**
P6-02	11116	602	Automatic thermal management (→ 🗎 156)	**1: Activated**
P6-03	11117	603	Auto-reset delay time (→ 🗎 156)	1 – **20** – 60 sec.
P6-04	11118	604	Hysteresis band user relay/analog outputs (→ 🗎 156)	0.0 – **0.3** – 25.0%
P6-05	11119	605	Activation of encoder feedback (→ 🗎 157)	**0: Deactivated**
P6-06	11120	606	PPR count (→ 🗎 157)	**0** – 65535 PPR
P6-07	11121	607	Trigger threshold speed error/speed monitoring (→ 🗎 157)	1.0 – **5.0** – 100%
P6-08	11122	608	Max. frequency for speed setpoint (→ 🗎 157)	0; **5** – 20 kHz
P6-09	11123	609	Droop speed/load distribution control (→ 🗎 158)	**0.0** – 25.0%
P6-10	11124	610	Reserved (→ 🗎 158)	
P6-11	11125	611	Speed holding time on enable (→ 🗎 158)	**0.0** – 250 sec.
P6-12	11126	612	Speed holding time on barring (→ 🗎 158)	**0.0** – 250 sec.
P6-13	11127	613	Fire mode logic/emergency mode (→ 🗎 158)	**0: Open trigger: Fire mode**
P6-14	11128	614	Fire mode/emergency mode speed (→ 🗎 159)	-P1-01 – **0** – P1-01 Hz
P6-15	11129	615	Analog output 1 scaling (→ 🗎 159)	0.0 – **100.0** – 500.0%

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Parameter	CANopen/ SBus index	Modbus register	Description	Setting range Factory setting
P6-16	11130	616	Analog output 1 offset (→ 🗎 159)	-500.0 – **0.0** – 500.0%
P6-17	11131	617	Max. torque limit timeout (→ 🗎 160)	0.0 – **0.5** – 25.0 sec.
P6-18	11132	618	DC braking voltage level (→ 🗎 160)	Auto, **0.0** – 30.0%
P6-19	11133	619	Braking resistance value (→ 🗎 160)	**0**, Min-R – 200 Ω
P6-20	11134	620	Braking resistor power (→ 🗎 160)	**0.0** – 200 kW
P6-21	11135	621	Brake chopper operating cycle at undertemperature (→ 🗎 161)	**0.0** – 20.0%
P6-22	11136	622	Reset fan runtime (→ 🗎 161)	**0: Deactivated**
P6-23	11137	623	Reset kWh counter (→ 🗎 161)	**0: Deactivated**
P6-24	11138	624	Parameter factory settings (→ 🗎 161)	**0: Deactivated**
P6-25	11139	625	Access code level 3 (→ 🗎 161)	0 – **201** – 9 999
P6-26	11378	626	Parameter backup (→ 🗎 161)	0: Basic setting of the parameter
P7-01	11140	701	Motor stator resistance (Rs) (→ 🗎 162)	depending on the motor
P7-02	11141	702	Motor rotor resistance (Rr) (→ 🗎 162)	depending on the motor
P7-03	11142	703	Motor stator inductance (Lsd) (→ 🗎 163)	depending on the motor
P7-04	11143	704	Motor magnetizing current (Id rms) (→ 🗎 163)	10% × P1-08 − 80% × P1-08
P7-05	11144	705	Motor leakage loss coefficient (sigma) (→ 🗎 163)	0.025 – **0.10** – 0.25
P7-06	11145	706	Motor stator inductance (Lsq) − only for synchronous motors (→ 🗎 163)	depending on the motor
P7-07	11146	707	Enhanced generator control (→ 🗎 163)	**0: Deactivated**
P7-08	11147	708	Parameter adjustment (→ 🗎 163)	**0: Deactivated**
P7-09	11148	709	Overvoltage current limit (→ 🗎 163)	0.0 – **1.0** – 100%
P7-10	11149	710	Stiffness (for vector control) (→ 🗎 164)	0 – **10** – 600
P7-11	11150	711	Pulse width min. limit (→ 🗎 164)	0 – 500
P7-12	11151	712	Premagnetization time (→ 🗎 164)	0 – 5000 ms
P7-13	11152	713	D-gain vector speed controller (→ 🗎 164)	**0.0** – 400%
P7-14	11153	714	Low-frequency torque increase (→ 🗎 164)	**0.0** – 100%
P7-15	11154	715	Frequency limit for torque increase (→ 🗎 165)	**0.0** – 50%
P7-16	11155	716	Speed according to motor nameplate (→ 🗎 165)	**0.0** – 6000 min^{-1}
P8-01	11156	801	Simulated encoder scaling (→ 🗎 165)	$\mathbf{2}^0$ – 2^3
P8-02	11157	802	Input pulse scaling value (→ 🗎 165)	2^0 – $\mathbf{2}^{16}$
P8-03	11158	803	Lag error low word (→ 🗎 165)	0 – **65535**
P8-04	11159	804	Lag error high word (→ 🗎 165)	**0** – 65535
P8-05	11160	805	Reference travel type (→ 🗎 166)	**0: Deactivated**
P8-06	11161	806	Position controller proportional gain (→ 🗎 166)	0.0 – **1.0** – 400%
P8-07	11162	807	Touch probe trigger mode (→ 🗎 166)	**0: TP1 P edge TP2 P edge**
P8-08	11163	808	Reserved (→ 🗎 166)	
P8-09	11164	809	Speed precontrol gain (→ 🗎 166)	0 – **100** – 400%
P8-10	11165	810	Acceleration precontrol gain (→ 🗎 166)	**0** – 400%
P8-11	11166	811	Low-word reference offset (→ 🗎 166)	**0** – 65535
P8-12	11167	812	High-word reference offset (→ 🗎 167)	**0** – 65535
P8-13	11168	813	Reserved (→ 🗎 167)	
P8-14	11169	814	Reference enable torque (→ 🗎 167)	0 – **100** – 500%
P9-01	11171	901	Input source enable (→ 🗎 168)	SAFE, din-1 – din-8
P9-02	11172	902	Rapid stop input source (→ 🗎 169)	OFF, din-1 – din-8, On
P9-03	11173	903	Input source for clockwise rotation (CW) (→ 🗎 169)	OFF, din-1 – din-8, On
P9-04	11174	904	Input source for counterclockwise rotation (CCW) (→ 🗎 169)	OFF, din-1 – din-8, On
P9-05	11175	905	Latch function enable (→ 🗎 169)	OFF, ON
P9-06	11176	906	Direction of rotation reversal (→ 🗎 169)	OFF, din-1 – din-8, On

Parameter	CANopen/ SBus index	Modbus register	Description	Setting range Factory setting
P9-07	11177	907	Reset input source (→ 169)	OFF, din-1 – din-8, On
P9-08	11178	908	External fault input source (→ 169)	OFF, din-1 – din-8, On
P9-09	11179	909	Source for activating terminal control (→ 169)	OFF, din-1 – din-8, On
P9-10	11180	910	Setpoint source 1 (→ 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
P9-11	11181	911	Setpoint source 2 (→ 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
P9-12	11182	912	Setpoint source 3 (→ 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
P9-13	11183	913	Setpoint source 4 (→ 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
P9-14	11184	914	Setpoint source 5 (→ 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
P9-15	11185	915	Setpoint source 6 (→ 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
P9-16	11186	916	Setpoint source 7 (→ 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
P9-17	11187	917	Setpoint source 8 (→ 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
P9-18	11188	918	Input 0 for setpoint source selection (→ 171)	OFF, din-1 – din-8, On
P9-19	11189	919	Input 1 for setpoint source selection (→ 171)	OFF, din-1 – din-8, On
P9-20	11190	920	Input 2 for setpoint source selection (→ 171)	OFF, din-1 – din-8, On
P9-21	11191	921	Input 0 for fixed setpoint speed selection (→ 171)	OFF, din-1 – din-8, On
P9-22	11192	922	Input 1 for fixed setpoint speed selection (→ 172)	OFF, din-1 – din-8, On
P9-23	11193	923	Input 2 for fixed setpoint speed selection (→ 172)	OFF, din-1 – din-8, On
P9-24	11194	924	Positive jog mode input (→ 172)	OFF, din-1 – din-8
P9-25	11195	925	Negative jog mode input (→ 172)	OFF, din-1 – din-8
P9-26	11196	926	Input for reference travel enable (→ 172)	OFF, din-1 – din-8
P9-27	11197	927	Reference cam input (→ 172)	OFF, din-1 – din-8
P9-28	11198	928	Motor potentiometer up input source (→ 172)	OFF, din-1 – din-8
P9-29	11199	929	Motor potentiometer down input source (→ 172)	OFF, din-1 – din-8
P9-30	11200	930	Positive limit switch CW (→ 172)	OFF, din-1 – din-8
P9-31	11201	931	Negative limit switch CCW (→ 173)	OFF, din-1 – din-8
P9-32	11202	932	Selection of the deceleration ramp/rapid stop ramp (→ 173)	OFF, din-1 – din-8
P9-33	11203	933	Fire mode/emergency mode input selection (→ 173)	OFF, din-1 – din-5
P9-34	11204	934	PID fixed setpoint reference selection input 0 (→ 173)	**OFF**, din-1 – din-8
P9-35	11205	935	PID fixed setpoint reference selection input 1 (→ 173)	**OFF**, din-1 – din-8

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9.2 Explanation of the parameters

9.2.1 Parameter group 1: Basic parameters (level 1)

P1-01 Maximum speed

Setting range: *P1-02* – **50.0 Hz** – 5 × *P1-09* (max. 500 Hz)

Specifies the upper limit for the frequency (speed) that can be applied to the motor in any operating mode. This parameter is displayed in Hz in factory default state or when the parameter for the rated motor speed (*P1-10*) is set to zero. If the rated motor speed was entered in rpm in *P1-10*, this parameter will be displayed in rpm.

The maximum speed is also limited by the switching frequency set in *P2-24*. The limit is determined by the maximum output frequency to the motor = *P2-24: 16*.

P1-02 Minimum speed

Setting range: **0** – *P1-01* Hz

Specifies the lower limit for the frequency (speed) that can be applied to the motor in any operating mode. This parameter is displayed in Hz when factory settings are used or when the parameter for the rated motor speed (*P1-10*) is set to zero. If the rated motor speed was entered in min^{-1} in *P1-10*, this parameter will be displayed in min^{-1}.

The speed drops below this limit only when the inverter enable signal is removed and the inverter decreases the output frequency to zero.

P1-03 Acceleration ramp time

Setting range:

Sizes 2 + 3: 0.00 – **5.0** – 600 sec.

Sizes 4 – 7: 0.0 – **5.0** – 6000 sec.

Specifies the time in seconds during which the output frequency (speed) increases from 0 to 50 Hz. Note that the ramp time is not affected by changing either the maximum or minimum speed limit. The reason is that the ramp time refers to 50 Hz, not to the speed *P1-01*/*P1-02.*

P1-04 Deceleration ramp time

Setting range:

Sizes 2 + 3: Coast – 0.01 – **5.0** – 600 sec.

Sizes 4 – 7: Coast – 0.1 – **5.0** – 6000 sec.

Specifies the time in seconds during which the output frequency (speed) decreases from 50 to 0 Hz. Note that the ramp time is not affected by changing either the maximum or minimum speed limit. The reason is that the ramp time refers to 50 Hz, not to *P1-01*/*P1-02.*

A ramp of 0 sec. is displayed as "coast" as this value leads to coasting to a stop.

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P1-05 Stop mode

Defines the delay behavior of the drive for normal operation and power failure.

- 0: Stop ramp along the process P1-04
- 1: Coast, the motor runs down to an idle state in a non-controlled manner.

P1-06 Energy saving function

- **0: Off**
- 1: On

If this function is activated, the inverter continuously monitors the motor load condition by comparing the output current with the nominal motor current. If the motor rotates with a constant speed in the partial load range, the inverter automatically reduces the output voltage, thus reducing the motor's energy consumption. If the motor load increases or the frequency setpoint changes, the output voltage increases immediately. The energy-saving function works only if the inverter setpoint remains constant over a certain period of time.

Application examples include, for example, fan applications or conveyor belts for which the energy requirement in the range between full, empty or partial load trips is optimized.

This function is only applicable for asynchronous motors.

P1-07 Rated motor voltage

Setting range:

- 230 V inverter: 20 – **230** − 250 V
- 400 V inverter: 20 – **400/460**[1)] – 500 V
- 575 V inverter: 20 – **575** – 600 V

Specifies the nominal voltage of the motor connected to the inverter (in accordance with the motor nameplate). The parameter value is used in V/f speed control for controlling the output voltage applied to the motor. In V/f speed control, the output voltage of the inverter amounts to the value set in *P1-07* if the output speed corresponds to the motor base frequency set in *P1-09*.

"0V" = DC link compensation is disabled. When braking, the V/f ratio shifts as a result of the voltage increase in the DC link, resulting in greater motor losses. The motor heats up more. The additional motor losses during braking might make a braking resistor redundant.

1) 460 V American version only

P1-08 Rated motor current

Setting range: 20 – 100% of the inverter output current. Is given as absolute value in ampere.

Specifies the rated current of the motor connected to the inverter (according to the motor nameplate). This allows the inverter to match its internal thermal motor protection (I x t protection) to the motor.

If the inverter output current is > 100% of the nominal motor current, the inverter switches off the motor after a certain amount of time (I.-trP) before there is any thermal damage to the motor.

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P1-09 Rated motor frequency

Setting range: 25 – **50/60**[1] – 500 Hz

Specifies the rated frequency of the motor connected to the inverter (according to the motor nameplate). This is the frequency at which the maximum (rated) output voltage is applied to the motor. Above this frequency, the voltage applied to the motor remains constant at its maximum value.

1) 60 Hz (only American version)

P1-10 Rated motor speed

Setting range: **0** – 30 000 min^{-1}

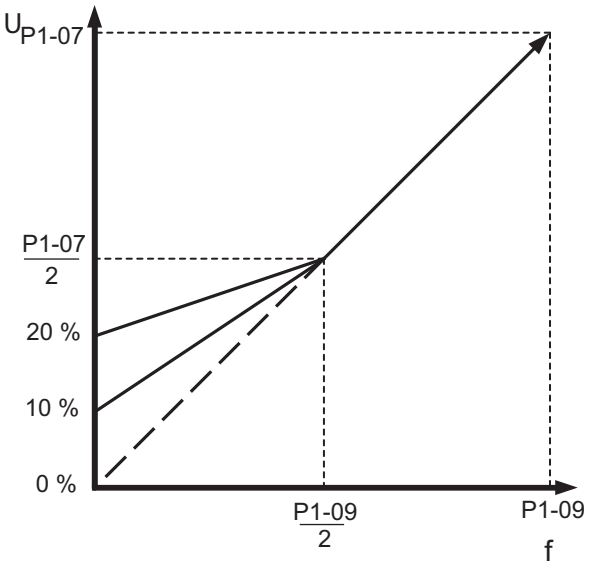
Specifies the rated speed of the motor. When the parameter is ≠ 0, all speed-related parameters, such as minimum speed and maximum speed, are displayed in "min^{-1}".

The slip compensation is activated at the same time. The frequency or speed shown on the display of the inverter corresponds to the calculated rotor frequency or rotor speed.

P1-11 Voltage increase, boost

Setting range: Auto / 0 – 30% (voltage and power-dependent)

Determines the voltage increase at low speeds in order to facilitate the removal of applied loads. Modifies the V/f limit values by ½ *P1-07* and ½ *P1-09*.



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A value is automatically set with the setting "Auto". This is based on the motor data measured during the dimensioning process.

P1-12 Control signal source

- **0: Terminal mode**
- 1: Keypad mode unipolar
- 2: Keypad mode bipolar
- 3: PID controller mode
- 4: Slave mode
- 5: SBus MOVILINK®
- 6: CANopen
- 7: Modbus RTU or fieldbus interface
- 8: MultiMotion

INFORMATION

As soon as you use a communication option or an encoder card in the option card slot, communication via Modbus is no longer possible.

P1-13 Error history

Ring memory of the last 4 errors.

You can toggle between sub-items by pressing the <Up>/<Down> keys. Multiple consecutive undervoltage errors are only listed once as these inevitably occur at each power OFF.

P1-14 Extended parameter access

Setting range: **0** – 30000

This parameter allows access to all parameters. Access is possible when the following values are valid.

- **0: P1-01 – P1-15** (basis parameter)
- 1: *P1-01* – *P1-22* (basis + servo parameter)
- 101[1)]: *P0-01* – *P5-20* (extended parameters)
- 201[2)]: *P0-01* – *P9-33* (Extended parameter menu → full access)

1) Code defined in P2-40
2) Code defined in P6-25

P1-15 Digital input function selection

Setting range: 0 – **1** – 26

Users can set the function of the digital inputs of the inverter, that is the user can parameterize the functions required for the application.

The following tables list the functions of the digital inputs depending on the value set in parameters *P1-12* (terminal/keypad/SBus control) and *P1-15* (selection of the digital input functions).

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INFORMATION

Individual configuration of digital inputs:

To individually configure the digital input assignment, set parameter *P1-15* to "0". The input terminals for DI1 – DI5 (with option DI1 – DI8) are thus set to "no function" and can be freely assigned via parameter group 9.

P1-15	Digital input 1	Digital input 2	Digital input 3	Analog input 1/digital input 4	Analog input 2/digital input 5	Comments
0	No function P9-xx	No function P9-xx	No function P9-xx	No function P9-xx	No function P9-xx	Configuration via parameter group P9-xx.
1	**0: Stop** **1: Enable + start**	**0: CW rotation** **1: CCW rotation**	**0: Selected speed setpoint (P1-12)** **1: Fixed setpoint speed 1, 2**	**Speed setpoint analog 1**	**0: Fixed setpoint speed 1** **1: Fixed setpoint speed 2**	**–**
2	0: Stop 1: Enable + start	0: CW rotation 1: CCW rotation	0: Open	0: Open	0: Open	Fixed setpoint speed 1
			1: Applied	0: Open	0: Open	Fixed setpoint speed 2
			0: Open	1: Applied	0: Open	Fixed setpoint speed 3
			1: Applied	1: Applied	0: Open	Fixed setpoint speed 4
			0: Open	0: Open	1: Applied	Fixed setpoint speed 5
			1: Applied	0: Open	1: Applied	Fixed setpoint speed 6
			0: Open	1: Applied	1: Applied	Fixed setpoint speed 7
			1: Applied	1: Applied	1: Applied	Fixed setpoint speed 8
3	0: Stop 1: Enable + start	0: CW rotation 1: CCW rotation	0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1	Speed setpoint analog 1	Torque reference analog. Set *P4-06* = 2 here.	–
4	0: Stop 1: Enable + start	0: CW rotation 1: CCW rotation	0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1	Speed setpoint analog 1	0: Decel. ramp P1-04 1: Decel. ramp P2-25	–
5	0: Stop 1: Enable + start	0: CW rotation 1: CCW rotation	0: Selected speed setpoint (P1-12) 1: Speed setpoint analog input 2	Speed setpoint analog 1	Speed setpoint analog 2	–
6	0: Stop 1: Enable + start	0: CW rotation 1: CCW rotation	0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1	Speed setpoint analog 1	External error[1)] 0: Error 1: Start	–
7	0: Stop 1: Enable + start	0: CW rotation 1: CCW rotation	0: Open	0: Open	External error[1)] 0: Error 1: Start	Fixed setpoint speed 1
			1: Applied	0: Open		Fixed setpoint speed 2
			0: Open	1: Applied		Fixed setpoint speed 3
			1: Applied	1: Applied		Fixed setpoint speed 4

P1-15	Digital input 1	Digital input 2	Digital input 3	Analog input 1/digital input 4	Analog input 2/digital input 5	Comments
8	0: Stop 1: Enable + start	0: CW rotation 1: CCW rotation	0: Open	0: Open	0: Decel. ramp P1-04 1: Decel. ramp P2-25	Fixed setpoint speed 1
			1: Applied	0: Open		Fixed setpoint speed 2
			0: Open	1: Applied		Fixed setpoint speed 3
			1: Applied	1: Applied		Fixed setpoint speed 4
9	0: Stop 1: Enable + start	0: CW rotation 1: CCW rotation	0: Open	0: Open	Setpoint changeover 0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1 – 4	Fixed setpoint speed 1
			1: Applied	0: Open		Fixed setpoint speed 2
			0: Open	1: Applied		Fixed setpoint speed 3
			1: Applied	1: Applied		Fixed setpoint speed 4
10	0: Stop 1: Enable + start	0: CW rotation 1: CCW rotation	Speed up pushbutton (NO contact)	Speed down pushbutton (NO contact)	Setpoint changeover 0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1	Motor potentiometer mode when P1-12 = 0
			If both inputs are active, deceleration is along ramp P1-04.			
11	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1, 2	Speed setpoint analog 1	0: Fixed setpoint speed 1 1: Fixed setpoint speed 2	–
	When both inputs are active, rapid stop ramp (P2-25) is activated.					
12	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	0: Open	0: Open	0: Open	Fixed setpoint speed 1
			1: Applied	0: Open	0: Open	Fixed setpoint speed 2
			0: Open	1: Applied	0: Open	Fixed setpoint speed 3
			1: Applied	1: Applied	0: Open	Fixed setpoint speed 4
			0: Open	0: Open	1: Applied	Fixed setpoint speed 5
			1: Applied	0: Open	1: Applied	Fixed setpoint speed 6
	When both inputs are active, rapid stop ramp (P2-25) is activated.		0: Open	1: Applied	1: Applied	Fixed setpoint speed 7
			1: Applied	1: Applied	1: Applied	Fixed setpoint speed 8
13	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1	Speed setpoint analog 1	Torque reference analog Set *P4-06* = 2 here.	–
	When both inputs are active, rapid stop ramp (P2-25) is activated.					
14	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1	Speed setpoint analog 1	0: Decel. ramp P1-04 1: Decel. ramp P2-25	–
	When both inputs are active, rapid stop ramp (P2-25) is activated.					
15	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	0: Selected speed setpoint (P1-12) 1: Speed setpoint analog input 2	Speed setpoint analog 1	Speed setpoint analog 2	–
	When both inputs are active, rapid stop ramp (P2-25) is activated.					

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P1-15	Digital input 1	Digital input 2	Digital input 3	Analog input 1/digital input 4	Analog input 2/digital input 5	Comments
16	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1	Speed setpoint analog 1	External error[1)] 0: Error 1: Start	–
	When both inputs are active, rapid stop ramp (P2-25) is activated.					
17	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	0: Open	0: Open	External error[1)] 0: Error 1: Start	Fixed setpoint speed 1
			1: Applied	0: Open		Fixed setpoint speed 2
	When both inputs are active, rapid stop ramp (P2-25) is activated.		0: Open	1: Applied		Fixed setpoint speed 3
			1: Applied	1: Applied		Fixed setpoint speed 4
18	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	0: Open	0: Open	0: Decel. ramp P1-04 1: Decel. ramp P2-25	Fixed setpoint speed 1
			1: Applied	0: Open		Fixed setpoint speed 2
	When both inputs are active, rapid stop ramp (P2-25) is activated.		0: Open	1: Applied		Fixed setpoint speed 3
			1: Applied	1: Applied		Fixed setpoint speed 4
19	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	0: Open	0: Open	Setpoint changeover 0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1 – 4	Fixed setpoint speed 1
			1: Applied	0: Open		Fixed setpoint speed 2
	When both inputs are active, rapid stop ramp (P2-25) is activated.		0: Open	1: Applied		Fixed setpoint speed 3
			1: Applied	1: Applied		Fixed setpoint speed 4
20	0: Stop 1: Enable + start clockwise rotation	0: Stop 1: Enable + start counterclockwise rotation	Speed up pushbutton (NO contact)	Speed down pushbutton (NO contact)	Setpoint changeover 0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1	Motor potentiometer mode when P1-12 = 0
	When both inputs are active, rapid stop ramp (P2-25) is activated.		If both inputs are active, deceleration is along ramp P1-04.			
21	Enable + start CW rotation pushbutton (NO contact)	Stop pushbutton (NC contact)	Enable + start CCW rotation pushbutton (NO contact)	Speed setpoint analog 1	Setpoint changeover 0: Selected speed setpoint (P1-12) 1: Fixed setpoint speed 1	3-Wire control when P1-12 = 0
22	0: Normal operation 1: Reference cam	0: Normal operation 1: Jog speed +	0: Normal operation 1: Jog speed –	Speed setpoint	0: Normal operation 1: Reference travel start	Only in combination with LTX encoder card
23	0: Normal operation 1: Reference cam	0: Limit switch + 1: Normal operation	0: Limit switch – 1: Normal operation	Speed setpoint	0: Normal operation 1: Reference travel start	Only in combination with LTX encoder card
24	0: Controller inhibit 1: Enable	0: Normal operation 1: Jog speed +	0: Normal operation 1: Jog speed –	Speed setpoint	0: Normal operation 1: Reference cam	Only in combination with LTX encoder card
25	0: Controller inhibit 1: Enable	0: Limit switch + 1: Normal operation	0: Limit switch – 1: Normal operation	Speed setpoint	0: Normal operation 1: Reference cam	Only in combination with LTX encoder card
26	0: Stop (controller inhibit) 1: Enable	No function	No function	Speed setpoint	Speed setpoint	Only in combination with LTX encoder card

1) The external error is defined in parameter P2-33.

INFORMATION

When using a TF/TH, KTY or PT1000, set *P2-33* to PTC-th, KTY or PT1000. See also the connection information in chapter "Motor temperature protection TF, TH, KTY84, PT1000" (→ 🗎 32).

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9.2.2 Parameter group 1: Servo-specific parameters (level 1)

P1-16 Motor type

This parameter is intended only for startup of the Smart Servo package (LTX) or MGF..-DSM.

The parameter must not be used in all other cases.

This parameter is available for the following inverters:

IP20	IP66
• 230 V: 0.75 – 5.5 kW • 400 V: 0.75 – 11 kW	• 230 V: 0.75 – 4 kW • 400 V: 0.75 – 7.5 kW

Setting the motor type:

Display value	Motor type	Explanation
In-Syn	Induction motor	Default setting. Do not change if none of the selection options match. Choose induction motor or permanent magnet motor in parameter *P4-01*.
Syn	Undefined servomotor	Undefined servomotor. You must set special servo parameters during startup. In this case, you must set *P4-01* to synchronous motor control.
40M 2 40M 4	230 V / 400 V CMP40M	Preset CMP motors from SEW-EURODRIVE. Selecting one of those motor types will automatically set all the motor-specific parameters. The overload behavior is set to 200% for 60 sec. and 250% for 2 sec. Only motor data of CMP.. motors of speed class 4500 min^{-1} with an AK0H encoder are included. Observe the Smart Servo Package.
40M 2b 40M 4b	230 V / 400 V CMP40M with brake	
50S 2 50S 4	230 V / 400 V CMP50S	
50S 2b 50S 4b	230 V / 400 V CMP50S with brake	
50M 2 50M 4	230 V / 400 V CMP50M	
50M 2b 50M 4b	230 V / 400 V CMP50M with brake	
50L 2 50L 4	230 V / 400 V CMP50L	
50L 2b 50L 4b	230 V / 400 V CMP50L with brake	
63S 2 63S 4	230 V / 400 V CMP63S	
63S 2b 63S 4b	230 V / 400 V CMP63S with brake	
63M 2 63M 4	230 V / 400 V CMP63M	
63M 2b 63M 4b	230 V / 400 V CMP63M with brake	
63L 2 63L 4	230 V / 400 V CMP63L	
63L 2b 63L 4b	230 V / 400 V CMP63L with brake	
71S 2 71S 4	230 V / 400 V CMP71S	
71S 2b 71S 4b	230 V / 400 V CMP71S with brake	
71M 2 71M 4	230 V / 400 V CMP71M	
71M 2b 71M 4b	230 V / 400 V CMP71M with brake	
71L 2 71L 4	230 V / 400 V CMP71L	
71L 2b 71L 4b	230 V / 400 V CMP71L with brake	

Display value	Motor type	Explanation
gF-2	MGF..2-DSM-B	If a MGF..-DSM is selected, the 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". All necessary motor data are set automatically.
gF-4	MGF..4-DSM-B	
gF-4Ht	MGF..4-DSM-B/XT	
gF-1c	MGF..1-DSM-C	
gF-2c[1)]	MGF..2-DSM-C	
gF-4c[1)]	MGF..4-DSM-C	
gF4Htc[1)]	MGF..4-DSM-C/XT	

1) in preparation

P1-17 Servo module function selection (for LTX only)

Setting range: 0 − **1** – 8

Determines the function of the servo module I/O. See chapter "*P1-17* Servomodule function selection" in the addendum to the MOVITRAC® LTX operating instructions.

Only use in connection with the LTX encoder card.

P1-18 Motor thermistor selection (for LTX only)

- **0: Deactivated**
- 1: KTY

If a motor is selected via *P1-16*, this parameter will be activated.

Only use in connection with the LTX encoder card.

P1-19 Inverter address

Setting range: 0 − **1** – 63

Mirror parameter of *P5-01*. Changing *P1-19* will have an immediate effect on *P5-01*.

Only use in connection with the LTX encoder card.

P1-20 SBus baud rate

Setting range: 125, 250, **500**, 1 000 kBd

Mirror parameter of *P5-02*. Changing *P1-20* will have an immediate effect on *P5-02*.

Only use in connection with the LTX encoder card.

P1-21 Stiffness (for LTX only)

Setting range: 0.50 – **1.00** – 2.00

Always use *P7-10* in the open control loop.

Only use in connection with the LTX encoder card.

P1-22 Inertia ratio between motor and load (for LTX only)

Setting range: 0.0 – **1.0** – 30.0

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The inertia ratio between motor and connected load can be specified in this parameter. This value can usually remain set to the default value "1.0". However, the inertia ratio is used by the control algorithm as precontrol value for CMP../synchronous motors from *P1-16* to provide the optimal torque/current for accelerating the load. This is why the exact setting of the inertia ratio improves the response characteristics and the dynamics of the system. For a closed control loop, the value is calculated as follows:

$$P1-22 = \frac{J_{ext}}{J_{mot}}$$

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If you do not know the value, keep the default setting "1.0".

Only use in connection with the LTX encoder card.

9.2.3 Parameter group 2: Extended parameter setting (level 2)

P2-01 – P2-08

If parameter *P1-10* is set to “0”, the following parameters *P2-01* to *P2-08* can each be changed in steps of 0.1 Hz.

If parameter *P1-10 ≠ 0*, the following parameters *P2-01* to *P2-08* can be changed in the following steps:

- *P1-09* ≤ 100 Hz → in 1 (min^{-1})
- 100 Hz < *P1-09* ≤ 200 Hz → in 2 (min^{-1})
- *P1-09* > 200 Hz → in 4 (min^{-1}).

Negative speeds or frequencies can also be set.

P2-01 Fixed setpoint speed 1

Setting range: *-P1-01* – **5.0 Hz** – *P1-01*

Is also used as jog speed.

P2-02 Fixed setpoint speed 2

Setting range: *-P1-01* – **10.0 Hz** – *P1-01*

P2-03 Fixed setpoint speed 3

Setting range: *-P1-01* – **25.0 Hz** – *P1-01*

P2-04 Fixed setpoint speed 4

Setting range: *-P1-01* – **50.0 Hz** – *P1-01*

P2-05 Fixed setpoint speed 5

Setting range: *-P1-01* – **0.0 Hz** – *P1-01*

Is also used as reference travel speed.

P2-06 Fixed setpoint speed 6

Setting range: *-P1-01* – **0.0 Hz** – *P1-01*

Is also used as reference travel speed.

P2-07 Fixed setpoint speed 7

Setting range: *-P1-01* – 0.0 Hz – *P1-01*

Also used for brake release speed in hoist mode.

P2-08 Fixed setpoint speed 8

Setting range: *-P1-01* – 0.0 Hz – *P1-01*

Also used for brake application speed in hoist mode.

P2-09/P2-10 Skip frequency/skip frequency band

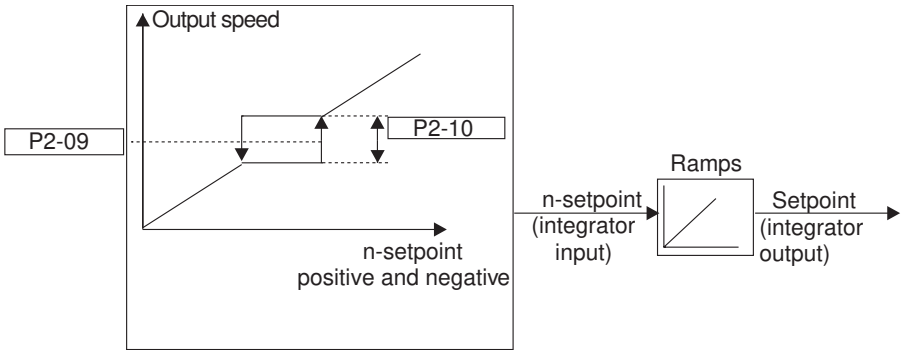
Setting range *P2-09*: **P1-02** – *P1-01*

Setting range *P2-10*: **0.0 Hz** – *P1-01*

In some applications, mechanical resonance vibrations may occur in certain speed ranges. This may have a negative effect on the machine behavior.

The speed skip function can be used to skip the interfering speed range. The input speed performs the depicted hysteresis with the ramps specified in P1-03 and P1-04.

If the setpoint speed is within the skipped frequency range, the actual speed remains on the upper or lower limit of the frequency range, depending on the previous setpoint.



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P2-11/P2-13 Analog outputs

Digital output mode: 0 V / 24 V

Setting	Function	Explanation
0	Inverter enabled (digital)	Logic 1 if the inverter is enabled.
1	/Failure. Inverter ready (digital)	Logic 1 when the inverter is ready. (No error)
2	Motor at setpoint speed (digital)	Logic 1 if output frequency = setpoint frequency (hysteresis *P6-04*).
3	Motor speed > 0 (digital)	Logic 1 if output frequency > speed 0 min^{-1} (hysteresis *P6-04*).
4	Motor speed ≥ limit value (digital)	Logic 1 if the level is greater than or equal to the value set in parameter "Upper user relay limit/analog output". Logic 0 if the level is below the value set in parameter "Lower user relay limit/analog output".
5	Motor current ≥ limit value (digital)	
6	Motor torque ≥ limit value (digital)	
7	Analog input 2 ≥ limit value (digital)	
13	Fieldbus/SBus (digital)	Control of the digital output via fieldbus/SBus. Logic 1 if 0x0001 via fieldbus. Logic 0 with all other values.

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Analog output mode: 0 – 10 V or 0 / 4 – 20 mA

Setting	Function	Explanation
8	Motor speed (analog)	The amplitude of the analog output signal represents the motor speed. It is scaled from 0 to the maximum speed limit defined in *P1-01*.
9	Motor current (analog)	The amplitude of the analog output signal represents the inverter output current (torque). It is scaled from 0 to 200% of the rated motor current defined in *P1-08*.
10	Motor torque (analog)	
11	Motor power (analog)	The amplitude of the analog output signal represents the apparent output power of the inverter. It is scaled from 0 to 200% of the inverter nominal power.
12	Fieldbus/SBus (analog)	Control of the analog output via fieldbus/SBus. 0x1000 = 100% of the format setting.

P2-11 Analog output 1 function selection

Setting range: 0 – **8** – 13

See table "P2-11/P2-13 Analog outputs" (→ 🗎 134).

P2-12 Analog output 1 format

- **0: 0 – 10 V**
- 1: 10 – 0 V
- 2: 0 – 20 mA
- 3: 20 – 0 mA
- 4: 4 – 20 mA
- 5: 20 – 4 mA

P2-13 Analog output 2 function selection

Setting range: 0 – **9** – 13

See table "P2-11/P2-13 Analog outputs" (→ 🗎 134).

P2-14 Analog output 2 format

- **0: 0 – 10 V**
- 1: 10 – 0 V
- 2: 0 – 20 mA
- 3: 20 – 0 mA
- 4: 4 – 20 mA
- 5: 20 – 4 mA

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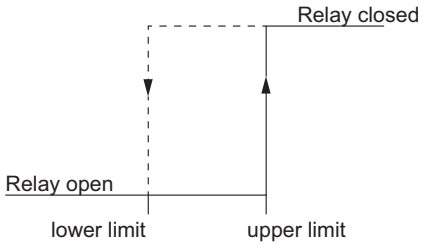
P2-15/P2-20 Relay outputs

The function of the relay outputs can be selected according to the table below. If a relay is controlled depending on a limit value, it reacts as follows:



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settings	Function	Explanation
0	Inverter enabled	Relay contact closed when the inverter is enabled.
1	/Failure. Inverter ready	Relay contact closed when inverter is operable (no error).
2	Motor at setpoint speed	Relay contact closed if output frequency = setpoint frequency (hysteresis *P6-04*).
3	Motor speed ≥ 0	Relay contact closed if output frequency > speed 0 min^{-1} (hysteresis *P6-04*).
4	Motor speed ≥ limit value	Relay contact closed if the level is greater than or equal to the value set in parameter "Upper user relay limit/analog output". Relay contact open if the level is below the value set in parameter "Lower user relay limit/analog output".
5	Motor current ≥ limit value	
6	Motor torque ≥ limit value	
7	Analog input 2 ≥ limit value	
8	Hoist (for *P2-18* only)	This setting is made automatically if the hoist function is activated via *P4-12*. The inverter controls the relay according to the hoist function.
9	STO status	Relay contacts closed if STO circuit is supplied with 24 V. Relay contacts open if STO circuit is open (inverter indicates "inhibit").
10	PID error ≥ limit value	Relay contact closed when the control error is greater than or equal to the value set in parameter "User relay upper limit". Relay contact closed when the control error is less than the value set in parameter "User relay lower limit". The relay opens also with negative control errors.
11[1)]	Drive referenced	Relay contacts closed when the inverter is referenced. This option is available only with LTX servo module and only for the following inverters: • 230 V: 0.75 – 5.5 kW • 400 V: 0.75 – 11 kW

1) Only in connection with LTX.

P2-15 User relay output 1 function selection

Setting range: 0 – **1** – 11

See table "P2-15/P2-20 Relay outputs" (→ 🗎 136).

P2-16 Upper user relay limit 1 / analog output 1

Setting range: 0.0 – **100.0** – 200.0%

P2-17 Lower user relay limit 1 / analog output 1

Setting range: **0.0** – P2-16%

P2-18 User relay output 2 function selection

Setting range: 0 – **3** – 11

See table "P2-15/P2-20 Relay outputs" (→ 🗎 136).

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P2-19 Upper user relay limit 2 / analog output 2

Setting range: 0.0 – **100.0** – 200.0%

P2-20 Lower user relay limit 2 / analog output 2

Setting range: **0.0** – P2-19%

P2-21/P2-22 Display scaling

A user-defined display value can be scaled and shown on the display with the following two parameters *P2-21/P2-22*.

This value is marked by a small "c" in the display and can be called up by briefly pressing the "Navigate" key.

Scaled display value = *P2-21* × *P2-22*

P2-21 Display scaling factor

Setting range: -30000 – **0.000** – 30000

In inverter mode, the setting serves as the scaling factor.

In operation with an SEW controller CCU/PLC, the setting serves to reverse the direction of rotation. If the value is negative, the velocity control is inverted. A restart of the controller is necessary after changing the value.

P2-22 Display scaling source

- 0: Motor speed information is used as the scaling source.
- 1: Motor current information is used as the scaling source.
- 2: The value of the second analog input is used as the scaling source. In this case, the range of input values is 0 to 4096.

P2-23 Zero speed holding time

Setting range: 0.0 – **0.2** – 60.0 sec.

As soon as the inverter is locked, the output frequency is decreased along the ramp to the minimum speed and remains there for the time defined here before the output stage is switched off.

If *P2-23* = 0, the output stage of the inverter is switched off immediately once the minimum speed is reached.

P2-24 PWM switching frequency

Setting range: 2 – 16 kHz (power-dependent)

Specifies the pulse width modulated switching frequency. A higher switching frequency means less motor noise, but also higher losses in the output stage. The maximum switching frequency depends on the inverter power rating.

The inverter reduces the switching frequency automatically when the heat sink temperature is excessively high. This automatic protection function can be deactivated with *P6-02*.

P2-25 Second deceleration ramp, rapid stop ramp

Setting range:

Sizes 2 + 3: Coast – 0.01 – **2.0** – 600 sec.

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Sizes 4 – 7: Coast – 0.1 – **2.0** – 6000 sec.

Is selected automatically in the event of a power failure if *P2-38* = 2.

Can also be selected using digital inputs depending on other parameter settings. With setting "0", the motor coasts to a halt.

P2-26 Flying start enable

When the flying start function is enabled, the inverter first determines the current rotor speed.

This causes a short delay between enable and start-up.

This function protects the inverter against overcurrent errors when switching to rotating motors.

- **0: Deactivated**
- 1: Activated

P2-27 Standby mode

Setting range: **0.0** – 250 sec.

When *P2-27* > 0, the inverter goes to standby mode if the minimum speed is maintained beyond the time specified in *P2-27*. This function is deactivated when *P2-23* > 0 or *P4-12*=1.

P2-28 Slave speed scaling

- **0: Deactivated**
- 1: Slave setpoint speed = master actual speed × *P2-29*
- 2: Slave setpoint speed = master actual speed × *P2-29* + analog input 1 reference
- 3: Slave setpoint speed = master actual speed × *P2-29* × analog input 1 reference

P2-29 Slave speed scaling factor

Setting range: -500 – **100** – 500%

P2-30 Analog input 1 format

- **0: 0 – 10 V / unipolar voltage range**
- 1: 10 – 0 V / unipolar voltage range
- 2: -10 – 10 V / bipolar voltage input
- 3: 0 – 20 mA / current input
- 4: t4 – 20 mA / current input
- 5: r4 – 20 mA / current input
- 6: t20 – 4 mA / current input
- 7: r20 – 4 mA / current input

"t.." indicates that the inverter shuts down when the signal is removed while the inverter is enabled. t4 – 20 mA, t20 – 4 mA

"r.." indicates that the inverter moves along a ramp to *P1-02* when the signal is removed while the inverter is enabled. r4 – 20 mA, r20-4 mA

P2-31 Analog input 1 scaling

Setting range: 0 – **100** – 500%

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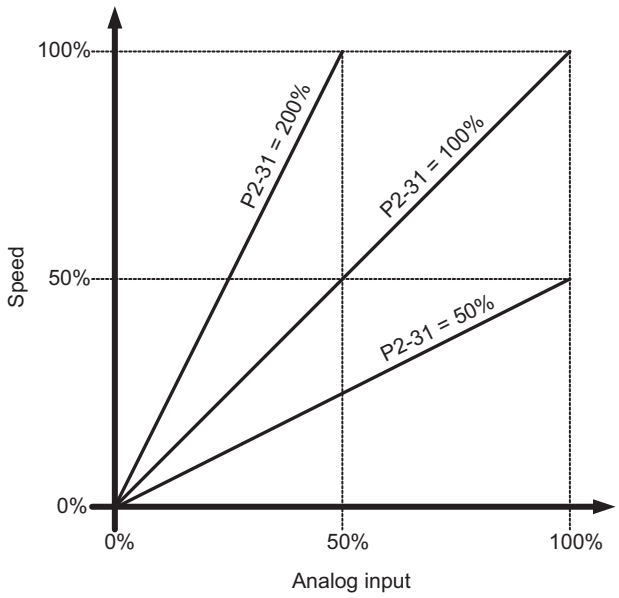
Additional scaling and offset examples can be found in chapter "Examples of analog input scaling and offset setting" (→ 🗎 80)



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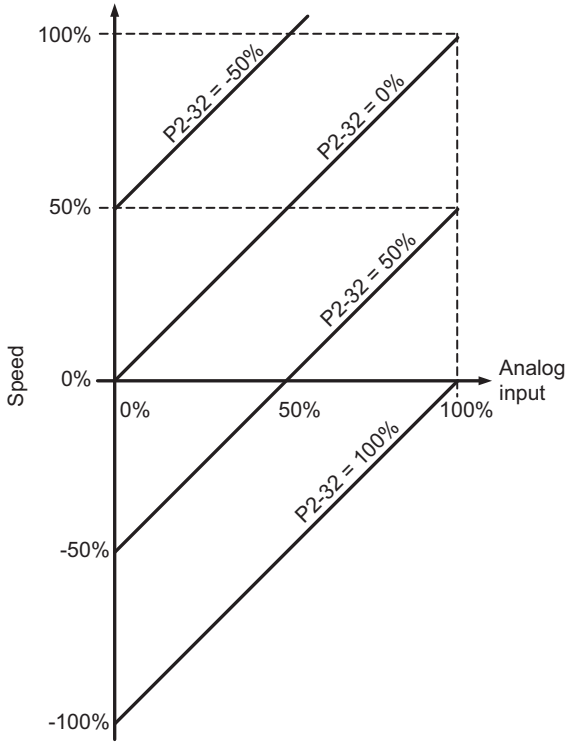
P2-32 Analog input 1 offset

Setting range: -500 – **0** – 500%

Additional scaling and offset examples can be found in chapter "Examples of analog input scaling and offset setting" (→ 🗎 80)



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P2-33 Analog input 2 format / motor protection

- **0: 0 – 10 V** / unipolar voltage input

- 1: 10 – 0 V / unipolar voltage input
- 2: PTC-th / motor thermistor input
- 3: 0 – 20 mA / current input
- 4: t4 – 20 mA / current input
- 5: r4 – 20 mA / current input
- 6: t20 – 4 mA / current input
- 7: r 20 – 4 mA / current input
- 8: ty-b / KTY84 motor temperature sensor (120 °C trigger, 100 °C reset)
- 9: ty-F / KTY84 motor temperature sensor (155 °C trigger, 125 °C reset)
- 10: ty-H / KTY84 motor temperature sensor (180 °C trigger, 160 °C reset)
- 11: Pt-b / PT1000 motor temperature sensor (120 °C trigger, 100°°C reset)
- 12: Pt-F / PT1000 motor temperature sensor (155 °C trigger, 125°°C reset)
- 13: Pt-H / PT1000 motor temperature sensor (180 °C trigger, 160°°C reset)

"t.." indicates that the inverter shuts down when the signal is removed while the inverter is enabled. t4 – 20 mA, t20 – 4 mA

"r.." indicates that the inverter moves along a ramp to *P1-02* when the signal is removed while the inverter is enabled. r4 – 20 mA, r20-4 mA

P2-34 Analog input 2 scaling

Setting range: 0 – **100** – 500%

Additional scaling and offset examples can be found in chapter "Examples of analog input scaling and offset setting" (→ 🗎 80)

P2-35 Analog input 2 offset

Setting range: -500 – **0** – 500%

Additional scaling and offset examples can be found in chapter "Examples of analog input scaling and offset setting" (→ 🗎 80)

P2-36 Start mode selection

The selection of the start mode defines the inverter behavior with reference to the enable digital input and configures the automatic restart function.

Setting range: Edge-r – **Auto-0** – Auto-5

Edge-r

- Edge-r: After activation or resetting of an error (Reset), the inverter does not start automatically, even if an enable signal is still present at the relevant digital input. To start the inverter after activation or resetting (Reset), the signal must first be deleted (open switch) and then reset (close switch).

Auto-0

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⚠ WARNING

With the setting "Auto-0" and set enable signal, there is a danger of an automatic restart of the drive after an error message has been acknowledged (reset) or after switch-on (voltage on).

Fatal or severe injuries and damage to property

- Disconnect the device from the supply system before rectifying a fault if automatic restart of the driven machine after fault elimination is not permitted for safety reasons.
- After a reset, make sure that the drive can start up automatically depending on the setting.
- Prevent the drive from starting up inadvertently, for example by activating STO.

- **Auto-0**: After activation or resetting (Reset), the inverter starts automatically if an enable signal is still present at the relevant digital input.

Auto-1 – Auto-5

⚠ WARNING

With the setting "Auto-1 – Auto-5" and set enable signal, there is a danger of an automatic restart of the drive after fault elimination or after switch-on (voltage on) as the inverter tries 1 – 5 times to automatically acknowledge the error.

Fatal or severe injuries and damage to property

- Disconnect the device from the supply system before rectifying a fault if automatic restart of the driven machine after fault elimination is not permitted for safety reasons.
- After a reset, make sure that the drive can start up automatically depending on the setting.
- Prevent the drive from starting up inadvertently, for example by activating STO.

- Auto-1 – Auto-5: Following an error shutdown (trip), the inverter makes up to 5 attempts to restart at intervals of 20 seconds. The duration of the intervals is defined in *P6-03*. To reset the counter, the inverter must be de-energized. The number of attempted restarts is counted. If the inverter is unable to start the drive with the final attempt, a permanent error shutdown occurs, which can only be reset by pressing the “Reset” key.

P2-37 Keypad restart speed

Defines the inverter switching and enable behavior when controlled via the integrated keypad (*P1-12* = 1 or 2).

The selection depends on the setting in *P1-15*.

Setting range: 0 – **1** – 7

Switchover behavior when the setpoint source switches to keypad mode:	
0	The motor speed changes to the minimum speed from *P1-02*.
1	The motor speed changes to the last keypad speed set.
2	The current motor speed is taken on after switchover.
3	The motor speed changes to the fixed setpoint speed from *P2-08*.

Switchover behavior when the setpoint source switches to keypad mode:	
4[1)]	The motor speed changes to the minimum speed from *P1-02*.
5[1)]	The motor speed changes to the last keypad speed set.
6[1)]	The current motor speed is taken on after switchover.
7[1)]	The motor speed changes to the fixed setpoint speed from *P2-08*.

Switching behavior when the inverter is enabled in keypad mode:	
0	The motor starts with the minimum speed from *P1-02*.
1	The motor starts with the last keypad speed set.
2	The motor starts with the minimum speed from *P1-02*.
3	The motor starts with the fixed setpoint speed from *P2-08*.
4[1)]	The motor starts with the minimum speed from *P1-02*.
5[1)]	The motor starts with the last keypad speed set.
6[1)]	The motor starts with the minimum speed from *P1-02*.
7[1)]	The motor starts with the fixed setpoint speed from *P2-08*.

1) With the setting 4 – 7, the inverter is started with the corresponding enable digital input. The <Start> and <Stop>- keys on the keypad have no function. The speed can be changed with the <Up> and <Down> keys.

P2-38 Mains loss stop control

The control behavior of the inverter as response to a power failure while the inverter is enabled.

- **0**: The inverter attempts to continue operation by recovering energy from the motor under load. If the power failure lasts only briefly and if sufficient energy can be recovered before control electronics shuts down, the inverter will restart as soon as the power supply is resumed.
- 1: The inverter immediately disables the output to the motor resulting in coasting or freewheeling of the load. If you use this setting for loads with a high inertia, it might be necessary to activate the flying start function (*P2-26*).
- 2: The inverter stops along the rapid stop ramp set in *P2-25*.
- 3: DC bus supply, if the inverter is supplied directly via the DC+ and DC-terminal, the power failure detection can be deactivated with this function.

P2-39 Parameter lock

No parameters can be changed when the lock is activated. The 7-segment display shows an "L", the full text display shows the picture of a padlock.

- **0: Deactivated**
- 1: Activated

P2-40 Extended parameter access code definition

Setting range: 0 – **101** – 9999

The set value determines the code for the parameter access (parameter groups 0 to 5) in *P1-14*.

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9.2.4 Parameter group 3: PID controller (level 2)

P3-01 PID proportional gain

Setting range: 0.0 – **1.0** – 30.0

PID Controller proportional gain. Higher values result in a greater change of the inverter output frequency as response to minor changes of the feedback signal. If the value is too high, it can cause instability.

P3-02 PID integral time constant

Setting range: 0.0 – **1.0** – 30.0 sec.

PID controller integral time constant. Higher values result in a damped response to systems, in which the overall process responds slowly.

P3-03 PID differential time constant

Setting range: **0.00** – 1.00 sec.

P3-04 PID operating mode

- **0: Direct operation** – The motor speed decreases with increasing feedback signal.
- 1: Inverse operation – The motor speed increases with increasing feedback signal.

P3-05 PID reference selection

Selects the source for the PID reference/setpoint.

- **0**: **Fixed setpoint reference P3-06** (up to 4 fixed setpoint references are possible, depending on the PID controller setting: *P3-06*, *P3-14 – P3-16*)
- 1: Analog input 1
- 2: Analog input 2
- 3: Fieldbus PID reference see "P5-09 – P5-11 Fieldbus process output data (PAx) definition" (→ 🗎 153).

P3-06 PID fixed setpoint reference 1

Setting range: **0.0** – 100.0%

Sets the preset digital PID reference/setpoint.

P3-07 PID controller upper limit

Setting range: P3-08 – **100.0%**

This parameter specifies the maximum output value of the PID controller. The upper limit is calculated as follows:

Upper limit = *P3-07* × *P1-01*

A value of 100% corresponds to the maximum speed limit defined in *P1-01*.

P3-08 PID controller lower limit

Setting range: **0.0%** − *P3-07*

This parameter specifies the minimum output value of the PID controller. The lower limit is calculated as follows:

Lower limit = *P3-08* × *P1-01*.

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A value of 0.0% corresponds to the minimum speed limit defined in *P1-02*.

P3-09 PID correcting variable limitation

- **0: Fixed setpoint limit**/PID output range limited by *P3-07* and *P3-08*.
- 1: Analog input 1 variable upper limit/PID maximum output limited by the signal present at analog input 1.
- 2: Analog input 1 variable lower limit/PID minimum output limited by the signal present at analog input 1.
- 3: PID output + analog input 1/PID output is added to the speed reference present at analog input 1.

P3-10 PID feedback selection

Selects the source for the PID feedback signal.

- **0: Analog input 2**
- 1: Analog input 1
- 2: Motor current (*P1-08* corresponds to 100%)
- 3: DC link voltage $U_{DC\ link}$ (1000 V = 100%)
- 4: Difference (AI1 – AI2)
- 5: Maximum value (AI1 or AI2)

P3-11 PID control difference threshold for ramp activation

Setting range: **0.0** – 25.0%

With a control difference larger than *P3-11*, the ramp times set in *P1-03/04* are ignored in order to compensate the control difference with the greatest possible acceleration/deceleration.

P3-12 PID actual value display scaling factor

Setting range: **0.000** – 50.000

A user-defined display value can be scaled and shown on the display with this parameter.

This value is marked by a small "r" in the display and can be called up by briefly pressing the <Navigate> key.

Scaled display value = *P3-13* × PID feedback value (= actual value)

P3-13 PID feedback wake-up level

Setting range: **0.0** – 100.0%

With a control difference less than *P3-13*, the system quits standby mode.

P3-14 PID fixed setpoint reference 2

Setting range: **0.0** – 100%

Sets the preset digital PID reference/setpoint.

P3-15 PID fixed setpoint reference 3

Setting range: **0.0** – 100%

Sets the preset digital PID reference/setpoint.

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P3-16 PID fixed setpoint reference 4

Setting range: **0.0** – 100%

Sets the preset digital PID reference/setpoint.

9.2.5 Parameter group 4: Motor control (level 2)

P4-01 Operating mode/motor controller

- 0: VFC speed control

  Vector speed control for induction motors with calculated rotor speed feedback control. Field-oriented control algorithms are used for motor speed control. As the calculated rotor speed is used to internally close the speed loop, this control mode provides a simple closed-loop control system without physical encoder. For optimal control, auto tune (*P4-02*) should be carried out prior to first operation.

- 1: VFC torque control

  Instead of the motor speed, the motor torque is controlled directly. In this operating mode, the speed is not specified but changes depending on the load. The maximum speed is limited by *P1-01*. This operating mode is often used for winding applications where a constant torque is required to maintain cable tension. For optimal control, "auto tune" (*P4-02*) should be carried out prior to first operation.

- **2: V/f speed control**

  With the operating mode V/f control, the output voltage and frequency are controlled proportionally in the same ratio. Nearly all asynchronous motors can be controlled in this way. If better performance is required with regard to motor control mode, torque stability and speed range, the VFC control mode should be used.

  – Slip compensation

    If *P1-10* ≠ 0 is set, the calculated slip speed is added to the output frequency.

    If *P1-10* = 0 is set, the slip is not included in the calculation. This causes the motor to react very slightly to load changes and not have a tendency to vibrate. SEW EURODRIVE recommends this motor control for fans, pumps, and applications with direct drive.

- 3: Synchronous motor speed control (PMVC)

  Speed control for synchronous motors. The same properties apply as for VFC speed control.

- 4: Synchronous motor torque control

  Torque control for synchronous motors. The same properties apply as for VFC torque control.

- 5: Synchronous motor position control

  Position control for synchronous motors. Speed and torque setpoints are provided via process data in Motion Protocol (*P1-12 = 8*). An encoder is required for this purpose.

- 6: LSPM motor speed control

  The LSPM control is a control type for asynchronous motors with synchronous characteristics such as motors of type DR..J with LSPM technology from SEW-EURODRIVE.

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- 7: Synchronous reluctance motor speed control (SYN-R)

  Speed control for synchronous reluctance motors.
- 8: Brushless DC motor speed control (BLCD)

  Speed control for brushless DC motors

INFORMATION

"Auto tune" must be performed after each operating mode/motor control change.

If the "auto tune" is not performed, motor control becomes poor due to the equivalent wiring diagram data not being measured.

P4-02 "Auto tune"

- **0: Locked**
- 1: Enable

Only enable the inverter after you have entered all nominal motor data correctly in the parameters. You can also start the automatic measuring procedure "Auto tune" manually with this parameter after entering the motor data.

After a reset to the factory setting, the measuring procedure starts automatically after the first enable and takes up to 2 minutes depending on the control type.

INFORMATION

After changing the nominal motor data, auto tune has to be started again. The inverter must not be in "inhibit" mode.

P4-03 Speed controller proportional gain

Setting range: 0.1 – **50** – 400%

Defines the proportional gain for the speed controller. Higher values provide for better output frequency regulation and response. If the value is too high, it can cause instability or even an overcurrent fault. For applications that require the best possible control, you can adapt the value to the connected load by gradually increasing the value and observing the actual speed of the load. Continue this process until you have achieved the required dynamics without or with only slightly exceeding the control range, i.e. the setpoint value of the output speed.

In general, higher friction loads can tolerate higher values of proportional gain. It might be necessary to reduce the gain for loads with high inertia and low friction.

INFORMATION

Controller optimization should always initially take place via parameter *P7-10*. This parameter affects parameters *P4-03/P4-04* internally.

P4-04 Speed controller integral time constant

Setting range: 0.010 – **0.100** – 1.000 sec.

Defines the integral time for the speed controller. Small values result in a faster response to changes in the motor load but bear the risk that they cause instability. For optimal dynamics, the value must be adjusted to match the connected load.

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INFORMATION

Controller optimization should always initially take place via parameter *P7-10*. This parameter affects parameters *P4-03/P4-04* internally.

P4-05 Motor power factor (cos phi)

Setting range: 0.00, 0.50 – 0.99

Power factor on the motor nameplate

P4-06 Torque reference/limit value source

Function of the parameter, depending on operating mode/motor control

Operating mode/motor controller	Torque limit value (% of rated motor torque)	Torque reference (% of rated motor torque)	Current limit (% of rated motor current)
P4-01 = 0, 3, 6, 7, 8	X	–	–
P4-01 = 1, 4	–	X	–
P4-01 = 2	–	–	X

- **0: P4-07 defines the torque reference/limit**.
- 1: Analog input 1 determines the torque reference/limit. (0 – 100% of *P4-07*)
- 2: Analog input 2 determines the torque reference/limit. (0 – 100% of *P4-07*)
- 3: Fieldbus process data word determines the torque reference/limit (0 – 100% of *P4-07*)
- 4: Master/slave (make setting in slave):

  The slave inverter takes over the torque reference/limit from the master inverter.
- 5: PID output determines the torque reference/limit (0 – 100% of *P4-07*)

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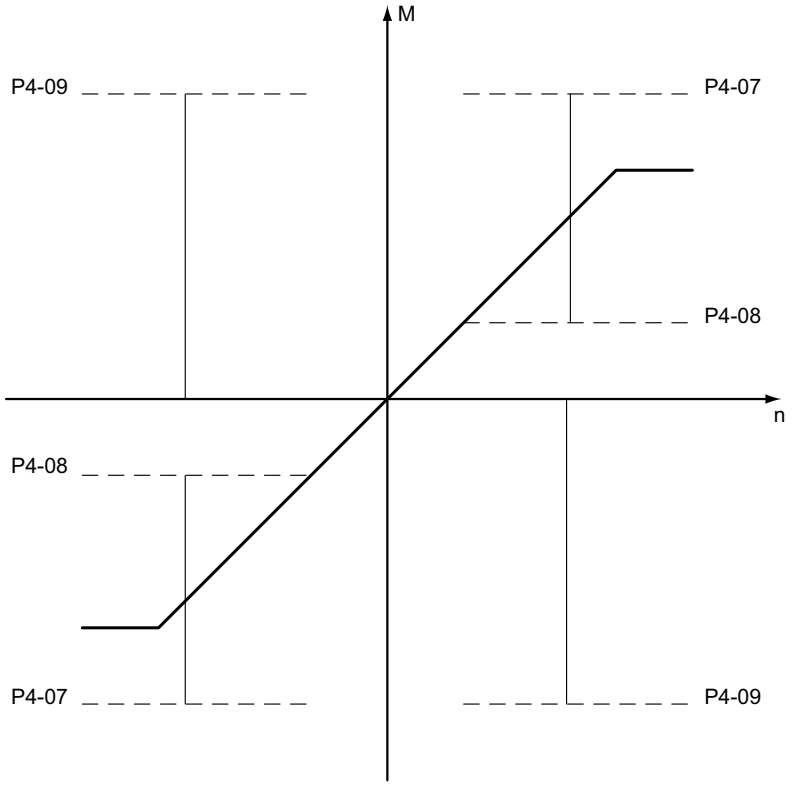
P4-07 – P4-09 Motor torque limit settings

These parameters are used to adjust the torque limits of the motor.



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P4-07 Max. motor torque limit

Setting range: *P4-08* – **200** – 500%

This parameter is used to set the upper torque limit. The limit value source is specified with parameter *P4-06*.

Example 1: Asynchronous motors in V/f control

In V/f control, the percentage apparent output current is limited, depending on *P1-08*.

Example 2: Asynchronous motors in VFC control

Setting and verifying the torque limit (*P4-07*) for asynchronous motors:

Data of the asynchronous motor:

P_n = 1.1 kW, $I_n = I_s$ = 2.4 A, n_n = 1420 min^{-1}, cos φ = 0.79

$$M_n = \frac{1.1\,kW \times 9550}{1420\,\frac{1}{min}} = 7.4\,Nm$$

The torque is limited to M_{max} = 8.1 Nm.

$$P407 = \frac{M_{max}}{M_n} \times 100\,\% = 109.45\,\%$$

For verification of the torque-generating inverter current in *P0-15*:

$I_q = \cos(\varphi) \times I_s = \cos(0.79) \times 2.4\ A = 1.89\ A$

For a calculated torque limit of 109.45%, *P0-15* should display the following

$$P0\text{-}15 = \frac{M_{max}}{M_n} \times I_q = 2.06\ A$$

Example 3: Synchronous motors in PMVC control

Setting and verifying the torque limit (*P4-07*) for synchronous motors:

The torque is limited to M_{max} = 1.6 Nm.

Data of the synchronous motor: I_0 = 1.5 A, M_0 = 0.8 Nm

$$P407 = \frac{M_{max}}{M_0} \times 100\,\% = 200\,\%$$

For verification of the torque-generating inverter current in *P0-15*:

I_d = 0, standard for synchronous motors with vector control, this results in $I_q \approx M$.

For a calculated torque limit of 200%, *P0-15* should display the following:

P0-15 = I_0 × 200% = 3 A

P4-08 Min. torque limit

Setting range: **0.0** – P4-07 %

Sets the minimum torque limit. As long as the motor speed is below the maximum speed defined in *P1-01*, the inverter attempts to maintain this torque at any time during operation on the motor.

If this parameter is set >0 and the maximum speed of the inverter is additionally increased to a value that is not reached during the travel cycle, the inverter is always in motor mode. Depending on the application, a braking resistor is thus not necessary.

INFORMATION

Use this parameter with the utmost care because the output frequency of the inverter will increase (to reach the torque) and the selected setpoint speed might be exceeded.

P4-09 Max. regenerative torque limit

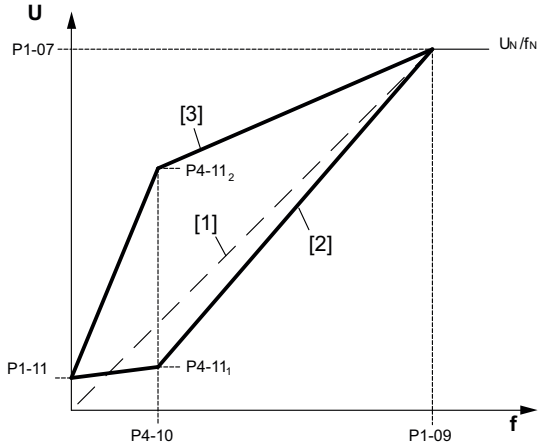
Setting range: *P4-08* – **200** – 500%

Defines the current limit in regenerative mode. The value of this parameter represents the percentage value of the rated motor current defined in *P1-08*. The current limit specified in this parameter overrides the normal torque-generating current limit when the motor operates in regenerative mode. If the value is too high, the result is an excessive motor current distortion causing the motor to behave unstable in regenerative mode. If the value is too small, the output torque of the motor might drop in regenerative mode.

P4-10/P4-11 V/f characteristic settings

The voltage/frequency characteristic curve determines the voltage level applied to the motor at a given frequency. Parameters *P4-10* and *P4-11* let you change the V/f characteristic curve if required.

Parameter *P4-10* can be set to any frequency between 0 and the base frequency (*P1-09*). It represents the frequency at which the percentage adjustment level set in *P4-11* is used. This function is only active when *P4-01* = 2.



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[1] Normal V/f characteristic curve
[2] Adjusted V/f characteristic curve (example 1)
[3] Adjusted V/f characteristic curve (example 2)
P1-07 = Nominal motor voltage
P1-09 = Rated motor frequency
P1-11 = Boost (x% of P1-07)
P4-10 = Frequency value of the V/f characteristic curve adjustment
P4-11 = Voltage value of the V/f characteristic curve adjustment

P4-10 V/f characteristic adjustment frequency

Setting range: **0.0** – 100.0% of *P1-09*

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P4-11 V/f characteristic adjustment voltage

Setting range: **0.0** – 100.0% of *P1-07*

P4-12 Motor brake control

Enables the hoist function of the inverter.

Parameters *P4-13* through *P4-16* are enabled.

Relay contact 2 is set to hoist. The function cannot be changed.

- **0: Disabled**
- 1: Activated

For examples, refer to chapter "Hoist function" (→ 🗎 74).

P4-13 Brake release time

Setting range: 0.0 – 5.0 s

This parameter is used to set the time required for the mechanical brake to release. This parameter prevents a sagging of the drive especially in hoists.

P4-14 Brake application time

Setting range: 0.0 – 5.0 s

This parameter is used to set the time required for the mechanical brake to apply. This parameter prevents a sagging of the drive in particular in hoists.

P4-15 Torque threshold for brake release

Setting range: 0.0 – 200%

Defines the torque in % of the maximum torque. This percentage torque must be generated before the motor brake is released.

This is to ensure that the motor is connected and torque is generated to prevent the load from dropping when the brake is released. For V/f control, the torque proof is not activated.

P4-16 Hoist torque threshold timeout

Setting range: 0.0 – 25.0 sec.

This parameter is used to set the time the inverter takes after a start command to attempt to generate enough motor torque to exceed the brake release threshold set in *P4-15*. If the torque threshold is not reached within this time, the inverter signals an error (U-Torq).

P4-17 Thermal motor protection to UL508C

- 0: Disabled
- 1: Activated

The inverters come equipped with a thermal motor protection function according to NEC to protect the motor from overload. In an internal memory, the motor current is accumulated over 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.

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When *P4-17* is disabled, the thermal overload memory is reset when switching power off and on again.

When *P4-17* is enabled, the memory is maintained even after power off and on again.

For inverters that are operated with a line frequency of 50 Hz, the factory setting is 0 = disabled.

For inverters that are operated with a line frequency of 60 Hz, the factory setting is 1 = enabled.

P4-18 Overload management

- **0: Deactivated**
- 1: Activated

When the function is activated, the I*t error (I.t-trp) is prevented by limiting the motor overload to 100%.

The limit kicks in as soon as the I.t_Trip counter (*P0-66*) reaches a value of 90%.

If the value in *P0-66* drops below 10%, the full overload is available again until *P0-66* reaches 90% again (hysteresis).

This function enables freeing or warming up without error in the event of sticking loads or cold gear unit oil.

P4-19 Master-slave torque reference

For the use of this parameter, please see chapter "Master-slave mode (P1-12 = 4)" (→ 🗎 72).

- **0: Slave setpoint speed = master actual speed**

  Slave torque limit = master torque limit
- 1: Slave nominal torque = master actual torque

  Slave speed limit = master setpoint speed

9.2.6 Parameter group 5: Fieldbus communication (level 2)

P5-01 Inverter address

Setting range: 0 − **1** – 63

This parameter is used to set the inverter address for SBus, Modbus, fieldbus and master/slave.

P5-02 SBus/CANopen baud rate

- 0: 125: 125 kBd
- 1: 250: 250 kBd
- **2: 500: 500 kBd**
- 3: 1000: 1000 kBd

P5-03 Modbus RTU baud rate

- 0: 9.6: 9600 Bd
- 1: 19.2: 19200 Bd
- 2: 38.4: 38400 Bd

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- 3: 57.6: 57600 Bd
- **4: 115.2: 115200 Bd**

P5-04 Modbus RTU data format

- **0: n-1: no parity, 1 stop bit**
- 1: n-2: no parity, 2 stop bits
- 2: O-1: odd parity, 1 stop bit
- 3: E-1: even parity, 1 stop bit

P5-05 Response to communication failure/timeout

- 0: Error and coast to a stop
- 1: Stop ramp and error
- **2: Stop ramp (without fault)**
- 3: Fixed setpoint speed 8

P5-06 Communication failure timeout for SBus and Modbus

Setting range: 0.0 – **1.0** – 5.0 s

Specifies the time in seconds after which the inverter performs the response set in *P5-05*. When set to "0.0 s", the inverter maintains the actual speed even if communication fails.

P5-07 Ramp specified via fieldbus

With the setting "activated", the inverter takes over the external ramp times via fieldbus.

The process data word for the fieldbus ramp must be defined via parameter P5-09 – P5-11.

With the setting "deactivated", the inverter takes over the internal ramps from P1-03 and P1-04.

- **0: Deactivated**
- 1: Activated

P5-08 Synchronization duration

Setting range: **0**, 5 – 20 ms

Defines the duration of the sync message from MOVI-PLC®. This value must correspond to the one set in MOVI-PLC®. When *P5-08* = 0, the inverter ignores synchronization.

P5-09 – P5-11 Fieldbus process output data (POx) definition

This parameter is used to define the process data words sent from the PLC or the gateway to the inverter.

- 0: Speed min^{-1} (1 = 0.2 min^{-1})→ only possible, if *P1-10* ≠ 0.
- 1: Speed % (0x4000 = 100% in relation to the maximum speed *P1-01*)
- 2: Torque setpoint/limit value % (1 = 0.1%[1)]) → *P4-06* = 3
- 3: Ramp time (1 = 1 ms) to maximum 65535 ms. Set → *P5-07* = 1.
- 4: PID reference (0x1000 = 100%) → *P1-12* = 3 (Control signal source)

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- 5: Analog output 1 (0x1000 = 100%)[2)]
  Digital output 1 (0x0001 = 24 V, other values = 0 V)[3)]
- 6: Analog output 2 (0x1000 = 100%)[2)]
  Digital output 2 (0x0001 = 24 V, other values = 0 V)[3)]
- 7: No function

1) The percentage reference comes from the table for P4-06.
2) If the analog outputs are controlled by fieldbus or SBus, parameter P2-11 or P2-13 = 12 (fieldbus/SBus (analog)) must be set additionally.
3) If the digital outputs are controlled by fieldbus or SBus, parameter P2-11 or P2-13 = 13 (fieldbus/SBus (digital)) must be set additionally.

P5-09 Fieldbus PO2 definition

Definition of output 2, 3, 4 for transmitted process data

Parameter description like *P5-09 – P5-11*

P5-10 Fieldbus PO3 definition

Definition of output 2, 3, 4 for transmitted process data

Parameter description like *P5-09 – P5-11*

P5-11 Fieldbus PO4 definition

Definition of output 2, 3, 4 for transmitted process data

Parameter description like *P5-09 – P5-11*

P5-12 – P5-14 Fieldbus process input data (PIx) definition

Definition of process data words sent from the inverter to the PLC or gateway.

- 0: Speed min^{-1} (1 = 0.2 min^{-1})→ only possible, if *P1-10* ≠ 0.
- 1: Speed % (0x4000 = 100% in relation to the maximum speed *P1-01*)
- 2: Current % (1 = 0.1% in relation to the nominal inverter current)
- 3: Torque % (1 = 0.1% in relation to the nominal motor torque, calculated from *P1-08*)
- 4: Power % (1 = 0.1% in relation to the rated inverter power)
- 5: Power electronics temperature (1 = 0.01°°C)
- 6: DC link voltage (1 = 1 V)
- 7: Analog input 1 (0x1000 = 100%)
- 8: Analog input 2 (0x1000 = 100%)
- 9: IO status of basic device and option

High byte								Low byte							
–	–	–	RL5*	RL4*	RL3*	RL2	RL1	DI8*	DI7*	DI6*	DI5	DI4	DI3	DI2	DI1

*Only available with suitable option module.

RL = Relay

- 10[1)]: LTX position low byte (number of increments within one revolution)
- 11[1)]: LTX position high byte (number of revolutions)

1) Only with inserted LTX module.

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P5-12 Fieldbus PI2 definition

Definition of input 2, 3, 4 for transmitted process data

Parameter description like *P5-12 – P5-14*.

P5-13 Fieldbus PI3 definition

Definition of input 2, 3, 4 for transmitted process data

Parameter description like *P5-12 – P5-14*

P5-14 Fieldbus PI4 definition

Definition of input 2, 3, 4 for transmitted process data

Parameter description like *P5-12 – P5-14*

P5-15 Expansion relay 3 function selection

INFORMATION

Only available and possible when I/O expansion module is connected.

Defines the function of expansion relay 3. For a description of the functions, see also table "P2-15/P2-20 Relay outputs" (→ 🗎 136).

- 0: Inverter enabled
- 1: /Failure, inverter ready
- 2: Motor at setpoint speed.
- 3: Motor speed > 0
- 4: Motor speed > limit value
- 5: Motor current > limit value
- 6: Motor torque > limit value
- 7: Analog input 2 > limit value
- 8: Fieldbus control
- 9: STO status
- 10: PID error ≥ limit value

P5-16 Relay 3 upper limit

Setting range: 0.0 – **100.0** – 200.0%

P5-17 Relay 3 lower limit

Setting range: **0.0** – 200.0%

P5-18 Expansion relay 4 function selection

Defines the function of expansion relay 4.

Parameter description like *P5-15*.

P5-19 Relay 4 upper limit

Setting range: 0.0 – **100.0** – 200.0%

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P5-20 Relay 4 lower limit

Setting range: **0.0** – 200.0%

INFORMATION

The function of expansion relay 5 is fixed to "Motor speed > 0".

9.2.7 Parameter group 6: Extended parameters (level 3)

P6-01 Firmware upgrade enable

Activates the firmware upgrade mode for the control electronics and/or the power electronics. This parameter is automatically activated with the software LT Shell V4.

- **0: Deactivated**
- 1: Enabled (DSP + I/O)
- 2: Enabled (I/O only)
- 3: Enabled (DSP only)

P6-02 Automatic thermal management

Enables automatic thermal management. The inverter automatically reduces the output switching frequency at excessive heat sink temperature to reduce the risk of an overtemperature fault.

- 0: Deactivated (PWM fixed - depending on the setting in *P2-24*)
- **1: Activated** (PWM varies, depending on the following table)

Heat sink temperature	Inverter behavior
70 °C	Automatic reduction from 16 kHz to 12 kHz.
75 °C	Automatic reduction from 12 kHz to 8 kHz.
80 °C	Automatic reduction from 8 kHz to 6 kHz.
85 °C	Automatic reduction from 6 kHz to 4 kHz.
90 °C	Automatic reduction from 4 kHz to 2 kHz.
97 °C	Error message overtemperature

P6-03 Auto-reset delay time

Setting range: 1 – **20** – 60 s

Sets the delay time that elapses between consecutive reset attempts of the inverter, if auto reset is enabled in *P2-36*.

P6-04 Hysteresis band user relay/analog outputs

Setting range: 0.0 – **0.3** – 25.0%

This parameter functions together with the function selection 2 (motor at setpoint speed) or 3 (motor speed > 0) in parameter *P2-11* (DO1), *P2-13* (DO2), *P2-15* (relay 1) and *P2-18* (relay 2).

If the speed lies within the set hysteresis band (+/- *P6-04* of *P1-01*), depending on the function selection, the respective digital output or the corresponding relay is active (1).

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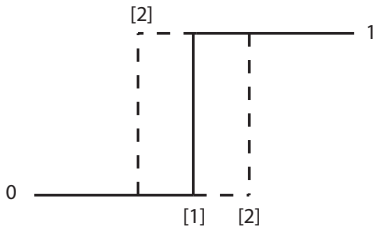
If the value is too small, the digital output or relay “bounces”.



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[1] Depending on the setting in *P2-11, P2-13, P2-15, P2-18*

[2] Percentage hysteresis of *P6-04* referred to *P1-01*

P6-05 Encoder feedback enable

When set to "1", encoder feedback is enabled. This parameter is enabled automatically as soon as an LTX module is connected.

- **0: Disabled**
- 1: Activated

P6-06 Encoder PPR

Setting range: **0** – 65535 PPR (Pulses Per Revolution)

Set the number of encoder increments (pulses per revolution). Also activate P6-05. This parameter is set automatically as soon as the LTX module is connected.

INFORMATION

For HTL/TTL encoders, a minimum of 512 increments are necessary for operation.

P6-07 Trigger threshold speed error/speed monitoring

Setting range: 1.0 – **5.0** – 100%

This parameter specifies the maximum permitted speed error between the speed setpoint and the actual speed value.

The parameter is active in all operating modes (except V/f control) with and without encoder feedback. If the speed error lies outside the set limit value, the inverter switches off with speed error (SP-Err or Enc-02). When set to "100%", speed monitoring is deactivated.

P6-08 Max. frequency for speed setpoint

Setting range: 0; **5** – 20 kHz

This parameter defines the frequency of the frequency input (DI3) at which the motor speed setpoint corresponds to the maximum speed (*P1-01*).

An individual configuration of the digital inputs with *P1-15* = 0 and parameter group 9 is necessary in order to be able to use this function.

Select the option "Pulse" at one of the corresponding speed sources (*P9-10 – P9-17*).

When set to 0, this function is deactivated.

P6-09 Droop speed/load distribution control

Setting range: **0.0** – 25.0%

This function requires one motor for each inverter. In applications where several motors drive a common load, but different motor loads occur due to mechanical reasons, this function can balance the load of individual motors. Group drives are not possible.

This function is available in all speed-controlled vector operating modes.

With the setting P6-09 = 0.0, this function is deactivated. With setting P6-09 > 0.0, this function induces a reduction of the actual speed compared to the setpoint speed for increased load.

Droop speed = setpoint speed - P6-09 × P1-09 × M_A/M_N

M_A = current application torque

M_N = nominal motor torque

In most cases, a small value in P6-09 is sufficient to achieve an adequate load distribution. If the value is too high, the actual speed controls towards 0 for small setpoint speeds or high loads.

P6-10 Reserved

P6-11 Speed holding time on enable

Setting range: **0.0** – 250 sec.

When the enable is activated, the inverter assumes the fixed setpoint speed 7 (*P2-07*) for the time defined here before the speed setpoint of the user is assumed.

This function thus defines a time-delayed adoption of the speed setpoint after the enable.

When set to "0.0", this function is deactivated.

P6-12 Speed holding time on inhibit

Setting range: **0.0** – 250 sec.

When the enable is deactivated, the inverter assumes the fixed setpoint speed 8 (*P2-08*) for the time defined here before the inverter stops along the deceleration ramp.

This function thus defines a time-delayed stop.

When set to "0.0", this function is deactivated.

INFORMATION

Setting this parameter to a value > 0 lets the inverter continue to run at the fixed setpoint speed for the set time after having removed the enable signal. It is important that you make sure that this operating mode is safe before you use this function.

P6-13 Fire mode logic/emergency mode

This parameter defines the logic of the wiring for activation of fire mode/emergency mode.

See also the description of the function in chapter "Fire mode/emergency mode" (→ 🗎 78).

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Do not use this function for servo applications or lifting applications.

- **0: NC switching contact: The function is activated with logic 0.**
- 1: NO switching contact: The function is activated with logic 1.

P6-14 Fire mode/emergency mode speed

Setting range: *-P1-01* – **0** – *P1-01* Hz

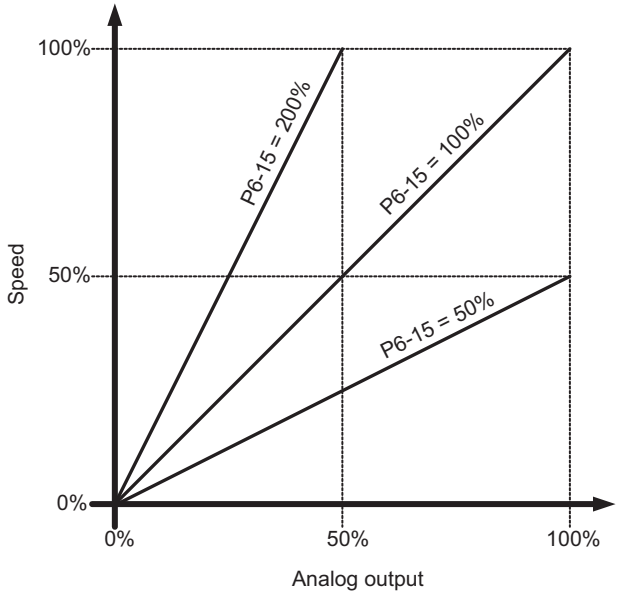
This parameter defines the speed when fire mode/emergency mode is activated.

See also the description of the function in chapter "Fire mode/emergency mode" (→ 🗎 78).

P6-15 Analog output 1 scaling

Setting range: 0.0 – **100.0** – 500.0%

Specifies the scaling factor in % used for analog output 1.



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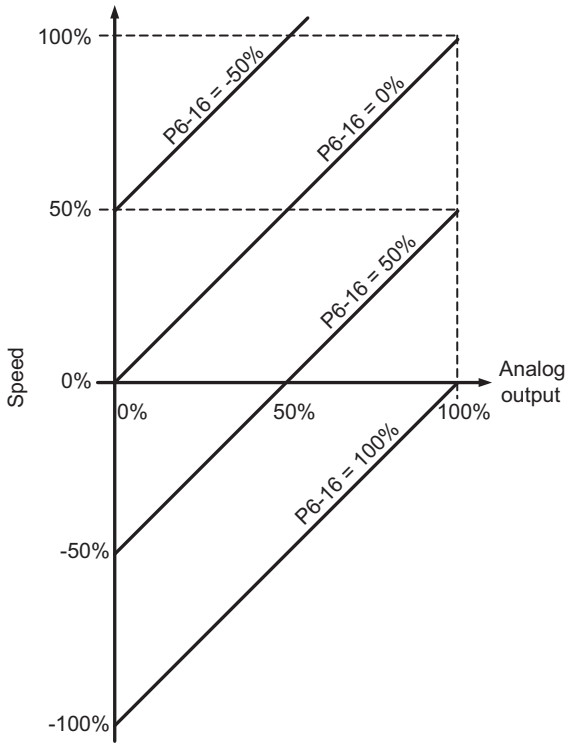
P6-16 Analog output 1 offset

Setting range: -500.0 – **0.0** – 500.0%

This parameter specifies the offset in % used for analog output 1.



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P6-17 Max. torque limit timeout

Setting range: 0.0 – **0.5** − 25.0 sec.

This parameter defines how long the motor is operated above the torque limits (*P4-07*; *P4-09*) before the inverter is switched off by the torque monitoring (O-Torq).

The parameter is active in all vector operating modes.

When set to "0.0", this function is deactivated.

P6-18 DC braking voltage level

Setting range: Auto, **0.0** – 30.0%

This parameter activates DC braking.

The motor is decelerated with the deceleration ramp (*P1-04*) and the braking energy is thereby fed back into the motor winding.

An excessive value will cause the motor to judder.

P6-19 Braking resistor value

Setting range: **0**; R_min – 200 Ω

Sets the braking resistor value in ohms. This value is used for thermal protection of the braking resistor. R_min depends on the inverter.

Setting this parameter to "0" disables the protection function for the braking resistor.

P6-20 Braking resistor power

Setting range: **0.0** – 200.0 kW

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Sets the braking resistor power in kW with a resolution of 0.1 kW. This value is used for thermal protection of the braking resistor.

When set to "0.0", the protection function for the braking resistor is disabled.

P6-21 Brake chopper operating cycle at undertemperature

Setting range: **0.0** – 20.0%

A value > 0 activates the heating function of the inverter.

The brake chopper is thereby active at temperatures below 0 °C (even with low temperature error U-Temp) and heats the connected braking resistor to the set value.

For this, the braking resistor must be installed directly on the heat sink to ensure optimum thermal conductivity.

Please use only the braking resistors provided for this.

Please contact SEW-EURODRIVE Service, if necessary.

An excessive value can overload the braking resistor.

Use an external thermal protection device for the braking resistor.

When set to "0.0", this function is deactivated.

P6-22 Reset fan runtime

- **0: Deactivated**
- 1: Reset fan runtime (*P0-35*)

P6-23 Reset kWh counter and MWh counter

- **0: Deactivated**
- 1: Reset kWh counter (*P0-26*) and MWh counter (*P0-27*).

P6-24 Parameter default settings

Inverter factory settings:

The inverter must not be enabled and the display must show "Inhibit".

- **0: Disabled**
- 1: Factory settings except for bus parameters.
- 2: Factory settings for all parameters.

P6-25 Access code level 3

Setting range: 0 – **201** – 9999

The set value determines the code for the full parameter access (parameter groups 0 to 9) in *P1-14*.

P6-26 Parameter backup

- **0: Output value**
- 1: Save parameters
- 2: Deleting parameters

Selection 0: The output value is always displayed.

Selection 1: Saving the current parameterization.

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The entire parameter settings are saved to a secured memory. Upon successful completion of the backup, the display shows "USr-PS".

The memory content is preserved, even when the device is de-energized and when the factory settings are activated.

Selection 2: Deleting the saved parameterization from the secure memory.

The internal memory is deleted again. The display shows "USr-cL".

Restoring the saved parameterization from the memory:

By pressing the 4 keys "Start + Stop + Up + Down" simultaneously for at least 2 seconds, the saved parameter setting can be restored. This overwrites the parameter data in the device and resets it to the value at the time of the backup. The display shows "U-dEF" upon successful completion of the restoring.

Establishing the delivery state (no change to preceding versions):

To reset the inverter to the factory setting (delivery state), press the 3 keys "Stop + Up + Down" for at least 2 seconds until "P-dEF" appears on the display. This process overwrites the current parameterization without deleting the saved data in the secure memory with the parameter backup.

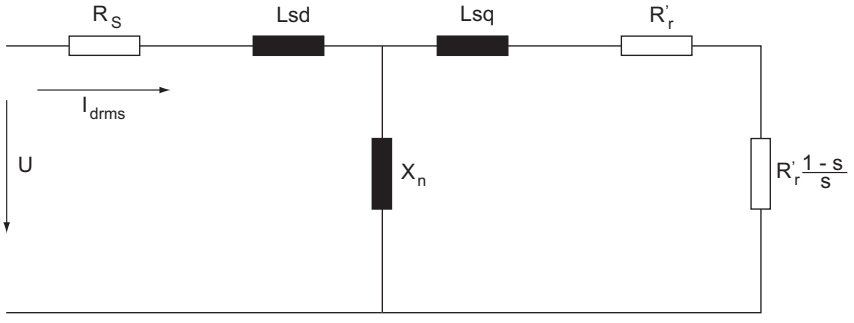
9.2.8 Parameter group 7: Motor control parameters (level 3)

NOTICE

Possible inverter damage

The following parameters are used internally by the inverter to provide for optimum motor control. Incorrect settings of the parameters can result in poor performance and unexpected behavior of the motor. Adjustments may be made only by experienced users who fully understand the functions of these parameters.

Equivalent wiring diagram for AC motors.



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P7-01 Motor stator resistance (Rs)

Setting range: (power-dependent) (Ω)

The stator resistance value is the ohmic phase-phase resistance of the copper winding. This value can be determined and set automatically during "auto tune".

Instead, you can enter this value manually.

P7-02 Motor rotor resistance (Rr)

Setting range: (Power range) (Ω)

For induction motors: Phase-to-phase rotor resistance value in ohms.

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For synchronous motors: Value has to be set to 0 ohm.

P7-03 Motor stator inductance (Lsd)

Setting range: (power-dependent) (H)

For induction motors: Phase stator inductance value.

For synchronous motors: Phase d-axis stator inductance in Henry.

P7-04 Motor magnetization current (Id rms)

Setting range: 10% × *P1-08* − 80% × *P1-08* (A)

For induction motors: Magnetizing current/no-load current. Before auto tune, this value is approximated to 60% of the rated motor current (*P1-08*) assuming a motor power factor of 0.8.

P7-05 Motor leakage loss coefficient (sigma)

Setting range: 0.025 − **0.10** − 0.25

For induction motors: Leakage loss coefficient of the motor.

P7-06 Motor stator inductance (Lsq) − only for synchronous motors

Setting range: depends on the motor (H)

For synchronous motors: Phase q-axis stator inductance in Henry.

P7-07 Enhanced generator control

Use this parameter when stability problems occur in extremely regenerative applications. When this function is enabled, regenerative operation is possible at low speeds.

- **0: Disabled**
- 1: Enabled

P7-08 Parameter adjustment

Use this parameter for small motors (P < 0.75 kW) with high impedance. When this function is enabled, the thermal motor model can adjust rotor and stator resistance during operation. In this way, impedance effects occurring with vector control and caused by heating are compensated.

- **0: Disabled**
- 1: Enabled

P7-09 Overvoltage current limit

Setting range: 0.0 – **1.0** – 100%

This parameter is only applicable in vector speed control mode and takes effect when the DC link voltage of the inverter exceeds a preset limit. This voltage level is set internally exactly below the trigger threshold for overvoltage.

When set to "0.0", this function is disabled.

Procedure:

- The motor with high inertia is decelerated. Regenerative energy flows back to the inverter.
- The DC link voltage increases and reaches the U_{Zmax} level.

- To discharge the DC link, the frequency inverter delivers current (*P7-09*) and the motor accelerates again.
- The DC link voltage falls below U_{Zmax} again.
- The motor is continued to be decelerated.

P7-10 Stiffness (for vector control)

Setting range: 0 – **10** – 600

P7-10 is used to improve the control response for control modes without encoder feedback. P7-10 has an internal effect on the P and I components of the control. This value can usually remain set to the default value "10".

Increasing *P7-10* increases the stiffness of the motor. Decreasing this parameter has the opposite effect.

This parameter must be set, depending on the inertia.

P7-11 Pulse width min. limit

Setting range: 0 – 500

This parameter is used to limit the minimum output pulse width (number of voltage flanks).

With long motor leads, increasing the value of this parameter can reduce the risk of overcurrent errors (O-I or hO-I).

An increase in this value reduces the maximum available output voltage.

Time = value × 16.67 ns

P7-12 Premagnetization time

Setting range: 0 – 5000 ms

Use this parameter to define a premagnetization time. Consequently, there is a corresponding start delay when the inverter is enabled. If the value is too small, the inverter might generate an overcurrent fault (O-I or hO-I) if the acceleration ramp is too short.

In the case of operating modes for synchronous motors, this parameter, together with *P7-14*, is used for the initial rotor adjustment. In particular, it must be adjusted for high moments of mass inertia.

P7-13 D-gain vector speed controller

Setting range: **0.0** – 400%

This parameter is used to set the differential gain (%) for the speed controller in vector mode operation.

P7-14 Low-frequency torque boost

Setting range: **0.0** – 100%

With synchronous motors, this parameter permits a boost current in % of the rated motor current (*P1-08*) on enable or if the frequencies are too low.

If the value is too high, this can cause overcurrent errors (O-I or hO-I).

The torque increase is limited by *P7-15*.

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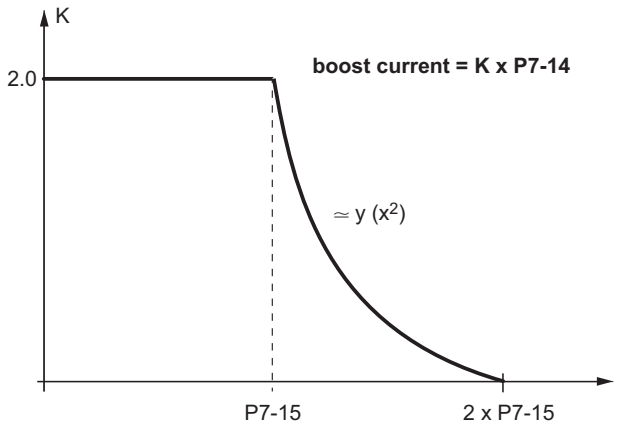
In addition, this parameter functions together with *P7-12* to align the rotor.



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P7-15 Torque boost frequency limit

Setting range: **0.0** – 50%

Frequency range for the applied boost current (*P7-14*) in % of the rated motor frequency (*P1-09*).

This parameter functions as shown in the corresponding chart in the parameter description for *P7-14*.

P7-16 Motor nameplate speed

The parameter has no function.

9.2.9 Parameter group 8: Application-specific parameters (only LTX) (level 3)

INFORMATION

For further information refer to the "MOVITRAC® LTX Servo Module for MOVITRAC® LTP-B" addendum for the operating instructions, chapter "LTX function parameter set (level 3)".

P8-01 Simulated encoder scaling

Setting range: $\mathbf{2}^0$ – 2^3

P8-02 Input pulse scaling value

Setting range: 2^0 – $\mathbf{2}^{16}$

P8-03 Lag error low word

Setting range: 0 – **65535**

Number of increments within a revolution.

P8-04 Lag error high word

Setting range: **0** – 65535

Number of revolutions.

P8-05 Reference travel type

- **0: Disabled**
- 1: Zero pulse with negative travel direction
- 2: Zero pulse with positive travel direction
- 3: End of reference cam negative travel direction
- 4: End of reference cam positive travel direction
- 5: No reference travel; only possible without enabled drive
- 6: Fixed stop positive direction of travel
- 7: Fixed stop negative direction of travel

P8-06 Position controller proportional gain

Setting range: 0.0 – **1.0** – 400%

P8-07 Touch probe trigger mode

- **0: TP1 P edge TP2 P edge**
- 1: TP1 N edge TP2 P edge
- 2: TP1 N edge TP2 N edge
- 3: TP1 P edge TP2 N edge

P8-08 Reserved

P8-09 Velocity precontrol gain

Setting range: 0 – **100** – 400%

Defines the command source for using terminal mode.

This parameter takes effect only when *P1-12* > 0. It allows the control signal source defined in *P1-12* to be overwritten.

High: The sources defined in parameters *P9-02* to *P9-07* control the inverter.

Low: The control signal source set in *P1-12* is effective.

The control signal sources of the inverter are prioritized as follows:

- STO deactivation
- External fault
- Rapid stop
- Enable
- *P9-09*
- Run forward/run reverse/reverse
- Reset

P8-10 Acceleration precontrol gain

Setting range: **0** – 400%

P8-11 Reference offset low word

Setting range: **0** – 65535

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P8-12 Reference offset high word

Setting range: **0** – 65535

P8-13 Reserved

P8-14 Reference enable torque

Setting range: 0 – **100** – 500%

9.2.10 Parameter group 9: Digital inputs defined by the user (level 3)

The purpose of parameter group 9 is to give the user full flexibility to control the inverter behavior in complex applications that require specific parameter settings. Use the parameters of this group with utmost care. Only users that are absolutely familiar with the use of the inverter and its control functions should adjust the parameters of this group.

Overview of functions

Parameter group 9 allows for the advanced programming of the inverter including user defined functions for the digital and analog inputs of the inverter as well as control of the speed setpoint source.

The following rules apply to parameter group 9:

- The parameters of this group cannot be changed unless *P1-15* = 0.
- Changing the value *P1-15* clears all the previous settings made in parameter group 9.
- Parameter group 9 has to be configured individually by the user.

INFORMATION

Write down your settings.

Logic source selection parameters

The parameters for selecting a logic source let users directly define the source for a control function in the inverter. These parameters can only be linked to digital values, which either enable or disable the function depending on their state.

Parameters defined as logic sources have the following range of possible settings:

Inverter display	Setting	Function
SAFE	STO input	Linked to the status of STO inputs, if allowed.
OFF	Always OFF	Function permanently disabled.
On	Always ON	Function permanently enabled.
din-1	Digital input 1	Function linked to digital input 1 status.
din-2	Digital input 2	Function linked to digital input 2 status.
din-3	Digital input 3	Function linked to digital input 3 status.

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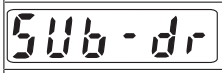
Inverter display	Setting	Function
	Digital input 4	Function linked to digital input 4 (analog input 1) status.
	Digital input 5	Function linked to digital input 5 (analog input 2) status.
	Digital input 6	Function linked to digital input 6 (requires extended I/O option).
	Digital input 7	Function linked to digital input 7 (requires extended I/O option).
	Digital input 8	Function linked to digital input 8 (requires extended I/O option).

The control sources for the inverter are handled in the following order of priority (from highest to lowest priority):

- STO circuit
- External fault
- Rapid stop
- Enable
- Terminal control override
- CW/CCW operation
- Reset

Setpoint source selection parameters

Parameters for selecting a setpoint source define the signal source for setpoint source 1 – 8. Parameters defined as data sources have the following range of possible settings:

Inverter display	Setting	Function
	Analog input 1	Analog input 1 signal level (*P0-01*).
	Analog input 2	Analog input 2 signal level (*P0-02*).
	Fixed setpoint speed	Selected fixed setpoint speed.
	Keypad (motorized potentiometer)	Keypad speed setpoint (*P0-06*).
	PID controller output	PID controller output (*P0-10*).
	Master speed setpoint	Master speed setpoint (master/slave operation).
	Fieldbus speed setpoint	Fieldbus speed setpoint PE2.
	User-defined speed setpoint	User-defined speed setpoint (PLC function).
	Frequency input	Pulse frequency input reference.

P9-01 Enable input source

Setting range: SAFE, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

This parameter specifies the source for the enable.

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P9-02 Rapid stop input source

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

This parameter specifies the source for the rapid stop. With a High signal, the motor stops along the ramp from *P2-25*.

P9-03 Input source for clockwise rotation (CW)

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

This parameter specifies the source for clockwise rotation (CW).

P9-04 Input source for counterclockwise rotation (CCW)

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

This parameter specifies the source for counterclockwise rotation (CCW).

INFORMATION

When the CW rotation and CCW rotation signals are set simultaneously, the inverter executes a rapid stop.

P9-05 Latch function enable

Setting range: OFF, ON

This parameter activates the stop function for clockwise rotation or counterclockwise rotation. The direction of rotation is thus flank-controlled without the input signal having to be permanently present. When using this function, an input with NC contact must be defined for Stop in *P9-01*.

P9-06 Direction of rotation reversal

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

This parameter specifies the source for the direction of rotation reversal.

P9-07 Reset input source

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

This parameter specifies the source for the error reset.

P9-08 External fault input source

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

This parameter specifies the source for the external error. The contact is an NC contact with wire break monitoring.

P9-09 Terminal control enable source

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

This parameter specifies the source for the activation of terminal control. When the defined digital input is activated, the selected control signal source in *P1-12* is deactivated and terminal control is activated.

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P9-10 – P9-17 Setpoint source

Up to 8 setpoint sources can be defined for the inverter and can be selected during operation using *P9-18 – P9-20*. When changing the setpoint source, the new source is applied immediately during ongoing operation. The inverter does not have to be stopped for this.

P9-10 Setpoint source 1

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Defines setpoint source 1.

P9-11 Setpoint source 2

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Defines setpoint source 2.

P9-12 Setpoint source 3

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Defines setpoint source 3.

P9-13 Setpoint source 4

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Defines setpoint source 4.

P9-14 Setpoint source 5

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Defines setpoint source 5.

P9-15 Setpoint source 6

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Defines setpoint source 6.

P9-16 Setpoint source 7

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Defines setpoint source 7.

P9-17 Setpoint source 8

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Defines setpoint source 8.

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P9-18 – P9-20 Setpoint source selection input

The active setpoint source can be selected and switched during operation with parameters *P9-18 – P9-20*:

P9-20	P9-19	P9-18	Setpoint source
0	0	0	1 (*P9-10*)
0	0	1	2 (*P9-11*)
0	1	0	3 (*P9-12*)
0	1	1	4 (*P9-13*)
1	0	0	5 (*P9-14*)
1	0	1	6 (*P9-15*)
1	1	0	7 (*P9-16*)
1	1	1	8 (*P9-17*)

P9-18 Input 0 for setpoint source selection

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

Logic source "Bit 0" for selection of the setpoint source.

P9-19 Input 1 for setpoint source selection

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

Logic source "Bit 1" for selection of the setpoint source.

P9-20 Input 2 for setpoint source selection

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

Logic source "Bit 2" for selection of the setpoint source.

P9-21–P9-23 Fixed speed selection input

The fixed setpoint speeds can be selected and switched with parameters *P9-21 – P9-23*:

P9-23	P9-22	P9-21	Fixed setpoint speed
0	0	0	1 (*P2-01*)
0	0	1	2 (*P2-02*)
0	1	0	3 (*P2-03*)
0	1	1	4 (*P2-04*)
1	0	0	5 (*P2-05*)
1	0	1	6 (*P2-06*)
1	1	0	7 (*P2-07*)
1	1	1	8 (*P2-08*)

P9-21 Fixed setpoint speed selection input 0

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

Logic source "Bit 0" for selection of the fixed setpoint speed.

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P9-22 Fixed setpoint speed selection input 1

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

Logic source "Bit 1" for selection of the fixed setpoint speed.

P9-23 Fixed setpoint speed selection input 2

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

Logic source "Bit 2" for selection of the fixed setpoint speed.

P9-24 Positive jog mode input

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

This parameter specifies the source for the positive jog mode.

The jog speed is specified in the parameter *P2-01*.

P9-25 Negative jog mode input

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

This parameter specifies the source for the negative jog mode.

The jog speed is specified in the parameter *P2-01*.

P9-26 Reference travel enable input (LTX parameter)

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

This parameter specifies the source for the release of the reference run.

P9-27 Reference cam input (LTX parameter)

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

This parameter specifies the source for the reference cams.

P9-28 Motor potentiometer up input source

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

This parameter specifies the source for the speed increase at the keypad/motor potentiometer. As long as a signal (logic 1) is present at the selected digital input, the speed is increased with the ramp defined in *P1-03*.

P9-29 Motor potentiometer down input source

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

This parameter specifies the source for the speed decrease at the keypad/motor potentiometer. As long as a signal (logic 1) is present at the selected digital input, the speed is decreased with the ramp defined in *P1-04*.

P9-30 Positive limit switch CW

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

The parameter defines the digital input for the positive limit switch. The switch must be wired as an NC contact with wire break monitoring. As soon as the limit switch is tripped, the inverter reduces the speed along ramp P1-04 to 0 Hz.

As long as the enable persists at the inverter, the inverter stays enabled at 0 Hz.

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The status of the limit switch is also depicted in the status word.

P9-31 Negative limit switch CCW

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

The parameter defines the digital input for the negative limit switch. The switch must be wired as an NC contact with wire break monitoring. As soon as the limit switch is tripped, the inverter reduces the speed along ramp P1-04 to 0 Hz.

As long as the enable persists at the inverter, the inverter stays enabled at 0 Hz.

The status of the limit switch is also depicted in the status word.

P9-32 Selection of deceleration ramp/rapid stop ramp

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

This parameter defines which ramp is used when the enable is canceled.

Logic 0: Deceleration ramp *P1-04*

Logic 1: Second deceleration ramp/rapid stop ramp *P2-25*

P9-33 Fire mode/emergency mode input selection

Setting range: OFF, din-1, din-2, din-3, din-4, din-5.

This parameter defines the digital input for selection of fire mode/emergency mode.

P9-34 PID fixed setpoint reference selection input 0

Setting range: **OFF**, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

P9-35 PID fixed setpoint reference selection input 1

Setting range: **OFF**, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

INFORMATION

Parameters *P3-14 − P3-16* cannot be used while *P9-34* and *P9-35* are set to "OFF".

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10 Technical data

10.1 Markings

The following table lists all markings that can be given on a nameplate or attached to the motor and an explanation of what they mean.

Marking	Meaning
CE	CE marking to state compliance with the Low Voltage Directive 2014/35/EU. EU directive 2011/65/EU (RoHS) serves for limiting the use of hazardous substances in electric and electronic equipment.
TÜVRheinland CERTIFIED Functional Safety www.tuv.com ID 0600000000	TÜV/FS mark with code number to identify functional safety relevant components
c UL us Listed2AD0 Ind. Conv. Eq. E155763	UL logo to confirm that a component is UL (Underwriters Laboratory) tested, also valid for CSA in conjunction with the register number.
EAC	EAC mark (EurAsian Conformity) Confirms compliance with the technical regulations of the economic and customs union of Russia, Belarus, Kazakhstan, Armenia.
RCM	RCM logo (Regulatory Compliance Mark). Confirmation of compliance with technical regulations of the Australian Communications and Media Authority ACMA.

All products meet the following international standards:

- UL 508C power converter
- EN 61800-3:2004/A1:2012 Variable-speed electrical drive systems – part 3
- EN ISO 13849-1 Safe Torque Off (STO) 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

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10.2 Ambient conditions

Ambient temperature range during operation (For PWM frequency 2 kHz)	-10 °C to +50 °C (IP20/NEMA 1) -10 °C to +40 °C (IP55/NEMA 12K) -10 °C to +40 °C (IP66/NEMA 4X)
Derating depending on the ambient temperature	2.5%/°C to 60 °C for the following inverters with degree of protection IP20/NEMA 1: 230 V: 0.75 – 5.5 kW 400 V: 0.75 – 11 kW 500 V: 0.75 – 15 kW
	2.5%/°C to 50 °C for the following inverters with IP degree of protection IP66/NEMA 4X: 230 V: 0.75 – 4 kW 400 V: 0.75 – 7.5 kW 500 V: 0.75 – 11 kW
	1.5%/°C to 50 °C for the following inverters with IP degree of protection IP55/NEMA 12K: 230 V: 5.5 – 75 kW 400 V: 11 – 160 kW 500 V: 15 – 110 kW
Storage temperature	-40°°C to +60°°C
Maximum installation altitude for nominal operation	1000 m
Derating above 1000 m	1%/100 m to max. 2000 m with UL 1%/100 m to max. 4000 m without UL
Maximum relative humidity	95% (condensation not permitted)
Unit designs	IP20/NEMA 1 IP55/NEMA 12K IP66/NEMA 4X

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10.3 Technical data

The "Horsepower" (HP) specification is defined as follows:

- 200 – 240 V devices: NEC2002, table 430-150, 230 V
- 380 – 480 V devices: NEC2002, table 430-150, 460 V
- 500 – 600 V devices: NEC2002, table 430-150, 575 V

10.3.1 1-phase system AC 200 – 240 V

INFORMATION

The cable cross sections and fusing recommended below apply to the use of copper conductors with PVC insulation laid in cable ducts at an ambient temperature of 25° C. Also comply with the regulations issued by specific countries and for specific machines regarding supply system and motor cable.

MOVITRAC® LTPB – EMC filter class C1 according to EN 61800-3				
Power in kW		**0.75**	**1.5**	**2.2**
		IP20/NEMA 1		
	MC LTP-B..	0008-2B1-4-00	0015-2B1-4-00	0022-2B1-4-00
	Part number	18251382	18251528	18251641
		IP66/NEMA 4X housing without switches		
	MC LTP-B..	0008-2B1-4-10	0015-2B1-4-10	0022-2B1-4-10
	Part number	18251390	18251536	18251668
		IP66/NEMA 4X housing with switches		
	MC LTP-B..	0008-2B1-4-40	0015-2B1-4-40	0022-2B1-4-40
	Part number	18251404	18251544	18251676
INPUT				
Nominal line voltage V_{line} according to EN 50160	V	1 × AC 200 – 240 ±10%		
Line frequency f_{line}	Hz	50 / 60 ±5%		
Recommended power supply cable cross section	mm^2	1.5		2.5
	AWG	14		12
Line fuse	A	16		25 (35)[1)]
Nominal input current	A	8.5	13.9	19.5
OUTPUT				
Recommended motor power	kW	0.75	1.5	2.2
	HP	1	2	3
Output voltage V_{motor}	V	3 × 20 - U_{line}		
Output current	A	4.3	7	10.5
PWM frequency	kHz	2/4/6/8/12/16		
Speed range	min^{-1}	-30000 – 0 – +30000		
Maximum output frequency	Hz	500		
Cross section of motor cable Cu 75C	mm^2	1.5		2.5
	AWG	14		12
Maximum motor cable length shielded	m	100		
Maximum motor cable length unshielded		150		
GENERAL				
Size		2		
Nominal power loss 24 V	W	8		
Nominal power loss power section	W	22	45	66
Minimum braking resistance value	Ω	27		
Maximum device terminal cross section	mm^2	10		
	AWG	8		

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MOVITRAC® LTPB – EMC filter class C1 according to EN 61800-3				
Power in kW		**0.75**	**1.5**	**2.2**
Maximum control terminal cross section	mm²	0.05 – 2.5		
	AWG	30 – 12		

1) Recommended values for UL compliance

10.3.2 3-phase system AC 200 – 240 V

INFORMATION

All inverters with a power supply of 3 × AC 200 – 240 V can also be operated with 1 × AC 200 – 240 V at device terminal L1 and L2 when observing a derating of 50% of the output current. Application example for SWER grids (Single-Wire Earth Return).

Power 0.75 – 5.5 kW

MOVITRAC® LTPB – EMC filter class C2 according to EN 61800-3							
Power in kW		**0.75**	**1.5**	**2.2**	**3**	**4**	**5.5**
		IP20/NEMA 1					
MC LTP-B..		0008-2A3-4-00	0015-2A3-4-00	0022-2A3-4-00	0030-2A3-4-00	0040-2A3-4-00	0055-2A3-4-00
Part number		18251358	18251471	18251617	18251722	18251765	18251846
		IP66/NEMA 4X housing without switches					IP55/NEMA 12K
MC LTP-B..		0008-2A3-4-10	0015-2A3-4-10	0022-2A3-4-10	0030-2A3-4-10	0040-2A3-4-10	0055-2A3-4-10
Part number		18251366	18251498	18251625	18251730	18251773	18251854
		IP66/NEMA 4X housing with switches					
MC LTP-B..		0008-2A3-4-40	0015-2A3-4-40	0022-2A3-4-40	0030-2A3-4-40	0040-2A3-4-40	–
Part number		18251374	18251501	18251633	18251749	18251781	–
INPUT							
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 200 – 240 ±10%					
Line frequency f_{line}	Hz	50 / 60 ±5%					
Recommended power supply cable cross section	mm^2	1.5		2.5		4.0	6.0
	AWG	16		14		12	10
Line fuse	A	10		16	20 (35)[1]	25 (35)[1]	35
Nominal input current	A	4.5	7.3	11	16.1	18.8	24.8
OUTPUT							
Recommended motor power	kW	0.75	1.5	2.2	3	4	5.5
	HP	1	2	3	4	5	7.5
Output voltage V_{motor}	V	3 × 20 - U_{line}					
Output current	A	4.3	7	10.5	14	18	24
PWM frequency	kHz	2/4/6/8/12/16					2/4/6/8
Speed range	min^{-1}	-30000 – 0 – +30000					
Maximum output frequency	Hz	500					
Cross section of motor cable Cu 75C	mm^2	1.5		2.5		4.0	6.0
	AWG	16		14		12	10
Max. motor cable length shielded	m	100					
Max. motor cable length unshielded		150					
GENERAL							
Size		2			3		3 / 4[2]
Nominal power loss 24 V	W	8					8/11[2]
Nominal power loss power section	W	22	45	66	90	120	165
Minimum braking resistance value	Ω	27					22
Maximum device terminal cross section	mm^2	10					10 / 16[2]
	AWG	8					8 / 6[2]
Maximum control terminal cross section	mm^2	0.05 – 2.5					
	AWG	30 – 12					

1) Recommended values for UL compliance

2) IP20 housing: Size 3 / IP55 housing: Size 4

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Power 7.5 – 18.5 kW

MOVITRAC® LTPB – EMC filter class C2 according to EN 61800-3					
Power in kW		**7.5**	**11**	**15**	**18.5**
		IP55/NEMA 12K			
MC LTP-B..		0075-2A3-4-10	0110-2A3-4-10	0150-2A3-4-10	0185-2A3-4-10
Part number		18251919	18251978	18252036	18252060
INPUT					
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 200 – 240 ±10%			
Line frequency f_{line}	Hz	50 / 60 ±5%			
Recommended power supply cable cross section	mm^2	10	16	25	35
	AWG	8	6	4	2
Line fuse	A	50	63	80	100
Nominal input current	A	40	47.1	62.4	74.1
OUTPUT					
Recommended motor power	kW	7.5	11	15	18.5
	HP	10	15	20	25
Output voltage V_{motor}	V	3 × 20 - V_{line}			
Output current	A	39	46	61	72
PWM frequency	kHz	2/4/6/8/12			
Speed range	1/min	-30000 – 0 – +30000			
Maximum output frequency	Hz	500			
Cross section of motor cable Cu 75C	mm^2	10	16	25	35
	AWG	8	6	4	2
Maximum motor cable length shielded	m	100			
Maximum motor cable length unshielded		150			
GENERAL INFORMATION					
Size		4		5	
Nominal power loss 24 V	W	11		11.3	
Nominal power loss power section	W	225	330	450	555
Minimum braking resistance value	Ω	22	12		6
Maximum device terminal cross section	mm^2	16		35	
	AWG	6		2	
Maximum control terminal cross section	mm^2	0.05 – 2.5			
	AWG	30 – 12			

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Power 22 – 45 kW

MOVITRAC® LTPB – EMC filter class C2 according to EN 61800-3					
Power in kW		**22**	**30**	**37**	**45**
		IP55/NEMA 12K			
MC LTP-B..		0220-2A3-4-10	0300-2A3-4-10	0370-2A3-4-10	0450-2A3-4-10
Part number		18252087	18252117	18252141	18252176
INPUT					
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 200 – 240 ±10%			
Line frequency f_{line}	Hz	50 / 60 ±5%			
Recommended power supply cable cross section	mm^2	35	50	95	
	AWG	2	1	3 / 0	
Line fuse	A	100	150	200	
Nominal input current	A	92.3	112.7	153.5	183.8
OUTPUT					
Recommended motor power	kW	22	30	37	45
	HP	30	40	50	60
Output voltage V_{motor}	V	3 × 20 - V_{line}			
Output current	A	90	110	150	180
PWM frequency	kHz	2/4/6/8		2/4/6	2/4
Speed range	1/min	-30000 – 0 – +30000			
Maximum output frequency	Hz	500			
Cross section of motor cable Cu 75C	mm^2	35	50	95	
	AWG	2	1	3 / 0	
Maximum motor cable length shielded	m	100			
Maximum motor cable length unshielded		150			
GENERAL INFORMATION					
Size		6			
Nominal power loss 24 V	W	11.6			
Nominal power loss power section	W	660	900	1110	1350
Minimum braking resistance value	Ω	6	3		
Maximum device terminal cross section		M10 stud with nut max. 95 mm^2 M8 braking resistor connector max. 70 mm^2 Crimping cable lug DIN 46235			
	AWG	-			
Maximum control terminal cross section	mm^2	0.05 – 2.5			
	AWG	30 – 12			

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Power 55 – 75 kW

MOVITRAC® LTPB – EMC filter class C2 according to EN 61800-3			
	Power in kW	**55**	**75**
		IP55/NEMA 12K	
	MC LTP-B..	0550-2A3-4-10	0750-2A3-4-10
	Part number	18252206	18252230
INPUT			
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 200 – 240 ±10%	
Line frequency f_{line}	Hz	50 / 60 ±5%	
Recommended power supply cable cross section	mm^2	120	150
	AWG	4 / 0	–
Line fuse	A	250	315
Nominal input current	A	206.2	252.8
OUTPUT			
Recommended motor power	kW	55	75
	HP	75	100
Output voltage V_{motor}	V	3 × 20 - V_{line}	
Output current	A	202	248
PWM frequency	kHz	2/4/6/8	2/4/6
Speed range	1/min	-30000 – 0 – +30000	
Maximum output frequency	Hz	500	
Cross section of motor cable Cu 75C	mm^2	120	150
	AWG	4 / 0	–
Maximum motor cable length shielded	m	100	
Maximum motor cable length unshielded		150	
GENERAL INFORMATION			
Size		7	
Nominal power loss 24 V	W	11.9	
Nominal power loss power section	W	1650	2250
Minimum braking resistance value	Ω	3	
Maximum device terminal cross section		M10 stud with nut max. 95 mm^2 M8 braking resistor connector max. 70 mm^2 Crimping cable lug DIN 46235	
	AWG	-	
Maximum control terminal cross section	mm^2	0.05 – 2.5	
	AWG	30 – 12	

10.3.3 3-phase system AC 380 – 480 V

INFORMATION

All inverters with a power supply of 3 × AC 380 – 480 V can also be operated with 1 × AC 380 – 480 V at device terminal L1 and L2 when observing a derating of 50% of the output current. Application example for SWER grids (Single-Wire Earth Return).

Power 0.75 – 11 kW

MOVITRAC® LTPB – EMC filter class C2 according to EN 61800-3								
Power in kW		**0.75**	**1.5**	**2.2**	**4**	**5.5**	**7.5**	**11**
		IP20/NEMA 1						
MC LTP-B..		0008-5A3-4-00	0015-5A3-4-00	0022-5A3-4-00	0040-5A3-4-00	0055-5A3-4-00	0075-5A3-4-00	0110-5A3-4-00
Part number		18251412	18251552	18251684	18251803	18251870	18251927	18251986
		IP66/NEMA 4X housing without switches						IP55/NEMA 12K
MC LTP-B..		0008-5A3-4-10	0015-5A3-4-10	0022-5A3-4-10	0040-5A3-4-10	0055-5A3-4-10	0075-5A3-4-10	0110-5A3-4-10
Part number		18251420	18251560	18251692	18251811	18251889	18251935	18251994
		IP66/NEMA 4X housing with switches						
MC LTP-B..		0008-5A3-4-40	0015-5A3-4-40	0022-5A3-4-40	0040-5A3-4-40	0055-5A3-4-40	0075-5A3-4-40	–
Part number		18251439	18251579	18251706	18251838	18251897	18251943	–
INPUT								
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 380 – 480 ±10%						
Line frequency f_{line}	Hz	50 / 60 ±5%						
Recommended power supply cable cross section	mm^2	1.5			2.5			6
	AWG	16			14			10
Line fuse	A	10			16 (15)[1]	16	20	35
Nominal input current	A	2.4	4.3	6.1	9.8	14.6	18.1	24.7
OUTPUT								
Recommended motor power	kW	0.75	1.5	2.2	4	5.5	7.5	11
	HP	1	2	3	5	7.5	10	15
Output voltage V_{motor}	V	3 × 20 - U_{line}						
Output current	A	2.2	4.1	5.8	9.5	14	18	24
PWM frequency	kHz	2/4/6/8/12/16				2/4/6/8/12		2/4/6/8
Speed range	min^{-1}	-30000 – 0 – +30000						
Maximum output frequency	Hz	500						
Cross section of motor cable Cu 75C	mm^2	1.5			2.5			6
	AWG	16			14			10
Max. motor cable length shielded	m	100						
Max. motor cable length unshielded		150						
GENERAL								
Size		2				3		3 / 4[2]
Nominal power loss 24 V	W	8				10		10/16.7[2]
Nominal power loss power section	W	22	45	66	120	165	225	330
Minimum braking resistance value	Ω	68				39		

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MOVITRAC® LTPB – EMC filter class C2 according to EN 61800-3								
Power in kW		**0.75**	**1.5**	**2.2**	**4**	**5.5**	**7.5**	**11**
Maximum device terminal cross section	mm^2	10						10 / 16[2)]
	AWG	8						8 / 6[2)]
Maximum control terminal cross section	mm^2	0.05 – 2.5						
	AWG	30 – 12						

1) Recommended values for UL compliance

2) IP20 housing: Size 3 / IP55 housing: Size 4

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Power 15 – 37 kW

MOVITRAC® LTPB – EMC filter class C2 according to EN 61800-3						
Power in kW		**15**	**18.5**	**22**	**30**	**37**
		IP55/NEMA 12K				
MC LTP-B..		0150-5A3-4-10	0185-5A3-4-10	0220-5A3-4-10	0300-5A3-4-10	0370-5A3-4-10
Part number		18252044	18252079	18252095	18252125	18252168
INPUT						
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 380 – 480 ±10%				
Line frequency f_{line}	Hz	50 / 60 ±5%				
Recommended power supply cable cross section	mm^2	6	10	16	25	35
	AWG	10	8	6	4	2
Line fuse	A	35	50	63	80	100
Nominal input current	A	30.8	40	47.1	62.8	73.8
OUTPUT						
Recommended motor power	kW	15	18.5	22	30	37
	HP	20	25	30	40	50
Output voltage V_{motor}	V	3 × 20 - U_{line}				
Output current	A	30	39	46	61	72
PWM frequency	kHz	2/4/6/8/12				
Speed range	min^{-1}	-30000 – 0 – +30000				
Maximum output frequency	Hz	500				
Cross section of motor cable Cu 75C	mm^2	6	10	16	25	35
	AWG	10	8	6	4	2
Max. motor cable length shielded	m	100				
Max. motor cable length unshielded		150				
GENERAL						
Size		4			5	
Nominal power loss 24 V	W	16.7			19.8	
Nominal power loss power section	W	450	555	660	900	1110
Minimum braking resistance value	Ω	22			12	
Maximum device terminal cross section	mm^2	16			35	
	AWG	6			2	
Maximum control terminal cross section	mm^2	0.05 – 2.5				
	AWG	30 – 12				

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Power 45 – 90 kW

MOVITRAC® LTPB – EMC filter class C2 according to EN 61800-3					
Power in kW		**45**	**55**	**75**	**90**
		IP55/NEMA 12K			
MC LTP-B..		0450-5A3-4-10	0550-5A3-4-10	0750-5A3-4-10	0900-5A3-4-10
Part number		18252184	18252214	18252249	18252273
INPUT					
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 380 – 480 ±10%			
Line frequency f_{line}	Hz	50 / 60 ±5%			
Recommended power supply cable cross section	mm^2	50	70	95	120
	AWG	1	2 / 0	3 / 0	4 / 0
Line fuse	A	125	150	200	250
Nominal input current	A	92.2	112.5	153.2	183.7
OUTPUT					
Recommended motor power	kW	45	55	75	90
	HP	60	75	100	150
Output voltage V_{motor}	V	3 × 20 - U_{line}			
Output current	A	90	110	150	180
PWM frequency	kHz	2/4/6/8		2/4/6	2/4
Speed range	min^{-1}	-30000 – 0 – +30000			
Maximum output frequency	Hz	500			
Cross section of motor cable Cu 75C	mm^2	50	70	95	120
	AWG	1	2 / 0	3 / 0	4 / 0
Max. motor cable length shielded	m	100			
Max. motor cable length unshielded		150			
GENERAL					
Size		6			
Nominal power loss 24 V	W	31.1			
Nominal power loss power section	W	1350	1650	2250	2700
Minimum braking resistance value	Ω	6			
Maximum device terminal cross section		M10 stud with nut max. 95 mm² Braking resistor terminal M8 max. 70 mm^2 Press cable lug DIN 46235			
	AWG	–			
Maximum control terminal cross section	mm^2	0.05 – 2.5			
	AWG	30 – 12			

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Power 110 – 160 kW

MOVITRAC® LTPB – EMC filter class C2 according to EN 61800-3				
Power in kW		**110**	**132**	**160**
		IP55/NEMA 12K		
MC LTP-B..		1100-5A3-4-10	1320-5A3-4-10	1600-5A3-4-10
Part number		18252303	18252311	18252346
INPUT				
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 380 – 480 ±10%		
Line frequency f_{line}	Hz	50 / 60 ±5%		
Recommended power supply cable cross section	mm^2	120	150	185
	AWG	4 / 0	–	–
Line fuse	A	250	315	355
Nominal input current	A	205.9	244.5	307.8
OUTPUT				
Recommended motor power	kW	110	132	160
	HP	175	200	250
Output voltage V_{motor}	V	3 × 20 - U_{line}		
Output current	A	202	240	302
PWM frequency	kHz	2/4/6/8	2/4/6	2/4
Speed range	min^{-1}	-30000 – 0 – +30000		
Maximum output frequency	Hz	500		
Cross section of motor cable Cu 75C	mm^2	120	150	185
	AWG	4 / 0	–	–
Maximum motor cable length shielded	m	100		
Maximum motor cable length unshielded		150		
GENERAL				
Size		7		
Nominal power loss 24 V	W	38.5		
Nominal power loss power section	W	3300	3960	4800
Minimum braking resistance value	Ω	6		
Maximum device terminal cross section		M10 stud with nut max. 95 mm^2 Braking resistor terminal M8 max. 70 mm^2 Press cable lug DIN 46235		
	AWG	–		
Maximum control terminal cross section	mm^2	0.05 – 2.5		
	AWG	30 – 12		

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10.3.4 3-phase system AC380 - 480 V as an IT system version - device without filter

INFORMATION

The listed inverters have no EMC filter and are only suitable for IT systems.

The technical data correspond to the 3 × 380 – 480 V standard devices with the exception of the filter class.

MOVITRAC® LTP-B – IT system version – devices without filter				
Power rating	**Size**	**Housing**	**Type designation**	**Part number**
0.75	2	IP66/NEMA 4X without switches	MC LTP-B0008-503-4-15	18265588
1.5	2	IP66/NEMA 4X without switches	MC LTP-B0015-503-4-15	18265596
2.2	2	IP66/NEMA 4X without switches	MC LTP-B0022-503-4-15	18265618
4	2	IP66/NEMA 4X without switches	MC LTP-B0040-503-4-15	18265626
5.5	3	IP66/NEMA 4X without switches	MC LTP-B0055-503-4-15	18265634
7.5	3	IP66/NEMA 4X without switches	MC LTP-B0075-503-4-15	18265642
11	4	IP55/NEMA 12K housing without switches	MC LTP-B0110-503-4-15	18265650
15	4	IP55/NEMA 12K housing without switches	MC LTP-B0150-503-4-15	18265669
18.5	4	IP55/NEMA 12K housing without switches	MC LTP-B0185-503-4-15	18265677
22	4	IP55/NEMA 12K housing without switches	MC LTP-B0220-503-4-15	18265685
30	5	IP55/NEMA 12K housing without switches	MC LTP-B0300-503-4-15	18265693
37	5	IP55/NEMA 12K housing without switches	MC LTP-B0370-503-4-15	18265707
45	6	IP55/NEMA 12K housing without switches	MC LTP-B0450-503-4-15	18265715
55	6	IP55/NEMA 12K housing without switches	MC LTP-B0550-503-4-15	18265723
75	6	IP55/NEMA 12K housing without switches	MC LTP-B0750-503-4-15	18265731
90	6	IP55/NEMA 12K housing without switches	MC LTP-B0900-503-4-15	18265758
110	7	IP55/NEMA 12K housing without switches	MC LTP-B1100-503-4-15	18265766
132	7	IP55/NEMA 12K housing without switches	MC LTP-B1320-503-4-15	18265774
160	7	IP55/NEMA 12K housing without switches	MC LTP-B1600-503-4-15	18265782

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10.3.5 3-phase system AC 500 – 600 V

INFORMATION

All inverters with a power supply of 3 × AC 500 – 600 V can also be operated with 1 × AC 500 – 600 V at device terminal L1 and L2 when observing a derating of 50% of the output current. Application example for SWER grids (Single-Wire Earth Return).

Power 0.75 – 5.5 kW

MOVITRAC® LTP-B						
Power in kW		**0.75**	**1.5**	**2.2**	**4**	**5.5**
		IP20/NEMA 1				
MC LTP-B..		0008-603-4-00	0015-603-4-00	0022-603-4-00	0040-603-4-00	0055-603-4-00
Part number		18251447	18251587	18251714	18410812	18410839
		IP66/NEMA 4X housing without switches				
MC LTP-B..		0008-603-4-10	0015-603-4-10	0022-603-4-10	0040-603-4-10	0055-603-4-10
Part number		18251455	18251595	18410804	18410820	18410847
		IP66/NEMA 4X housing with switches				
MC LTP-B..		0008-603-4-40	0015-603-4-40	0022-603-4-40	0040-603-4-40	0055-603-4-40
Part number		18251463	18251609	18271928	18271936	18251900
INPUT						
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 500 – 600 ±10%				
Line frequency f_{line}	Hz	50 / 60 ±5%				
Recommended power supply cable cross section	mm^2	1.5				2.5
	AWG	16				14
Line fuse	A	10 / (6)[1]		10		16 / (15)[1]
Nominal input current	A	2.5	3.7	4.9	7.8	10.8
OUTPUT						
Recommended motor power	kW	0.75	1.5	2.2	4	5.5
	HP	1	2	3	5	7.5
Output voltage V_{motor}	V	3 × 20 - U_{line}				
Output current	A	2.1	3.1	4.1	6.5	9
PWM frequency	kHz	2/4/6/8/12				
Speed range	min^{-1}	-30000 – 0 – +30000				
Maximum output frequency	Hz	500				
Cross section of motor cable Cu 75C	mm^2	1.5				2.5
	AWG	16				14
Max. motor cable length shielded	m	100				
Max. motor cable length unshielded		150				
GENERAL						
Size		2				
Nominal power loss 24 V	W	8				
Nominal power loss power section	W	22	45	66	120	165
Minimum braking resistance value	Ω	68				
Maximum device terminal cross section	mm^2	10				
	AWG	8				
Maximum control terminal cross section	mm^2	0.05 – 2.5				
	AWG	30 – 12				

1) Recommended values for UL compliance

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Power 7.5 – 30 kW

MOVITRAC® LTP-B							
Power in kW		**7.5**	**11**	**15**	**18.5**	**22**	**30**
		IP20/NEMA 1					
MC LTP-B..		0075-603-4-00	0110-603-4-00	0150-603-4-00	–	–	–
Part number		18410855	18410863	18410871	–	–	–
		IP66/NEMA 4X housing without switches		IP55/NEMA 12K			
MC LTP-B..		0075-603-4-10	0110-603-4-10	0150-603-4-10	0185-603-4-10	0220-603-4-10	0300-603-4-10
Part number		18251951	18252028	18252052	18410898	18252109	18252133
		IP66/NEMA 4X housing with switches					
MC LTP-B..		0075-603-4-40	0110-603-4-40	–	–	–	–
Part number		18271944	18271952	–	–	–	–
INPUT							
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 500 – 600 ±10%					
Line frequency f_{line}	Hz	50 / 60 ±5%					
Recommended power supply cable cross section	mm^2	2.5	4	6		10	14
	AWG	14	12	10		8	6
Line fuse	A	20	25 / (30)[1]	35	40 / (45)[1]	50 / (60)[1]	63 / (70)[1]
Nominal input current	A	14.4	20.6	26.7	34	41.2	49.5
OUTPUT							
Recommended motor power	kW	7.5	11	15	18.5	22	30
	HP	10	15	20	25	30	40
Output voltage V_{motor}	V		3 × 20 - U_{line}				
Output current	A	12	17	22	28	34	43
PWM frequency	kHz	2/4/6/8/12					
Speed range	min^{-1}	-30000 – 0 – +30000					
Maximum output frequency	Hz	500					
Cross section of motor cable Cu 75C	mm^2	2.5	4	6		10	14
	AWG	14	12	10		8	6
Max. motor cable length shielded	m	100					
Max. motor cable length unshielded		150					
GENERAL							
Size		3		3 / 4[2]	4		
Nominal power loss 24 V	W	10		10/16.7[2]	16.7		
Nominal power loss power section	W	225	330	450	555	660	900
Minimum braking resistance value	Ω	39			22		
Maximum device terminal cross section	mm^2	10		10 / 16[2]	16		
	AWG	8		8 / 6[2]	6		
Maximum control terminal cross section	mm^2	0.05 – 2.5					
	AWG	30 – 12					

1) Recommended values for UL compliance in brackets

2) IP20 housing: Size 3 / IP55 housing: Size 4

Power 37 – 110 kW

MOVITRAC® LTP-B							
Power in kW		**37**	**45**	**55**	**75**	**90**	**110**
		IP55/NEMA 12K					
MC LTP-B..		0370-603-4-10	0450-603-4-10	0550-603-4-10	0750-603-4-10	0900-603-4-10	1100-603-4-10
Part number		18410901	18252192	18252222	18252257	18252281	18410928
INPUT							
Nominal line voltage V_{line} according to EN 50160	V	3 × AC 500 – 600 ±10%					
Line frequency f_{line}	Hz	50 / 60 ±5%					
Recommended power supply cable cross section	mm^2	25	35		50	70	95
	AWG	4	2		1	2/0	3/0
Line fuse	A	80	100		125/(150)[1]	160/(175)[1]	200
Nominal input current	A	62.2	75.8	90.9	108.2	127.7	158.4
OUTPUT							
Recommended motor power	kW	37	45	55	75	90	110
	HP	50	60	75	100	125	150
Output voltage V_{motor}	V		3 × 20 - U_{line}				
Output current	A	54	65	78	105	130	150
PWM frequency	kHz	2/4/6/8/12		2/4/6/8		2/4/6	
Speed range	min^{-1}	-30000 – 0 – +30000					
Maximum output frequency	Hz	500					
Cross section of motor cable Cu 75C	mm^2	25	35		50	70	95
	AWG	4	2		1	2 / 0	3 / 0
Max. motor cable length shielded	m	100					
Max. motor cable length unshielded		150					
GENERAL							
Size		5		6			
Nominal power loss 24 V	W	19.8		31.1			
Nominal power loss power section	W	1110	1350	1650	2250	2700	3300
Minimum braking resistance value	Ω	22		12		6	
Maximum device terminal cross section	mm^2	35		M10 stud with nut max. 95 mm^2 Braking resistor terminal M8 max. 70 mm^2 Press cable lug DIN 46235			
	AWG	2		-			
Maximum control terminal cross section	mm^2	0.05 – 2.5					
	AWG	30 – 12					

1) Recommended values for UL compliance in brackets

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10.4 Input voltage ranges

Depending on the model, the inverters are designed for direct connection to the following voltage sources:

MOVITRAC® LTP-B			
Nominal voltage according to EN 50160	**Power rating**	**Connection type**	**Rated frequency**
200 – 240 V ± 10%	0.75 – 2.2 kW	1-phase*	50 – 60 Hz ±5%
200 – 240 V ± 10%	0.75 – 75 kW	3-phase	
380 – 480 V ± 10%	0.75 – 160 kW		
500 – 600 V ± 10%	0.75 – 110 kW		

Units that are connected to a 3-phase supply system are designed for a maximum power grid imbalance of 3% between the phases. For supply systems with a power grid imbalance of more than 3% (for example, in India and parts of the Asia-Pacific region including China), SEW-EURODRIVE recommends that you use input chokes.

INFORMATION

*Single-phase inverters can also be connected to 2 phases of a 3-phase supply system of 200 – 240 V.

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10.5 Setting range

	Setting range without encoder card		Setting range with HTL/TTL encoder card	
Operating mode/ motor control (P4-01)	**Continuous setting range referred to n_{max} = 3000 min^{-1}**	**Static control accuracy referred to n_{max} = 3000 min^{-1}**	**Continuous setting range referred to n_{max} = 3000 min^{-1}**	**Static control accuracy referred to n_{max} = 3000 min^{-1}**
0: VFC speed control	1:50	0.5%	1:3000	0.03%
1: VFC torque control	1:50	0.5%	1:3000	0.03%
2: V/f speed control	1:20	0.50%	–	–
3: Synchronous motor speed control (PMVC)	1:20	0.5%	–	–
4: Synchronous motor torque control	1:20	0.5%	–	–
5: Synchronous motor position control	–	–	1:3000[1)]	0.03%[1)]
6: LSPM motor speed control	1:20	0.5%	–	–
7: Synchronous reluctance motor speed control (SYN-R)	1:20	0.5%	–	–
8: Brushless DC motor speed control (BLDC)	1:20	0.5%	–	–

1) With LTX only

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10.6 Overload capacity

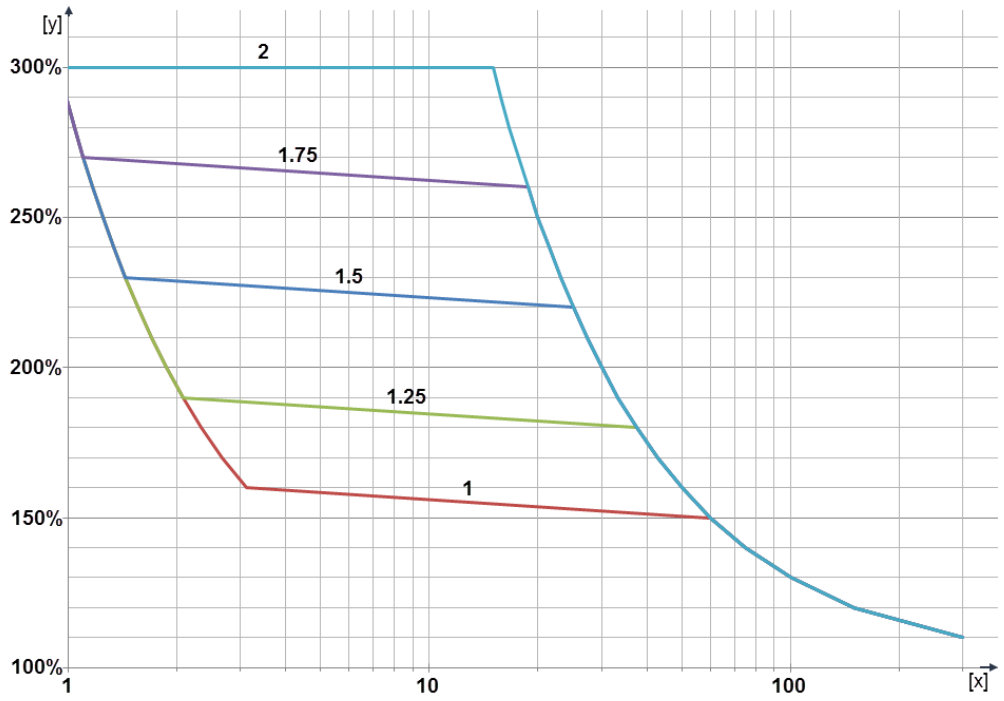
The inverter supplies a constant output current of 100%.

Inverter

Overload capacity based on nominal inverter current	60 seconds	2 seconds
MOVITRAC® LTP-B	150%	175%

Motors

The following chart shows the overload capacity of the inverter with regard to the ratio of rated inverter current to the rated motor current:



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[x] = Overload duration in sec.

[y] = Motor overload with regard to its rated current

Overload capacity based on nominal motor current	60 seconds	2 seconds
MGF..2-DSM with MC LTP-B 0015-5A3-4-xx	200%	220%
MGF..4-DSM with MC LTP-B 0022-5A3-4-xx	190%	220%
MGF..4/XT-DSM[1] with MC LTP-B 0040-5A3-4-xx	%[1]	%[1]

1) In preparation.

10.7 Protection function

- Output short circuit, phase-phase, phase-ground
- Output overcurrent
- Overload protection
  - Inverter responds to overload as described in chapter "Overload capacity" (→ 🗎 193).
- Overvoltage fault
  - Set to 123% of the maximum nominal line voltage of the inverter.
- Undervoltage fault
- Overtemperature fault
- Undertemperature fault
  - The inverter is shut down at a temperature below -10 °C.
- Line phase failure
  - A running inverter shuts down when one phase of a three-phase system fails for longer than 15 seconds.
- Thermal motor overload protection according to NEC (National Electrical Code, US)
- Evaluation of TF, TH, KTY84 and PT1000
- Motor phase failure detection in all vector operating modes

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10.8 Housing variants and dimensions

10.8.1 Housing variants

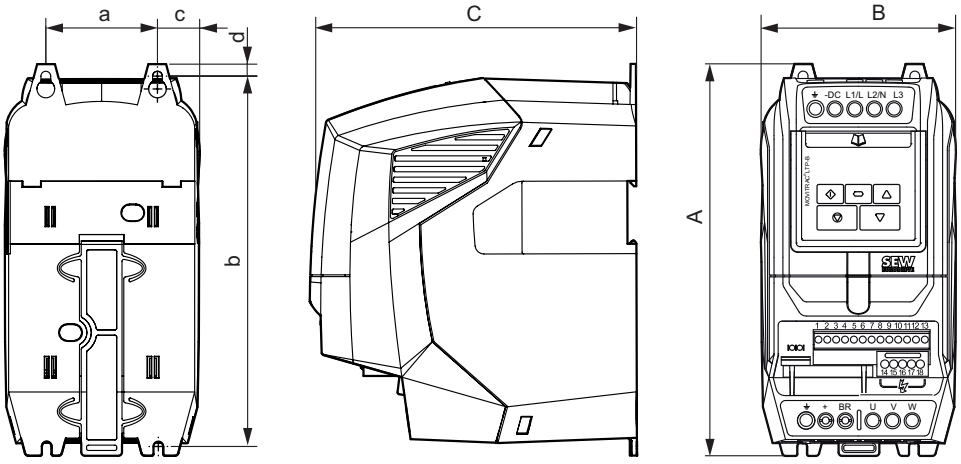
The inverter is available with the following housing variants:

- IP20/NEMA-1 housing for use in control cabinets
- IP55/NEMA-12K housing
- IP66/NEMA-4X housing

The housings with degree of protection IP55/NEMA 12K and IP66/NEMA 4X are protected against humidity and dust. This allows for operating the inverter indoors under difficult conditions. The inverter functions are identical.

10.8.2 Dimensions

Inverters with degree of protection IP20/NEMA 1



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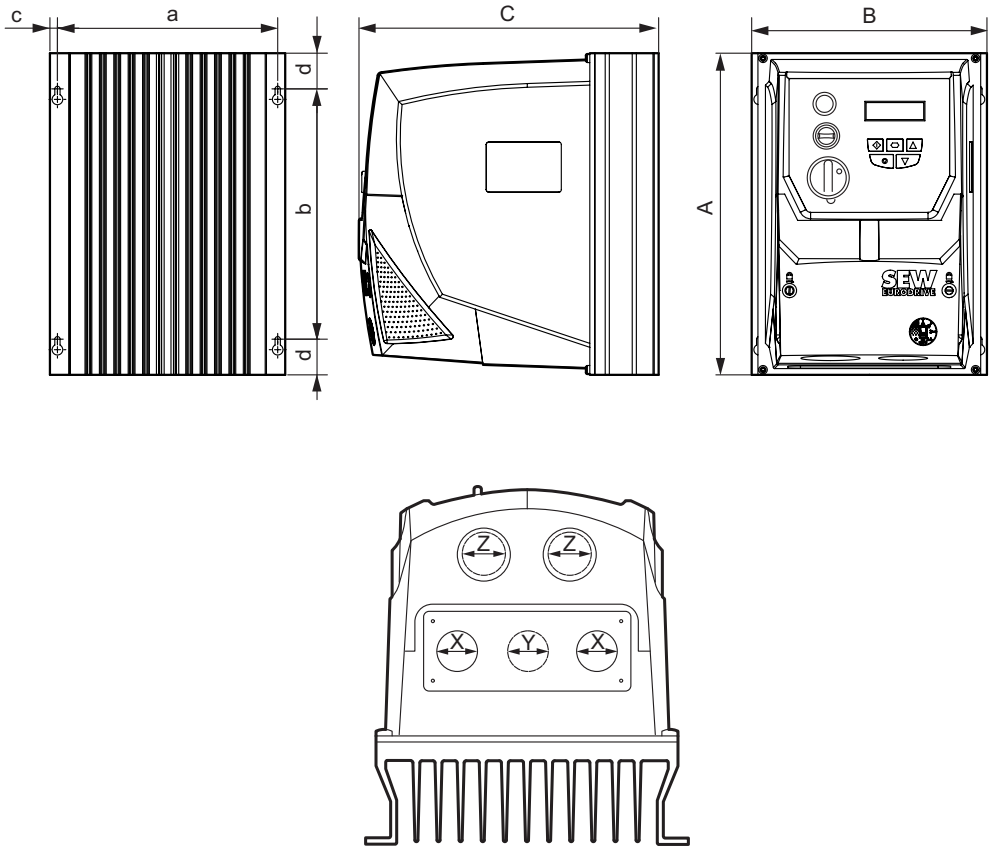
Dimension		230 V: 0.75 – 2.2 kW 400 V: 0.75 – 4 kW 575 V: 0.75 – 5.5 kW	230 V: 3 – 5.5 kW 400 V: 5.5 – 11 kW 575 V: 7.5 – 15 kW
Height (A)	mm	221	261
Width (B)	mm	110	131
Depth (C)	mm	185	205
Mass	kg	1.8	3.5
a	mm	63.0	80.0
b	mm	209	247
c	mm	23	25.5
d	mm	7.00	7.75
Recommended screw size		4 × M4	

Inverters with degree of protection IP66/NEMA 4X



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Dimension		230 V: 0.75 – 2.2 kW 400 V: 0.75 – 4 kW 575 V: 0.75 – 5.5 kW	230 V: 3 – 4 kW 400 V: 5.5 – 7.5 kW 575 V: 7.5 – 11 kW
Height (A)	mm	257	310
Width (B)	mm	188	211
Depth (C)	mm	239	270
Mass	kg	4.8	7.3
a	mm	178	200
b	mm	200	252
c	mm	5	5.5
d	mm	28.5	29
Recommended screw size		4 × M4	

IP66 cable openings

Use suitable cable glands to achieve the corresponding IP/NEMA classification.

Dimensions		Size 2	Size 3
X[1]	mm	28.2	28.2
	PG/M[2]	PG21/M25	PG21/M25

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Dimensions		Size 2	Size 3
Y[3]	mm	22	22
	PG/M[2]	PG13.5/M20	PG13.5/M20
Z[4]	mm	32/25	32/25
	PG/M[2]	PG21/M32 PG16/M25	PG21/M32 PG16/M25

1) Cable bushing X is open ex works
2) The data above refers to plastic screw connections.
3) Cable bushing Y is prepunched and can be broken out with a suitable tool.
4) Cable bushing Z is provided on the cover but has to be drilled.

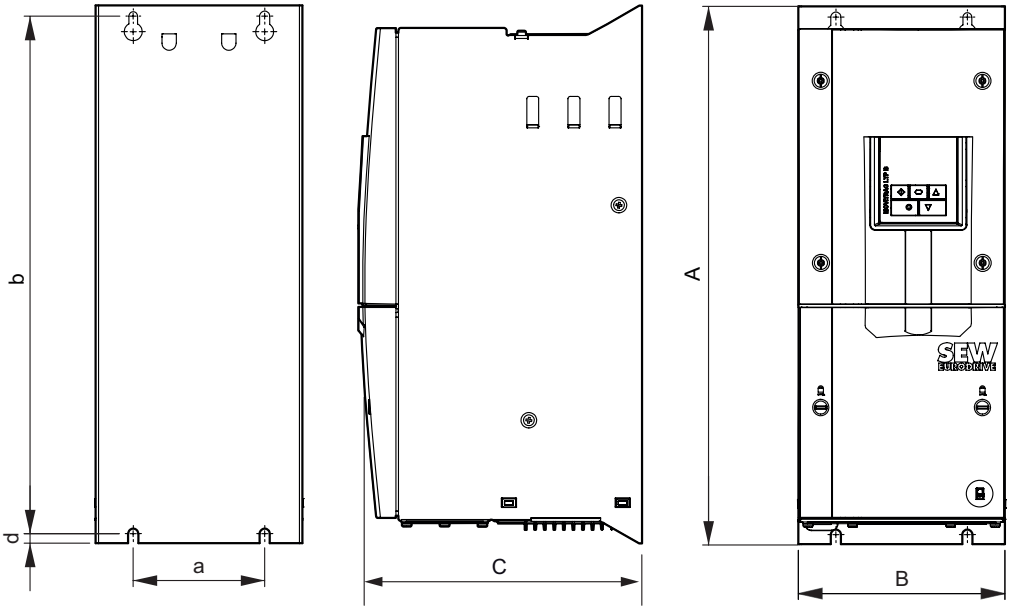
Inverters with degree of protection IP55/NEMA 12K

NOTICE

Residual particles after drilling the cable entires can damage the device.

Device can be damage by a short circuit

- Carefully remove all particles on and in the inverter after drilling.



There are no holes in the cable entry plate of devices of the BG4-7 series. These must be drilled or punched by the user.

Dimension		230 V: 5.5 – 11 kW 400 V: 11 – 22 kW 575 V: 15 – 30 kW	230 V: 15 – 18.5 kW 400 V: 30 – 37 kW 575 V: 37 – 45 kW	230 V: 22 – 45 kW 400 V: 45 – 90 kW 575 V: 55 – 110 kW	230 V: 55 – 75 kW 400 V: 110 – 160 kW
Height (A)	mm	450	540	865	1280
Width (B)	mm	171	235	330	330
Depth (C)	mm	250	268	335	365
Mass	kg	11.5	22.5	47	80
a	mm	110	175	200	200
b	mm	423	520	840	1255
c	mm	61	60	130	130
d	mm	8	8	10	10
Recommended screw size		4 × M8		4 × M10	

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11 Functional safety (STO)

Safe Torque Off is abbreviated to STO for the remainder of this section.

11.1 Integrated safety technology

The safety technology of MOVITRAC® LTP-B described below has been developed and tested in accordance with the following safety requirements:

Underlying standards	Safety class
EN 61800-5-2:2016	SIL 2
EN ISO 13849-1:2015	PL d
EN 61508 (Parts 1 – 7):2010	SIL 2
EN 60204-1:2006 +A1:2009 + AC:2010	Stop category 0
EN 62061:2005/A2:2015	SIL CL 2

STO certification was conducted by TÜV Rheinland. It is valid only for devices that have the TÜV logo imprinted on the nameplate. Copies of the TÜV certificate can be obtained from SEW-EURODRIVE.

11.1.1 Safe condition

For the safety-related use of MOVITRAC® LTP-B, "Safe Torque Off" is defined as a safe state. The underlying safety concept is based on this.

11.1.2 Safety concept

- In the event of danger, any potential risk related to a machine must be eliminated as quickly as possible. Idle state with restart prevention is generally the safe state for preventing dangerous movements.
- The STO function is available independently of the operating mode or parameter settings.
- The inverter offers the possibility of connecting an external safety relay. This safety relay activates the STO function when a connected command device (e.g. emergency stop button with latching function) is actuated. The motor coasts to a halt and is now in the "Safe Torque Off" state.
- The active STO function prevents the inverter from supplying a torque-generating rotating field to the motor.

Safe disconnection function (STO)

The function of the safe disconnection locks the output stage of the inverter. This prevents a torque-generating rotating field from being connected to the motor. The motor coasts to a halt.

Restarting the motor is possible only if:

- A voltage of 24 V is present between STO+ and STO- as shown in chapter "Overview of signal terminals".
- All error messages are acknowledged.

Using the STO function makes it possible to integrate the drive into a safety system in which the STO function must be fully compliant.

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The STO function makes the use of electro-mechanical protection with self-checking auxiliary contacts for implementing safety functions redundant.

Safe Torque Off function

INFORMATION

The STO function does not prevent the inverter from restarting unintentionally. An automatic restart may occur as soon as the STO inputs obtain a valid signal (depending on the parameter settings). For this reason, do not use this function to carry out brief non-electrical work (for example, cleaning or maintenance).

The STO function integrated into the inverter meets the definition of "Safe Torque Off" in accordance with IEC 61800-5-2:2016.

The STO function corresponds to an uncontrolled stop in accordance with category 0 (emergency off) of IEC 60204-1. If the STO function is activated, the motor coasts to a stop. This stop procedure must be in accordance with the system that drives the motor.

The inverter is tested in accordance with the safety standards specified below:

	SIL **Safety integrity level**	**PFH_D** **Probability of dangerous failure per hour**	**SFF** **Safe failure fraction**	**Assumed service life**
EN 61800-5-2	2	1.23×10^{-9} 1/h (0.12% of SIL 2)	50%	20 years

	PL **Performance level**	**CCF (%)** **Common cause failure**
EN ISO 13849-1	PL d	1

	SILCL
EN 62061	SILCL 2

Information: The above values are not achieved if the inverter is installed in an environment whose limit values lie outside the values specified in chapter "Ambient conditions" (→ 🗎 175).

INFORMATION

Some applications require additional measures in order to satisfy the requirements of the system's safety function. The STO function does not have a motor brake. If a motor brake is required, it is necessary to use a delayed safety relay and/or a mechanical braking device or similar. It is necessary to establish which protective function is required when braking. The brake control in the inverter has not been evaluated from a safety technology perspective and therefore cannot be used to safely control the brake without the use of additional measures.

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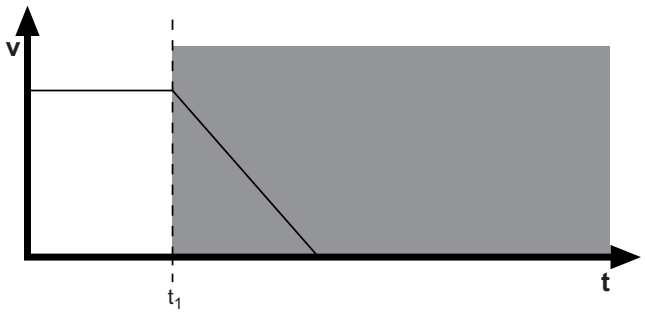
Safety functions

The following figure shows the STO function:



2463228171

v Speed
t Time
t_1 Time at which STO is triggered
Switch-off range

STO status and diagnostics

Inverter display

Inverter display **"Inhibit"**: The STO function is active due to signals present at the safety inputs. If, at the same time, the inverter switches to a fault status, the relevant error message is displayed instead of "Inhibit".

Inverter display **"STo-F"**: See chapter Error codes.

Inverter output relay

Inverter relay 1: If *P2-15* is set to "9", the relay opens when the STO function is activated.

Inverter relay 2: If *P2-18* is set to "9", the relay opens when the STO function is activated.

Response times of STO function

The entire response time is the time from when a safety-relevant event occurs on the system components (total) until they are in a safe state (stop category 0 in accordance with IEC 60204-1).

Response time	Description
< 1 ms	From the time • when the STO inputs are no longer energized Until the time • when the motor can no longer generate torque.
< 20 ms	From the time • when the STO inputs are no longer energized Until the time • when the STO monitoring status changes.
< 20 ms	From detection • of a fault in the STO circuit Until display • of the fault in the inverter display or the digital output. Status: "Frequency inverter fault"

11.1.3 Restrictions

⚠ WARNING

The safety concept is only suitable for performing mechanical work on driven system/machine components.

If the STO signal is disconnected, the line voltage is still present at the inverter DC link.

- Before working on the electric part of the drive system, disconnect it from the supply system using an appropriate external disconnecting device and secure it against unintentional reconnection to the voltage supply.
- The STO function does not prevent an unintended restart. As soon as the STO inputs receive the corresponding signal, the drive can restart automatically. The STO function must not be used for maintenance and repair work.

- The STO function does not have a motor brake. A possible coasting down of the motor may not result in a further hazard. This must be taken into account in a risk assessment of the system/machine. Additional safety measures might have to be implemented (e.g. safety brake system).

  The inverter cannot be used alone without an additional brake system for application-specific safety functions that require active deceleration (braking) of the dangerous movement!
- When using a permanent-field motor and a multiple output stage error occurs – which is extremely rare –, the rotor could rotate by 180°/p (p = number of pole pairs).

INFORMATION

In case of safety-related disconnection of the DC 24 V supply voltage at terminal 12 (STO activated), the brake is always applied. The brake control in the inverter is not safety-related.

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11.2 Safety conditions

The requirement for safe operation is that the safety functions of the inverter are properly integrated into an application-specific, higher-level safety function. A system/machine-specific risk assessment must be always carried out by the system/machine manufacturer and taken into account for the use of the drive system with the inverter.

The system/machine manufacturer and the user are responsible for compliance of the system/machine with applicable safety regulations.

Approved devices:

All available MOVITRAC® LTP-B inverters have the STO function.

The following requirements are mandatory when installing and operating the inverter in safety-related applications.

11.2.1 Storage requirements

To avoid accidental damage, SEW-EURODRIVE recommends keeping the inverter in its original packaging until you are going to install it. The storage location must be dry and clean. The temperature range at the storage location must be between –40°C and + 60°C.

11.2.2 Installation requirements

NOTICE

The STO wiring must be protected against accidental short circuits or external influences. Otherwise, it may cause the STO input signal to fail.

In addition to the wiring guidelines for the STO circuit, section "Electromagnetic compatibility" (→ 🗎 37) must also be observed.

Shielded twisted-pair cables are always recommended here.

Requirements:

- The safety-related DC 24 V supply voltage must be EMC-compliant and routed as follows:
  - Outside an electrical installation space, shielded cables must be routed permanently (fixed) and protected against external damage, or other equivalent measures have to be taken.
  - Inside an electrical installation space: Single conductors can be routed.
  - Adhere to the regulations in force for the application.
- Make sure that you apply shielding for the safety-related DC 24 V supply cable at both ends.
- Power cables and safety-related control cables must be installed in separate cables.
- Make sure that no parasitic voltages can be generated in the safety-related control cables.
- Wiring technology must comply with EN 60204-1.
- Use only grounded voltage sources with protective extra-low voltage (PELV) according to VDE0100 and EN 60204-1. In case of a single fault, the voltage between the outputs or between any output and grounded parts must not exceed a DC voltage of 60 V.

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- The safety-related DC 24 V supply voltage may not be used for feedback.
- You can supply power to the 24 V STO input either via an external 24 V supply or via the internal 24 V supply of the inverter. If an external voltage source is used, its cable length to the inverter must not exceed 25 meters.
  - Nominal voltage: DC 24 V
  - STO Logic High: DC 18 – 30 V (Safe Torque Off in standby)
  - Maximum current consumption: 100 mA
- When planning the installation, observe the technical data of the inverter.
- Observe the values specified for safety components when designing the safety circuits.
- Inverters with degree of protection IP20 must be installed in an IP54 control cabinet (minimum requirement) in an environment with degree of pollution 1 or 2.
- The safe 24 V must be connected between the safety relay and STO+ input in such a way that a fault can be ruled out.

  The fault assumption "short circuit between any 2 conductors" can be excluded according to EN ISO 13849-2: 2008 under the following conditions.

  The conductors are:
  - Permanently (fixed) installed and protected against external damage (for example, using a cable duct or armored conduit)
  - Installed in different light plastic-sheathed cables in an electrical installation space provided that both the lines and the installation space meet the relevant requirements, see EN 60204-1.
  - Protected individually by a ground connection.

  The fault assumption "short circuit between any conductor and an exposed conductive part or ground or a protective conductor" can be excluded under the following condition:
  - Short circuits between a conductor and any exposed conductive part within an installation space.

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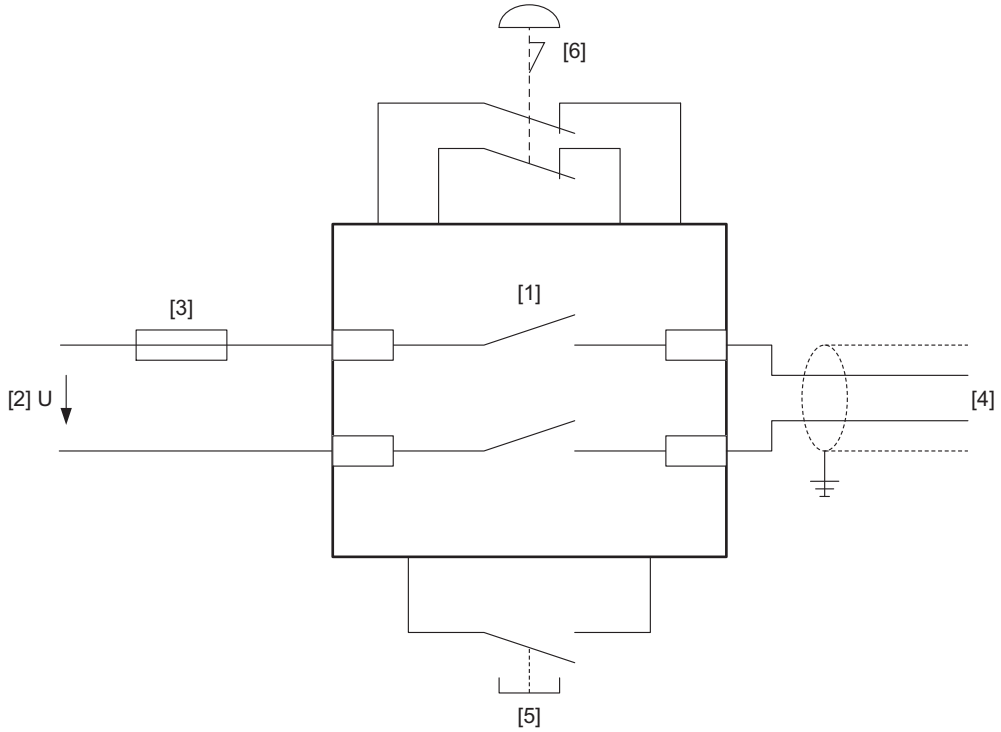
11.2.3 Requirements on the external safety controller



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[1] Safety relay with approval

[2] DC 24 V voltage supply

[3] Fuses in accordance with the manufacturer's specifications of the safety relay

[4] Safety-related DC 24 V voltage supply

[5] Reset button for manual reset

[6] Approved EMERGENCY STOP actuating device

A safety relay can be used as an alternative to a safety controller. The following requirements apply analogously:

- The safety controller and all other safety-related subsystems must be approved for at least that safety class which is required in the overall system for the respective, application-related safety function.

  The following table shows an example of the required safety class of the safety controller:

Application	Safety controller requirements
Performance level d in accordance with EN ISO 13849-1	Performance level d in accordance with EN ISO 13849-1 SIL 2 in accordance with EN 61508

- The wiring of the safety controller must be suitable for the required safety class (see manufacturer documentation).
  - When disconnected, test pulses on the supply cable are not permitted.
- The values specified for the safety controller must be strictly adhered to when designing the circuit.

- The switching capacity of the safety relays or the relay outputs of the safety controller must, at the very least, correspond to the maximum permitted, limited output current of the 24 V supply voltage.

  Observe the manufacturer's instructions concerning the permitted contact loads and fusing that may be required for the safety contacts. If the manufacturer does not provide any specific information on this matter, the contacts must be protected with 0.6 times the nominal value of the maximum contact load specified by the manufacturer.
- To ensure protection against an unintentional restart in accordance with EN 1037, the safe control system must be designed and connected in such a way that resetting the control device alone does not result in a restart. In other words, a restart may only be carried out after the safety circuit has been manually reset.

INFORMATION

It is not possible to control the STO inputs via pulsed signals (for example, self-testing digital outputs of safety controllers).

11.2.4 Requirements for safety relays

The requirements of the manufacturers of safety relays, such as protecting the output contacts against welding or other safety components, must be strictly observed. For cable routing, the basic requirements apply as described in this documentation.

Other information by the manufacturer on the use of safety relays for specific applications must also be observed.

Choose the safety relay in such a way that it has at least the same safety standards as the required PL/SIL of the application.

Minimum requirements	SIL2 or PLd SC3 or higher (with positively-driven contacts).
Number of output contacts	2 independent
Rated switching voltage	30 V DC
Switching current	100 mA

11.2.5 Requirements on startup

- To validate the implemented safety functions, they must be documented and checked after successful startup (validation).

  Observe the limitations for safety functions in chapter "Limitations" (→ 🗎 202) for this. Non-safety-related parts and components that affect the result of the validation (e.g. motor brake) must be deactivated, if necessary.
- For using MOVITRAC® LTP-B in safety-relevant applications, it is essential that you perform and record startup checks for the disconnecting device and correct wiring.

11.2.6 Requirements on operation

- Operation is only allowed within the limits specified in the data sheets. This principle applies to the external safety controller as well as MOVITRAC® LTP-B and approved options.
- The fans must be able to rotate freely. The heat sink must be kept clear of dust and dirt.

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- The space in which the inverter is installed must be free of dust and condensation. Check the fans and air filters regularly to ensure that they are working properly.
- All electrical connections and the correct tightening torque for the terminals must be checked regularly.
- Check power cables for damage caused by heat.

Testing the STO function

Before starting up the system, perform the following tests to ensure that the STO function is working properly. Here, the configured enable source must be taken into account in accordance with the settings in *P1-15*.

- 1. Initial situation:

  The inverter is not enabled. Therefore, the motor is in an idle state.

  – The STO inputs are no longer energized ("Inhibit" displayed on the inverter display).

  – Enable the inverter. Since the STO inputs continue to not be energized, "Inhibit" continues to be displayed on the inverter display.

- 2. Initial situation:

  The inverter is enabled. The motor rotates.

  – Disconnect the STO inputs from the power supply.

  – Check whether "Inhibit" is displayed on the inverter display, the motor is stopped, and the operation runs in accordance with sections "Safe disconnection function (STO)" (→ 🗎 199) and "STO status and diagnostics" (→ 🗎 201).

Maintaining the STO function

Test the safety functions at regular intervals (at least once per year) to ensure that they are working properly. The test intervals must be specified on the basis of the risk assessment.

Furthermore, test the integrity of the STO function after each change to the safety system or following any maintenance work.

If error messages occur, determine their significance under section "Service and error codes" (→ 🗎 112).

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11.3 Connection variants

11.3.1 General information

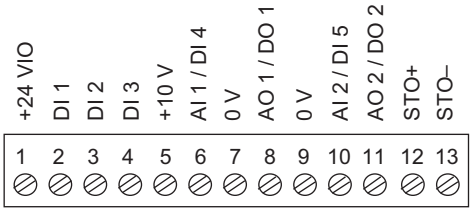
Generally, all the connection variants listed in this documentation are permitted for safety-relevant applications as long as the basic safety concept is fulfilled. This means you have to make sure that the DC 24 V safety inputs are operated by an external safety relay or a safety controller, thus preventing an automatic restart.

All safety conditions mentioned in chapters 2, 3 and 4 of the present documentation must be met for the basic selection, installation, and application of the safety components (for example, safety relay, EMERGENCY STOP switch, and so on), and the approved connection variants.

The wiring diagrams are block diagrams whose only purpose is to show the safety function(s) with the relevant components. Circuit-related measures, which usually always have to be implemented additionally, are not shown in the diagrams to enhance clarity. Such measures are taken, for example, to ensure protection against contact, to handle overvoltage and undervoltage, to detect insulation faults, line-to-ground faults and short circuits, which can occur on externally installed lines, or to ensure the necessary immunity against electromagnetic interference.

Connections to MOVITRAC® LTP-B

The following illustration shows an overview of the signal terminals.



7952931339

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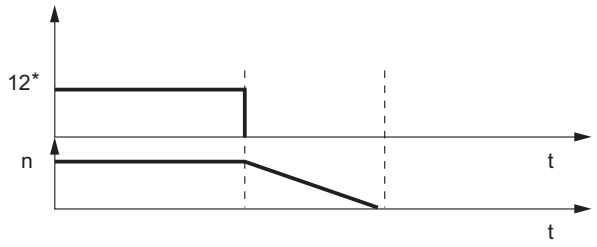
11.3.2 Disconnection of a single drive

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

The procedure is as follows:

- The STO input 12 is disconnected.
- The motor coasts to a halt, if no brake is installed.

STO – Safe Torque Off (EN 61800-5-2)



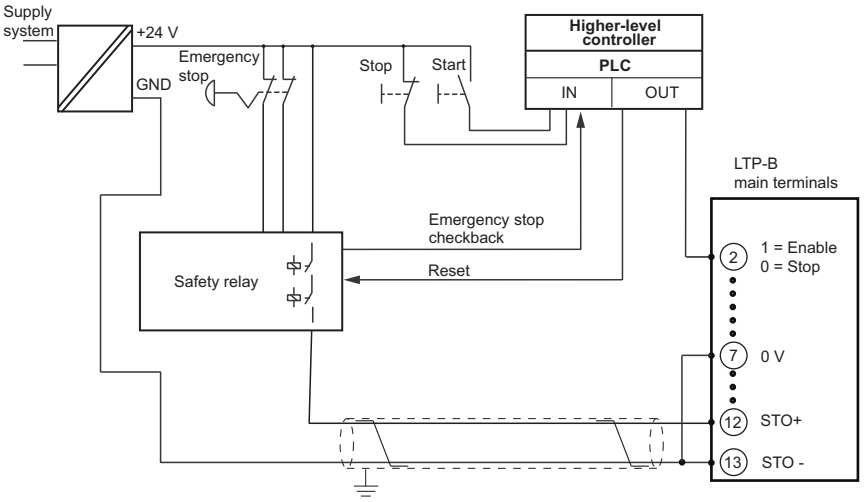
18014406471159051

* Safety input (terminal 12)
n Speed

INFORMATION

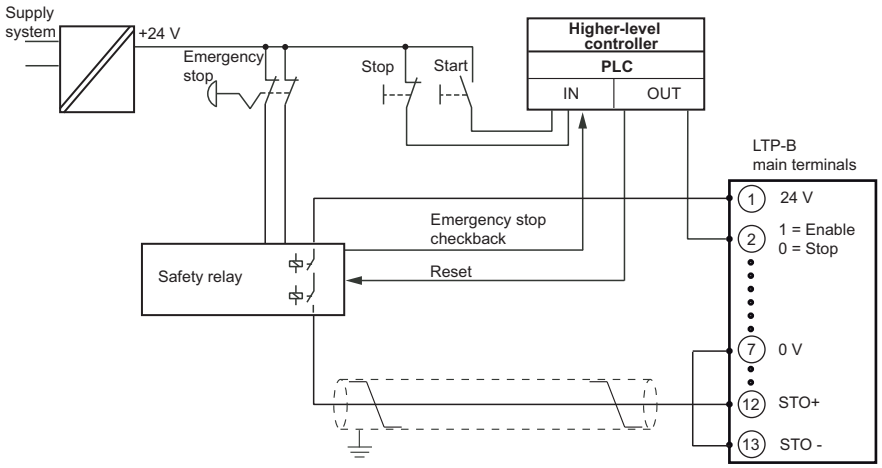
The displayed STO disconnections can be used up to PL d according to EN ISO 13849-1 observing chapter "Requirements on safety relays" (→ 🗎 206).

Digital control with safety relay with external 24 V supply



36028805542448523

Digital control with safety relay with internal 24 V supply



36028805542458635

INFORMATION

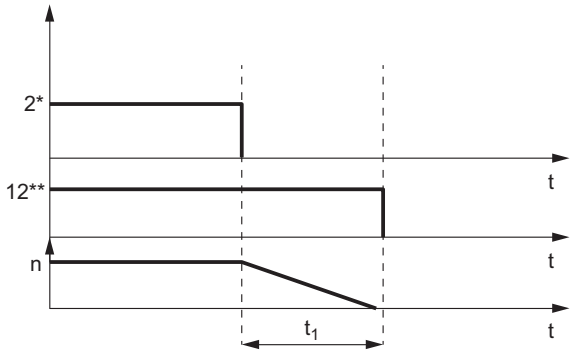
With single-channel disconnection, you have to make certain fault assumptions and provide for corresponding fault exclusions. Observe chapter "Requirements on safety relays" (→ 🗎 206).

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

The procedure is as follows:

- Terminal 2 is disconnected, e.g. in case of an emergency stop/halt.
- During the safety time interval t_1, the motor decelerates to a complete stop along the ramp.
- After t_1 has elapsed, the safety input disconnects terminal 12. The safety time interval t_1 must be sufficient for the motor to reach a complete stop.

SS1(c) – Safe Stop 1 (EN 61800-5-2)



18014407035653003

* Digital input 1 (terminal 2)
** Safety input (terminal 12)
n Speed

INFORMATION

The displayed SS1(c) disconnections can be used up to PL d according to EN ISO 13849-1 observing chapter "Requirements on safety relays" (→ 🗎 206).

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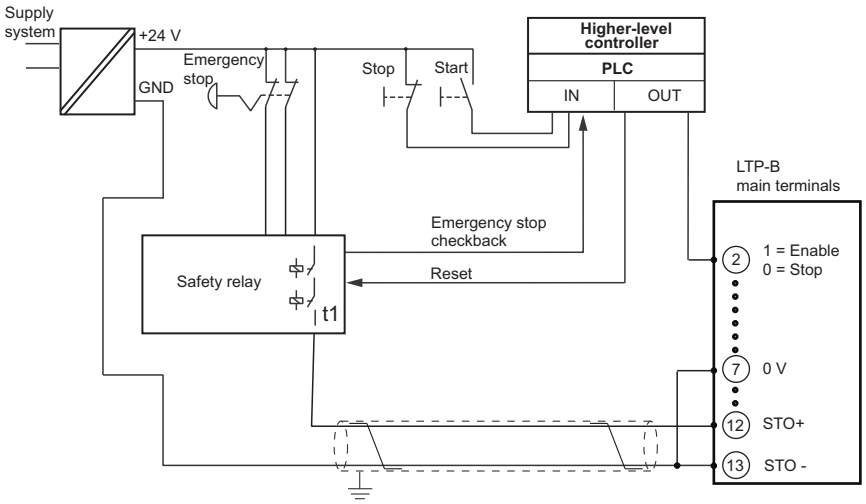
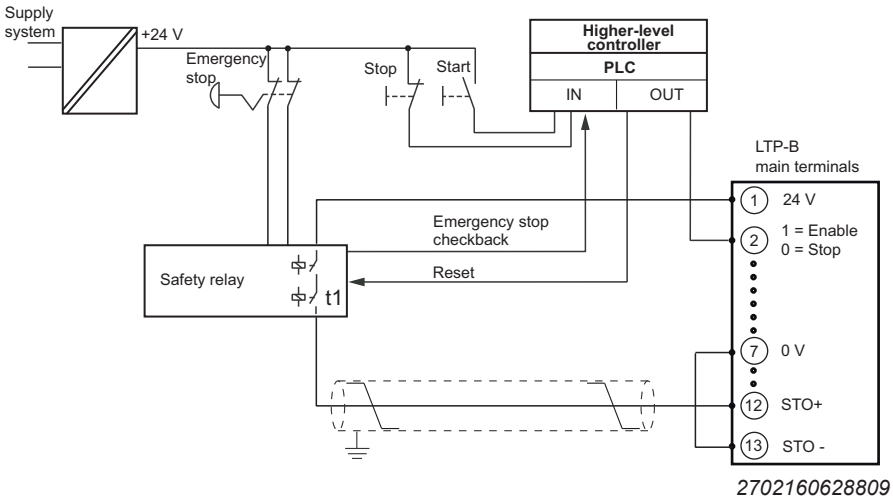
Digital control with safety relay with external 24 V supply



27021606288081419

Digital control with safety relay with internal 24 V supply



27021606288091915

INFORMATION

With single-channel disconnection, you have to make certain fault assumptions and provide for corresponding fault exclusions. Observe chapter "Requirements on safety relays" (→ 🗎 206).

11.4 Safety characteristics

Characteristic values according to:	EN 61800-5-2	EN ISO 13849-1	EN 62061
Classification/underlying standards	SIL 2 (Safety Integrity Level)	PL d (Performance Level)	SILCL 2
(PFHd value)[1]	1.23×10^{-9} 1/h		
Mission time/service life	20 years, after which the component must be replaced with a new one.		
Proof test interval	20 years	–	20 years
Safe state	Safe torque off (STO)		
Safety functions	STO, SS1[2] according to EN 61800-5-2		

1) Probability of dangerous failure per hour.
2) With suitable external control

11.5 Signal terminal block for STO safety contact

MOVITRAC® LTP-B	Terminal	Function	General electronics data
Safety contact	12	STO+	DC +24 V input, max. 100 mA, STO safety contact
	13	STO-	Reference potential for DC +24 V input
Permitted cable cross section			One core per terminal: 0.05 – 2.5 mm² (AWG 30 – 12).

	Min.	Typical	Max.
Input voltage range	DC 18 V	DC 24 V	DC 30 V
Time to inhibit output stage	–	–	1 ms
Time until inhibit is shown on the display when STO is active	–	–	20 ms
Time until an STO switching time error is detected and displayed	–	–	20 ms

INFORMATION

It is not possible to control the STO inputs via pulsed signals, e.g. self-testing digital outputs of safety controllers.

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	Ulaanbaatar	IM Trading LLC Olympic street 28B/3 Sukhbaatar district, Ulaanbaatar 14230	Tel. +976-77109997 Fax +976-77109997 imt@imt.mn
Kenya			
Sales	Nairobi	SEW-EURODRIVE Pty Ltd Transnational Plaza, 5th Floor Mama Ngina Street P.O. Box 8998-00100 Nairobi	Tel. +254 791 398840 http://www.sew-eurodrive.co.tz info@sew.co.tz
Latvia			
Sales	Riga	SIA Alas-Kuul Katlakalna 11C 1073 Riga	Tel. +371 6 7139253 Fax +371 6 7139386 http://www.alas-kuul.lv info@alas-kuul.com

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

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

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

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

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

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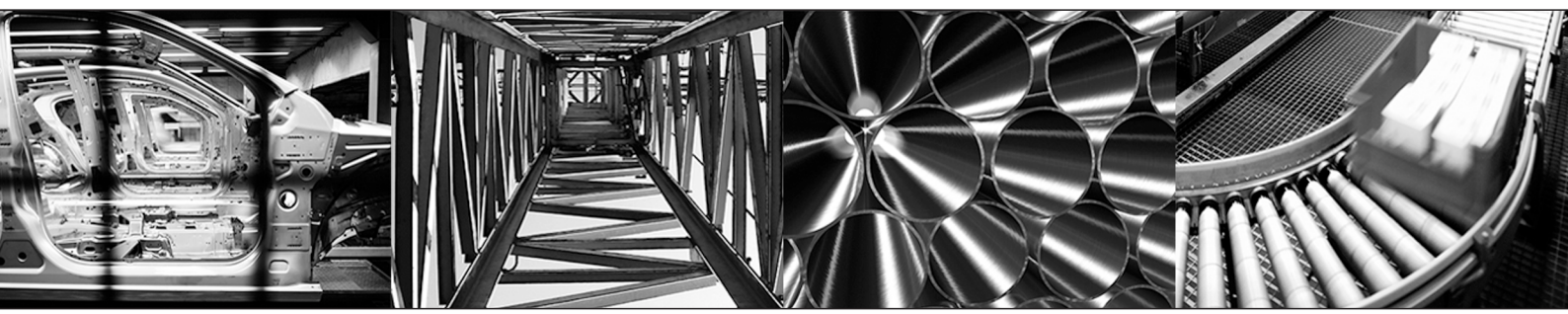

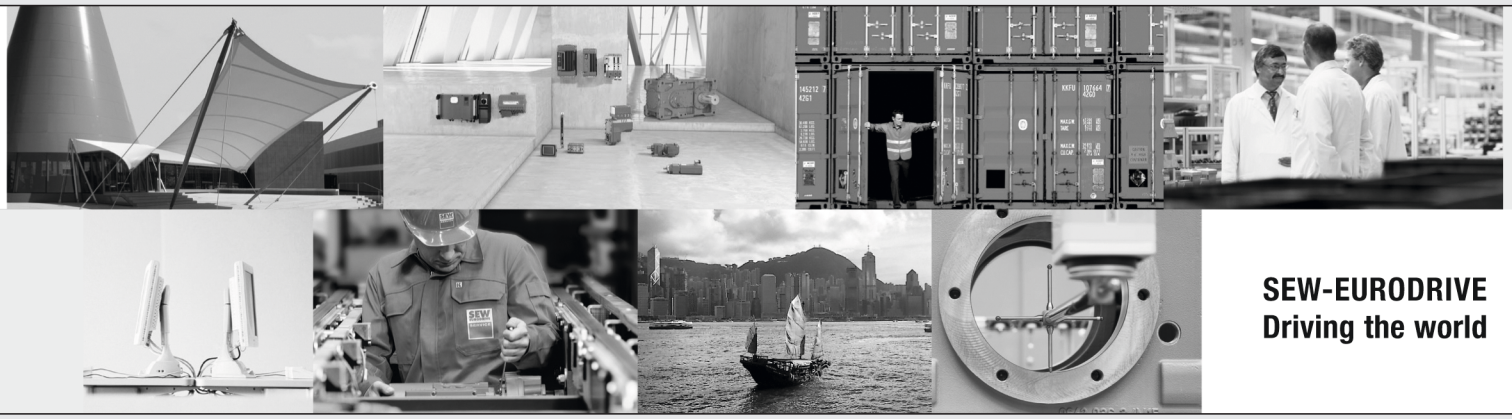

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