SEW EURODRIVE

Operating Instructions

Standard Inverters

MOVITRAC® LTP-B

Edition 09/2016

22872051/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 have the purpose to avoid injury and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components also observe the relevant warning and safety notes.

2.2 Operator's duties

Make sure that the basic safety notes are read and observed. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE.

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

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

Make sure persons working on the product adhere to the following regulations, requirements, documents and information:

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

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

2.3 Target group

Specialist for mechanical work

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

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

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Specialist for electrotechnical work

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

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

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

Instructed persons

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

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

If necessary, use suitable, sufficiently dimensioned handling equipment.

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

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

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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

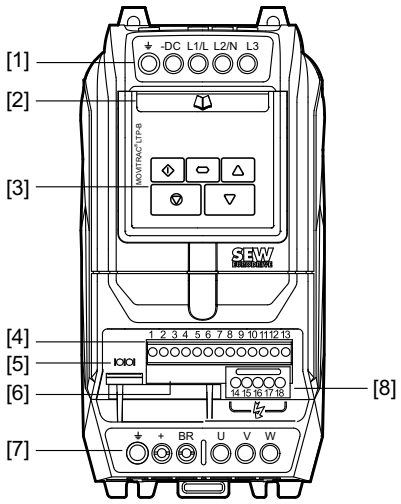
Example: MCLTP-B 0015-2B1-4-00 (60 Hz)		
Product name	**MCLTP**	MOVITRAC® LTP-B
Version	**B**	Version status of the device series
Recommended motor power	**0015**	0015 = 1.5 kW
Connection voltage	**2**	2 = 200 – 240 V 5 = 380 – 480 V 6 = 500 – 600 V
Interference suppression on the input	**B**	0 = Class 0 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
Country-specific variant	**(60 Hz)**	60 Hz design

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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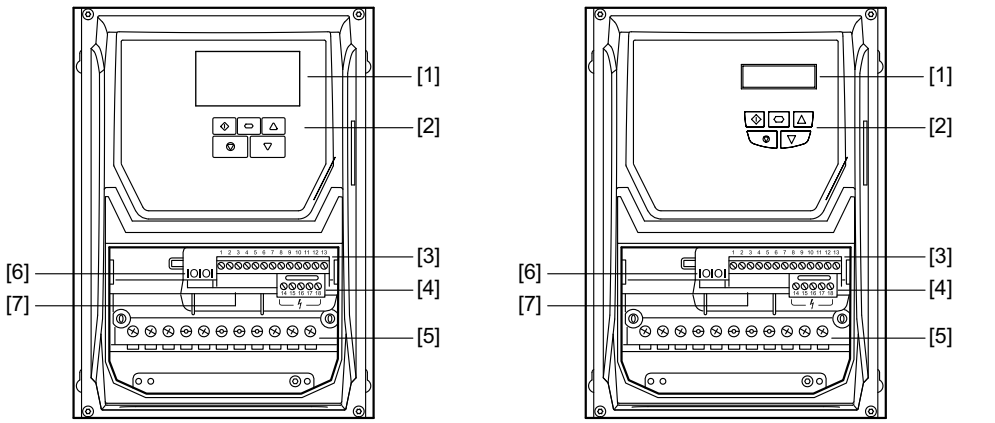
3.3.2 Inverters with degree of protection IP66/NEMA 4X

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/6-digit 7-segment 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

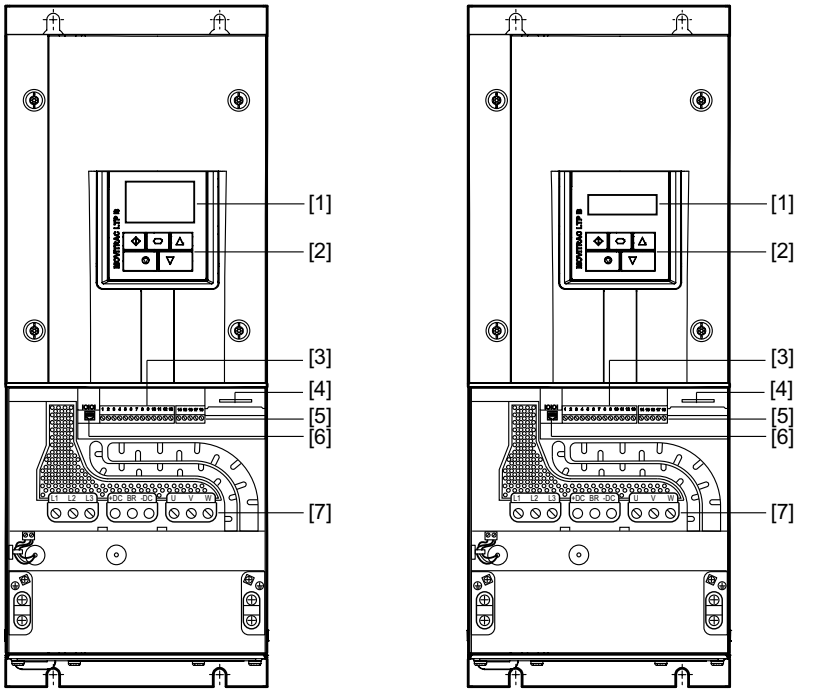
[6] RJ45 communication socket

[7] Option card slot

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

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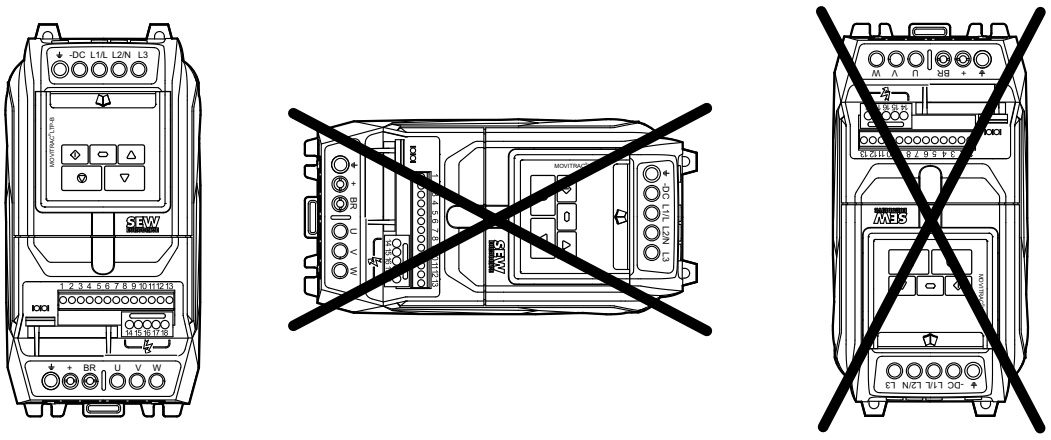
4 Installation

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 materials away from the inverter.
- Prevent the ingress of conductive or flammable foreign objects.
- The relative humidity must be kept below 95% (condensation is not permitted).
- Protect the IP55/IP66 inverter from direct sunlight. Use a cover when using the inverter outdoors.
- Inverters can be installed next to each other. Ensure sufficient ventilation space between the individual devices. If the inverter is to be installed above another inverter or another device that dissipates heat, then there must be a vertical minimum clearance of 150 mm. To enable self-cooling, the control cabinet must either be cooled through forced ventilation, or dimensioned accordingly. See chapter "IP20 housing: Installation and installation space" (→ 🗎 21).
- The permitted ambient temperatures are defined in chapter "Ambient conditions" (→ 🗎 174).
- 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.
- Install the frequency inverter only as depicted 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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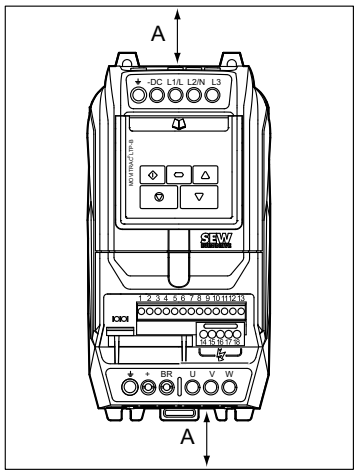
4.3 Mechanical installation

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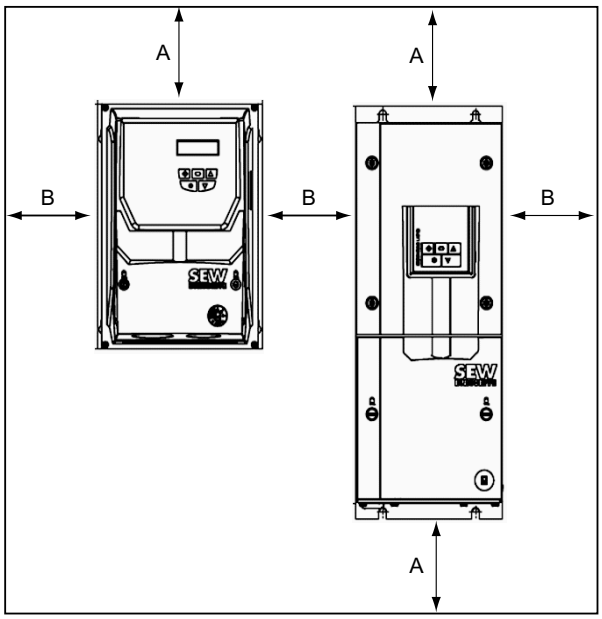
Power of the inverter	A in mm	Air flow rate per inverter
230 V: 0.75 kW, 1.5 kW **400 V**: 0.75 kW, 1.5 kW, 2.2 kW **575 V**: 0.75 – 5.5 kW	60	> 45 m^3/h
230 V: 2.2 kW	100	> 45 m^3/h
All other power ranges	100	> 80 m^3/h

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 motor circuit breaker. You find more information in section "Permitted voltage supply systems" (→ 🗎 27).
- 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 industry sector as well as the rules and standards. Conductor end sleeves are required for connecting the power cables to the inverter.
- Make sure that shieldings and sheaths of power cables are designed according to the wiring diagram in section "Connecting inverter and motor" (→ 🗎 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 industry sector.
- Make sure that all terminals are tightened with the respective tightening torques, see chapter "Technical data" (→ 🗎 173).
- To comply with UL regulations, all earth connections must be designed with UL listed crimping cable lugs.

Unlike direct operation in the supply system, 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.

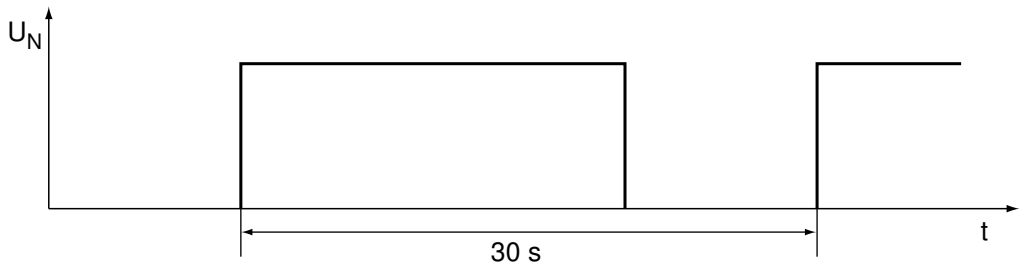
INFORMATION

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 mains 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:
  - Rated fusing voltage ≥ rated 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 characteristic B:
  - 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.

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

- Inverters generate a DC current component in the leakage current and can significantly reduce the sensitivity of an residual current device of type A. A type A residual current device is this 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.

4.4.4 Operation on an IT system

IP20 devices can be operated on the IT system as described below. Please contact SEW-EURODRIVE for all other devices.

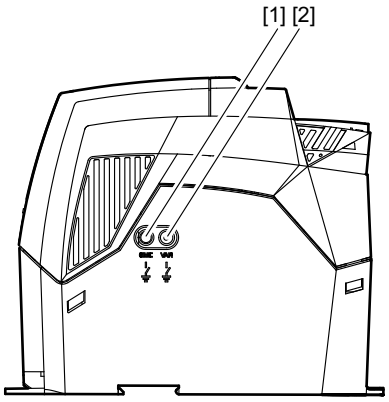
For operation on the IT system, the connection of the overvoltage protection and the EMC filter to PE has to be separated. Screw out the EMC and VAR screw on the side of the device.

⚠ 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 power supply.

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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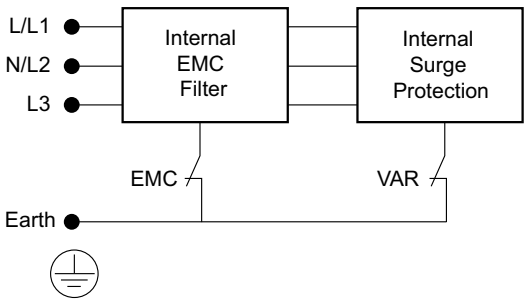
[1] EMC screw
[2] VAR screw



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

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4.4.5 Operation on a TN system with an RCD switch (IP20)

IP20 inverters with integrated EMC filter (such as MOVITRAC® LT xxxx xAx-x-00 or MOVITRAC® LT xxxx xBx-x-00) have a higher leakage current than devices without EMC filter. The EMC filter may cause errors when operated with a RCCB. Deactivate the EMC filter to reduce the leakage current. To do so, screw out the EMC and VAR screw on the side of the device. See figure in chapter "Operation on an IT system" (→ 🗎 26).

4.4.6 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 non-grounded star point (for example IT systems) is only permitted for inverters with degree of protection IP20. See chapter "Operation on an IT system" (→ 🗎 26).

- **Voltage 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.

4.4.7 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 IP55/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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4.4.8 Removing the terminal cover

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

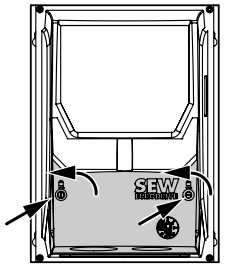
The connection terminals can be accessed when the screws on the front of the product are removed as shown below.

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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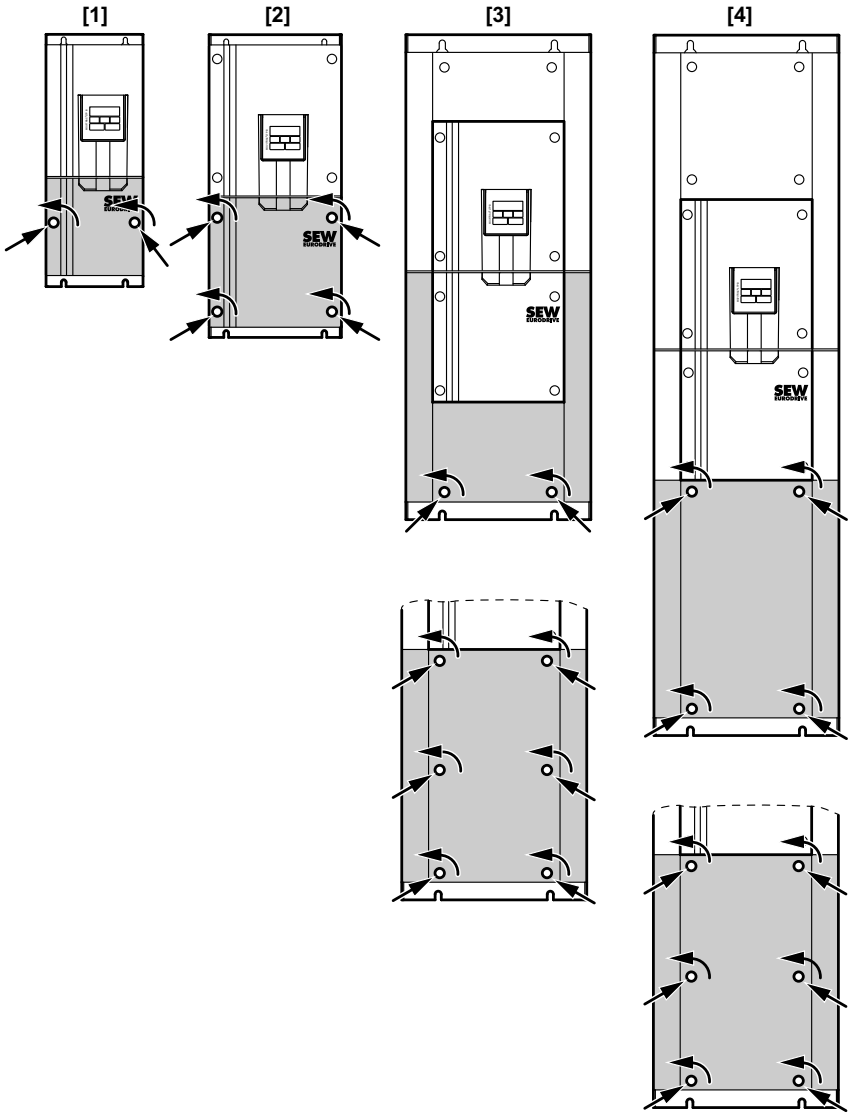
Inverters with degree of protection IP55/NEMA 12K

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

4.4.9 Cable gland plate

A suitable cable gland system is required to maintain the respective IP/NEMA degree of protection. Cable entry holes have to be drilled that correspond to this system.

NOTICE

Drilling cable entry holes may lead to particles entering the inverter.

Possible damage to property.

- Be careful when drilling the hole to prevent particles from entering the inverter.

→ Remove all particles at and in the inverter.

Some guide sizes are listed below:

Recommended hole sizes and hole types for the cable gland.

Power of the inverter	Hole size	Imperial	Metrical
230 V: 0.75 – 4 kW 400 V: 0.75 – 7.5 kW 575 V: 0.75 – 11 kW	25 mm	PG16	M25

Hole sizes for flexible electrical installation ducts

Power of the inverter	Hole size	Commercial size	Metrical
230 V: 0.75 – 4 kW 400 V: 0.75 – 7.5 kW 575 V: 0.75 – 11 kW	35 mm	1 in	M25

An IP degree of protection is only ensured when the cables are installed with a bushing or sleeve for a flexible electrical installation duct approved by UL.

When installing electrical installation ducts, the insertion holes of the duct must have standard openings for the required sizes according to NEC specifications.

Not intended for rigid electrical installation ducts.

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4.4.10 Connecting and installing the braking resistor

⚠ WARNING

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

Severe or fatal injuries.

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

⚠ CAUTION

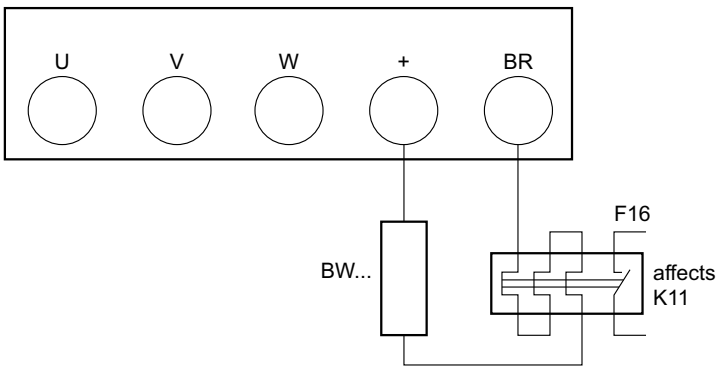
Risk of burns. The surfaces of the braking resistors get very hot when the braking resistors are loaded with P_N.

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 prior to 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 has to be dimensioned according to the tripping current I_F of F16, the 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 flat-type braking 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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4.4.11 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)

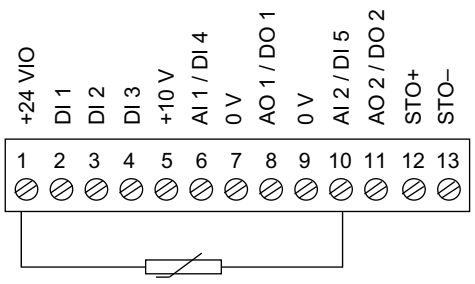
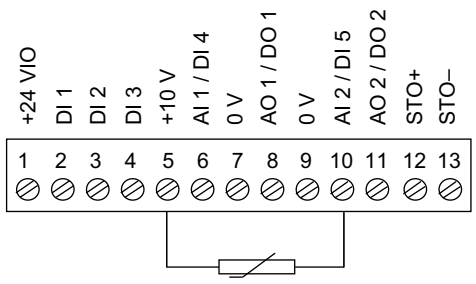
When parameter *P2-33* is configured for motor protection, this setting automatically overwrites the function selection of the digital inputs (*P1-15*) to analog input AI2 = motor protection.

INFORMATION

Configure the temperature sensor on the inverter using *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.

For information regarding the parameter P2-33, refer to chapter "P2-33 Analog input 2 format / motor protection" (→ 🗎 140).

Connection example for various temperature sensors:

Thermal sensor TF Bimetallic switch TH	KTY84 PT1000
	
P2-33 = PTC-th	*P2-33* = KTY84 or PT1000 (B, F, H)

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4.4.12 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" (→ 🗎 173).

The motor group is limited to five motors and must not differ by more than 3 frame sizes.

Multi-motor operation 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.

4.4.13 Motor cables and fusing

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

Determine the permitted length of all motor cables connected in parallel as follows:

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

3172400139

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

I_{max} = Recommended maximum motor cable length

n = Number of motors connected in parallel

No additional fusing is required if the cross section of the motor cable corresponds to the cross section of the supply system lead. If the cross section of the motor cable is smaller than the cross section of the supply system lead, you must protect the motor cable against a short circuit for the corresponding cross section. Motor protection switches are suited to this purpose.

4.4.14 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.

4.4.15 UL-compliant installation

Note the following information for UL-compliant installation:

Ambient temperatures

The inverters can be operated at the following ambient temperatures:

Degree of protection	Ambient temperature
IP20/NEMA 1	-10 °C to 50 °C
IP55/NEMA 12K	-10 °C to 40 °C
IP66/NEMA 4X	

Use only copper connection cables suited for ambient temperatures up to 75 °C.

Tightening torques for the power and control terminals

Refer to chapter "Permitted tightening torques" (→ 🗎 20) for the permitted tightening torques for the inverters.

External DC 24 V supply

Use only certified devices with a limited output voltage (U_{max} = DC 30 V) and limited output current (I ≤ 8 A) as an external DC 24 V voltage source.

Voltage supply systems and fusing

The inverters are suitable for operation in voltage supply systems with earthed star point (TN and TT systems) that can supply a maximum line current and a maximum line voltage in accordance with the following table. The fuses listed in the following tables are the maximum permitted fuses for each inverter. Only use melting fuses.

UL certification does not apply to operation in voltage supply systems with a non-grounded star point (IT systems).

1 × 200 – 240 V devices

1 × 200 – 240 V	Fuse 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

3 × 200 − 240 V	Fuse 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

3 × 380 − 480 V	Fuse 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

3 × 500 − 600 V	Fuse or MCB (type B)	Max. supply short circuit current	Max. line voltage
0008	6 A	100 kA rms (AC)	600V
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		

Thermal motor protection

The inverter is provided with thermal motor overload protection according to NEC (National Electrical Code, US).

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

- NEC compliant installation of a motor temperature sensor, see also chapter "Motor temperature protection (TF/TH)" (→ 🗎 32).
- Using internal thermal motor overload protection by activating parameter *P4-17*.

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4.4.16 Information regarding UL

INFORMATION

Due to UL requirements, the following chapters are always printed in English independent of the language of the revision:

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 additional parameter was added to MOVITRAC® LTP-B/LTX inverters to implement internal thermal motor protection according to NEC:

- P4-17 Thermal motor protection according to NEC
  - 0: disabled
  - 1: enabled

Functional principle

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

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

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

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4.4.17 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 frequency inverter with an EMC filter meets the limit values defined in the standard EN 61800-3 and can therefore be used for both industrial and domestic (light industrial) applications.

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 table below.

<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">in accordance with 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 the 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">If necessary, you can use a line filter of the type NF LT xxx to minimize the electromagnetic interference emission. However, compliance with the limit classes cannot be guaranteed.
Use a shielded motor cable.</td></tr>
</table>

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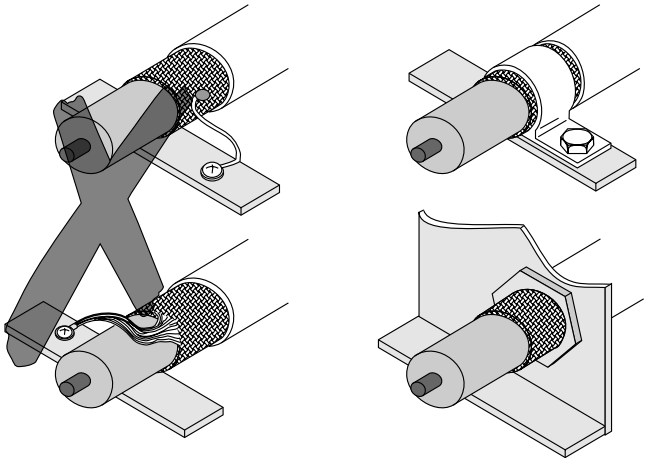
General information about connecting the motor shield

We strongly recommend that you use the shield plate with LTX applications.

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



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Recommendation for motor shield connection at frequency inverters with IP20

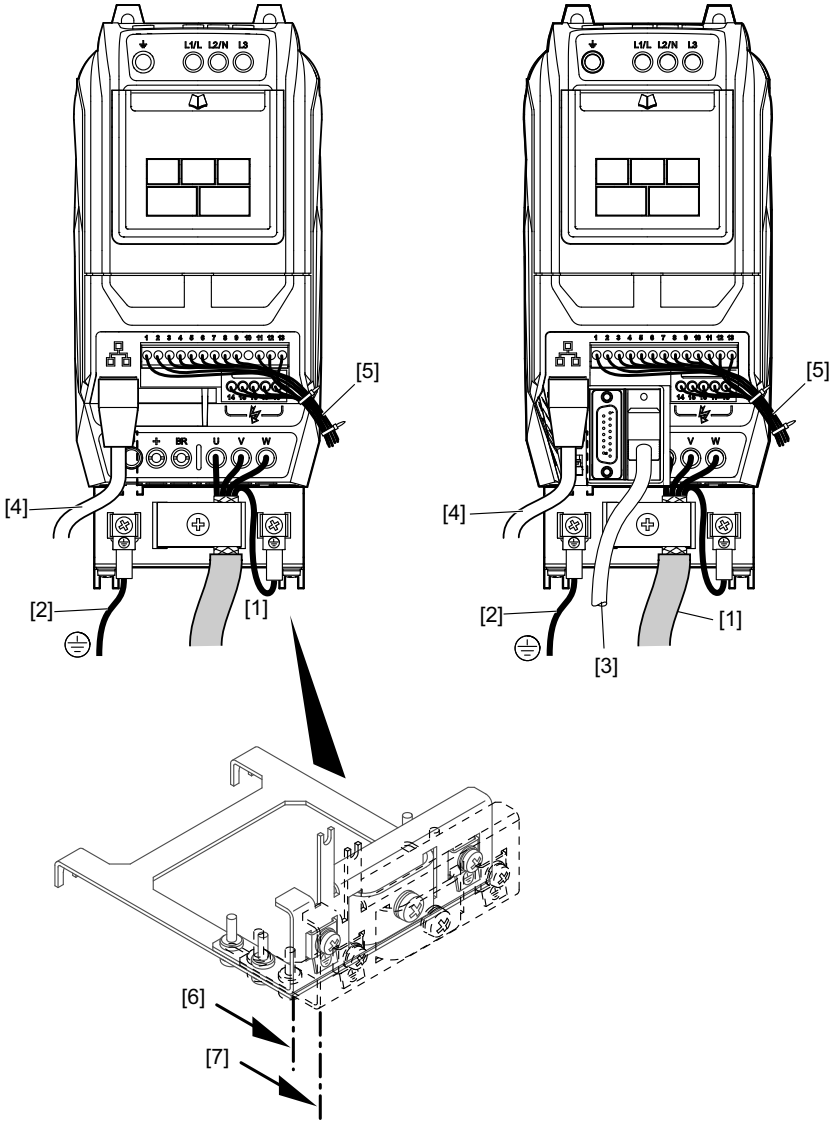
Inverters with degree of protection IP20/NEMA 1

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

Example LTP-B inverter

Example LTP-B inverter with LTX module



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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 plate up to the stop according to the required size.
3. Tighten the screws again.

Make sure that the plate is correctly attached to the PE connection.

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Recommendation for motor shield connection at frequency 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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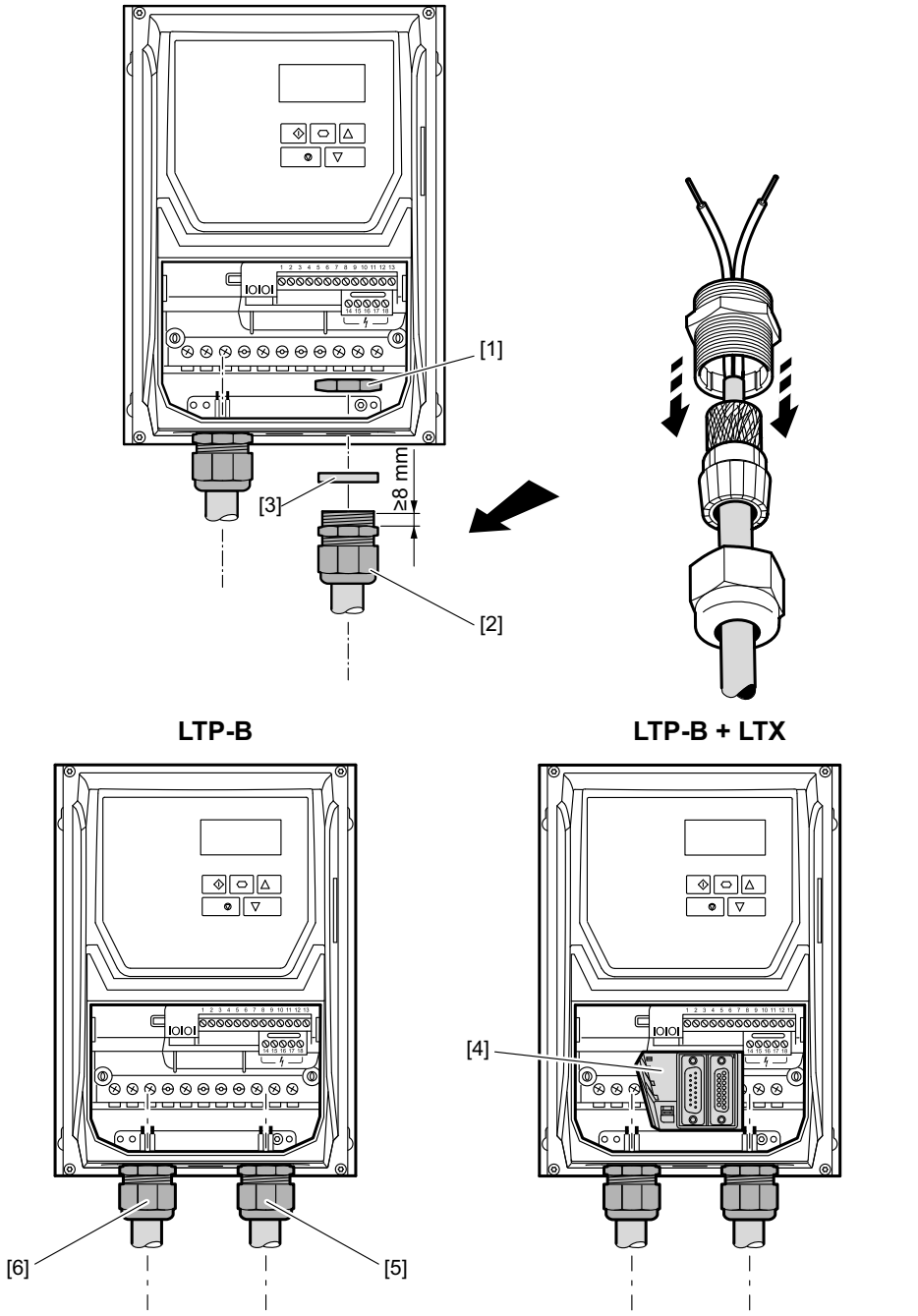

9007212157811595

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

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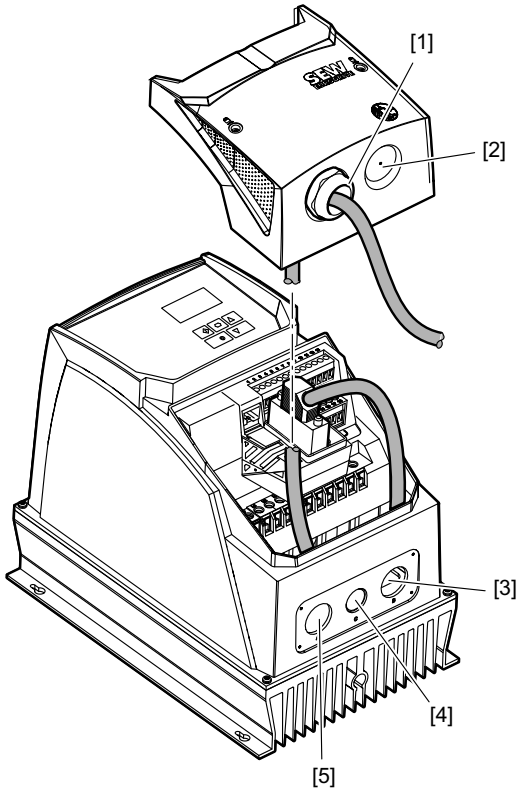
Recommendation for routing the encoder, control and communication cables



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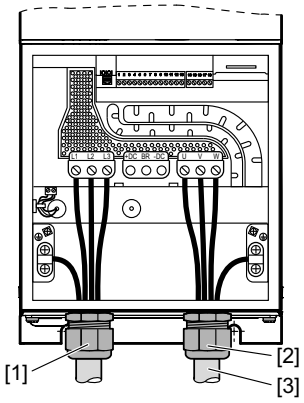
[1] Encoder cable, if LTX module
[2] Signal terminal/communication
[3] Motor cable
[4] Signal terminal/communication
[5] Supply system cable

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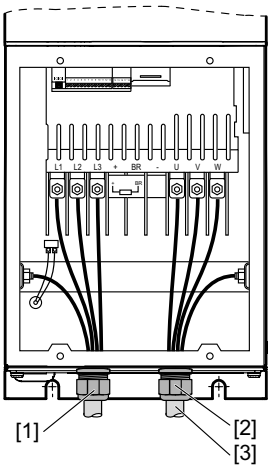
[1] Supply system cable
[2] Metal cable gland
[3] Motor cable

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



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

4.4.18 Overview of signal terminals

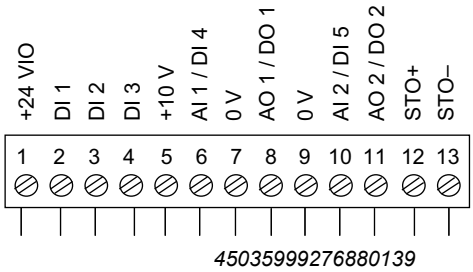
Main terminals

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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The signal terminal block is equipped with the following connections:

Terminal no.	Signal	Connection	Description
1	+24 VIO	+24 V: Reference voltage/ backup voltage	Reference voltage for controlling the digital inputs (max. 100 mA)[1)] Adhere to the "Note for connecting the STO function" (→ 🗎 46).
2	DI 1	Digital input 1	Positive logic "Logic 1" input voltage range: DC 8 – 30 V "Logic 0" input voltage range: DC 0 – 2 V Compatible with PLC requirement if 0 V is connected to terminal 7 or 9.
3	DI 2	Digital input 2	
4	DI 3	Digital input 3	
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: "Logic 1" input voltage range: DC 8 – 30 V
7	0 V	0 V: Reference potential	Adhere to the "Note for connecting the STO function" (→ 🗎 46).
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 maximum output current: 20 mA
9	0 V	0 V: Reference potential	Adhere to the "Note for connecting the STO function" (→ 🗎 46).
10	AI 2 / DO 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: "Logic 1" input voltage range: DC 8 – 30 V
11	AO 2 / DO 2	Analog output 2 (10 bit) Binary 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 maximum output current: 20 mA
12	STO+	Output stage enable	DC +24 V input, max. 100 mA current consumption STO safety contact, high = DC 18 – 30 V Adhere to the "Note for connecting the STO function" (→ 🗎 46).
13	STO-		GND reference potential for DC +24 V input STO safety contact Adhere to the "Note for connecting the STO function" (→ 🗎 46).

1) With inverter operation with fieldbus option, terminal 1 can be used to supply the backup voltage.

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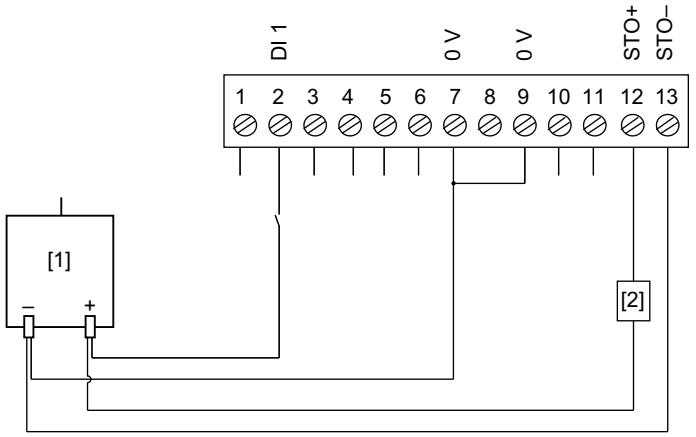
All digital inputs are enabled with an input voltage in the range of 8 – 30 V. This means they are +24 V compatible.

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.

Note for connecting the STO function

If terminal 12 is permanently supplied with 24 V, and terminal 13 is permanently connected to GND, then the "STO" function is permanently disabled.



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[1] External DC 24 V supply

[2] Optional safety relay

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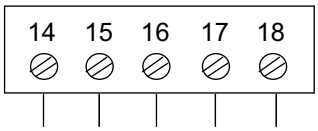
Relay terminals



NOTICE

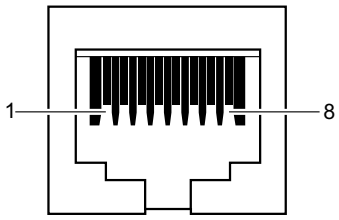
Possible damage to property

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		

4.4.19 Communication socket RJ45

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)

4.4.20 24 V backup mode

The inverter allows for realizing a backup mode via external 24 V. This means the control electronics and the option cards such as the fieldbus cards are fully functional even when the power supply is switched off.

Requirements

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

Range of functions

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

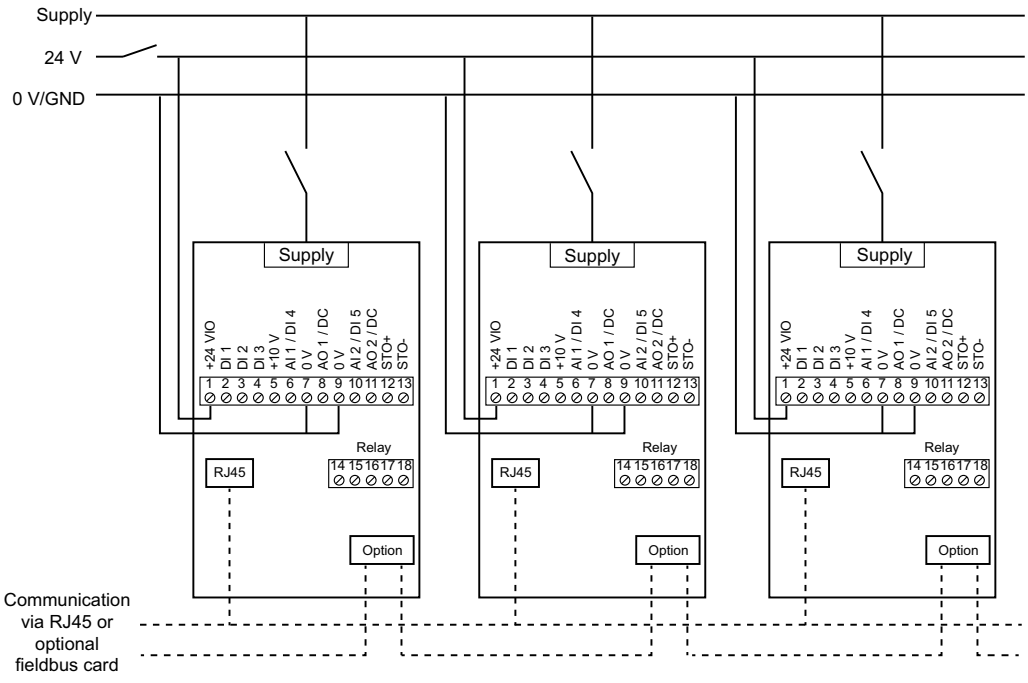
Setting up 24 V backup mode

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 24 V supply. Make sure that all connected inverters are always supplied with external 24 V at the same time.

Example of a wiring diagram



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4.4.21 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.

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.

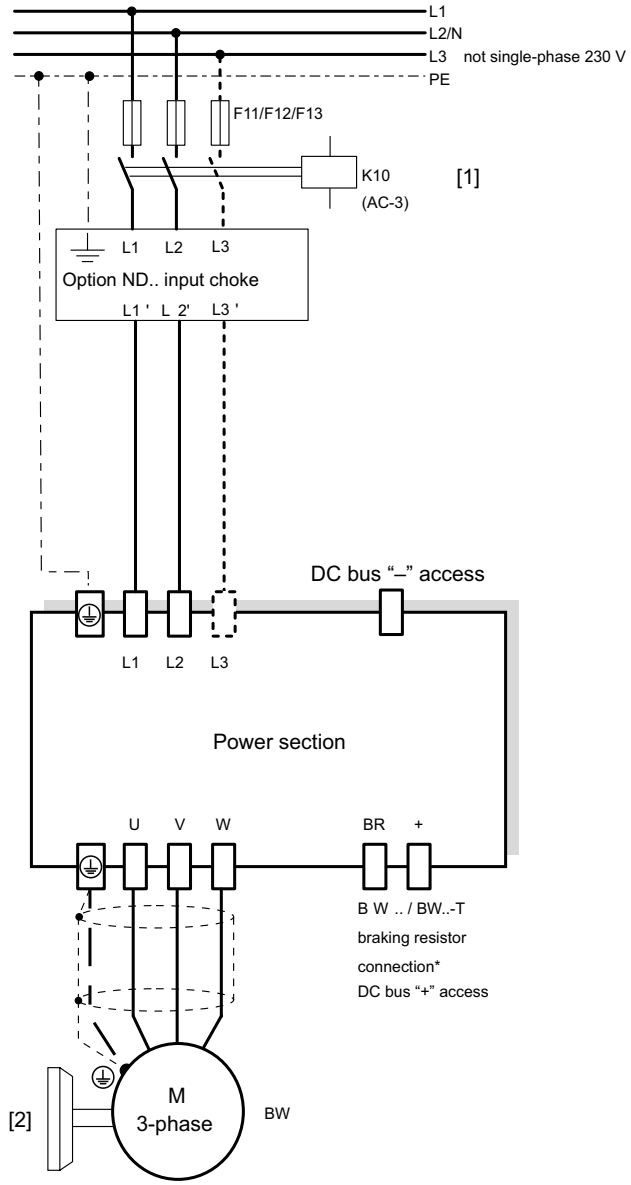
Please note the following:

- 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 his 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 lead.
- 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.



18380767883

[1] Line contactor between supply system and inverter.

[2] Brake

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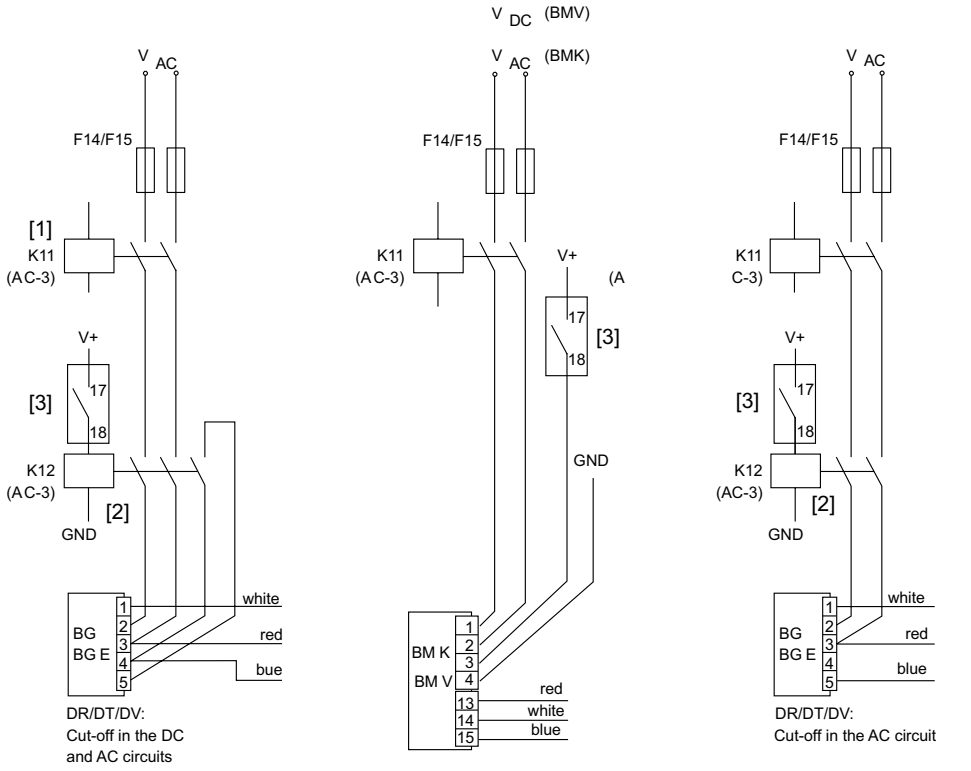
4.5.1 Brake control



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

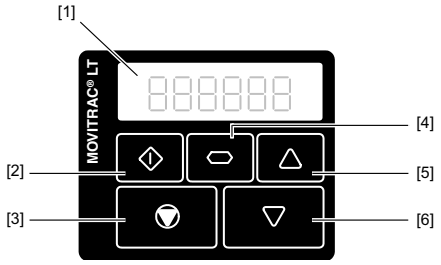
5.1.1 Keypads

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.

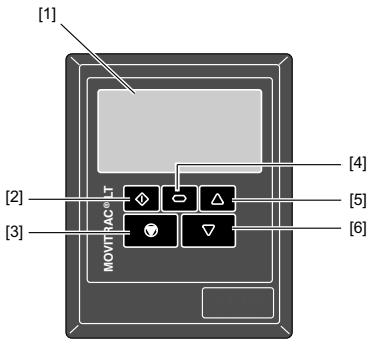
Standard keypad



9007202188405387

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

Keypad with full text display



18364520203

[1] Full text display (multilingual)
[2] Start button
[3] Stop/Reset button
[4] Navigate button
[5] Up 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 <Upwards arrow> key simultaneously. The inverter must not be enabled during this operation.

The list of available languages is now displayed.

5.1.2 Resetting parameters to default settings

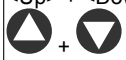
To reset the parameters to the factory setting, proceed as follows:

1. The inverter must not be enabled and the display must show "Inhibit".
2. Press the 3 keys  , and simultaneously for at least 2 s.
   "P-deF" appears on the display.
3. Press the  key to acknowledge the "P-deF" message.

INFORMATION

If the inverter is set to the factory settings, the <Start> and <Stop> keys of the keypad are disabled. To enable using the <Start>/<Stop> keys on the keypad, set the parameter *P-12* to "1" or "2".

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 • .....

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.

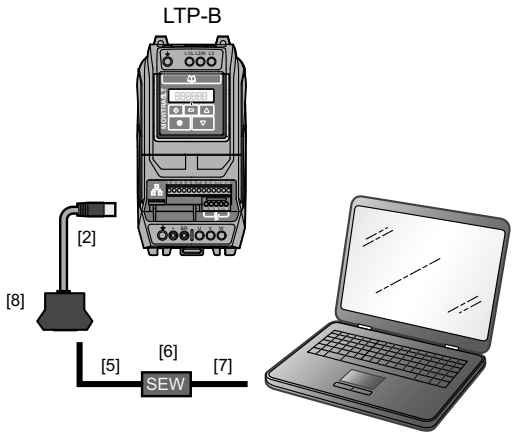
The software can be used to carry out the following tasks:

- 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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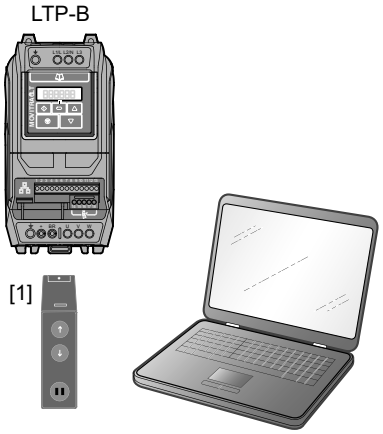
Bluetooth®



9007216440559755

[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.

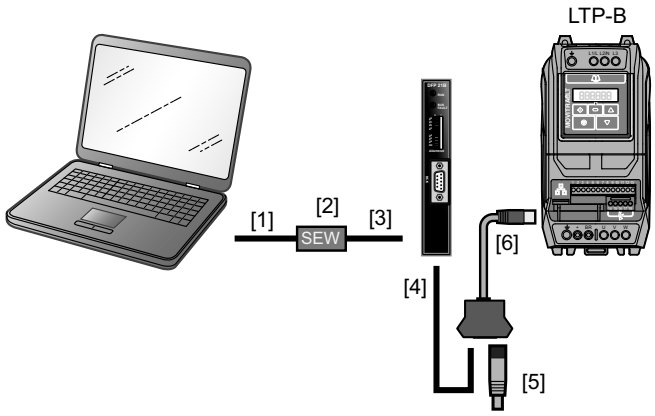
The following functions are available in MOVITOOLS® MotionStudio:

- 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

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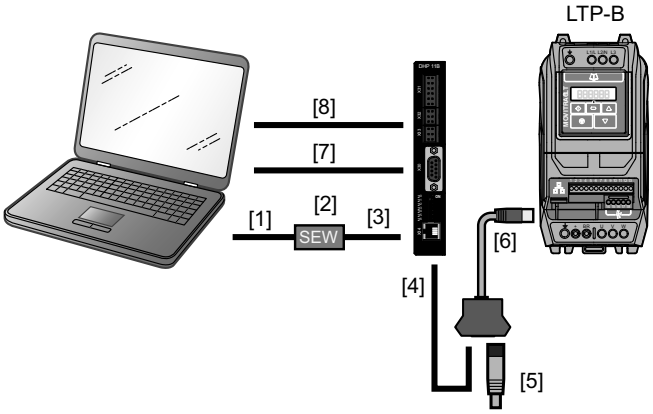
Controller



17186293003

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

When parameter *P4-02* is set to "1" (auto tune) 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.

INFORMATION

The ramp times in parameters *P1-03* and *P1-04* refer to 50 Hz. If *P1-16* is set to "In-Syn", overload capacity is set to "150%" depending on *P1-08*.

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5.3.1 Startup for asynchronous motors with V/f 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
     - Value = 0: Slip compensation deactivated
     - Value ≠ 0: Slip compensation activated
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 for 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 for asynchronous motors with VFC torque 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* = 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 Startup of 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. During the connection, adhere to the nominal motor voltage.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = For synchronous motors, not the system voltage is set, but the internal voltage for 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 problems, check or set the following:

- To achieve a higher torque in the lower speed range, the 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. The premagnetization time *P7-12* as well as the field strength during the premagnetization time can be slightly adjusted 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 preset motors from SEW-EURODRIVE

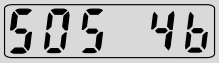
Startup can be performed if one of the following CMP.. motors (speed class 4500 1/min) or MGF..-DSM motors (speed class 2000 1/min) are connected to the inverter:

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	gf-2
MGF..4-DSM	gf-4
MGF..4/XT-DSM	gf-4Ht

Procedure

- Set *P1-14* to "1" for access to LTX-specific parameters.
- Set *P1-16* to the preset motor; see chapter "LTX-specific parameters (level 1)" in the "MOVITRAC® LTX" addendum to the operating instructions.

Example

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

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

INFORMATION

"Auto Tune" is not necessary for preset motors.

If a CMP.. motor with 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 according to the documentation "Addendum to the Operating Instructions, Drive Unit MGF..-DSM on LTP-B Inverter".

All necessary motor data are set automatically. For motor protection, the KTY temperature sensor has to be connected to terminal 5 (+10 V) and terminal 10 (analog input 2) and activated via parameter P2-33. Refer to the chapter "Motor temperature protection TF, TH, KTY84, PT1000" (→ 🗎 32).

- Refer to chapter "Parameter group 1: Servo-specific parameters (level 1)" (→ 🗎 130) for a detailed list.

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5.4 Startup of control

⚠ 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 demands in *P1-15*. Refer to chapter P1-15 Digital inputs function selection for the possible settings.
- Connect a switch between terminals 1 and 2 on the user terminal block.
- Connect a potentiometer (1 k – 10 k) between terminals 5, 6 and 7. The center tap is connected to terminal 6.
- Connect the terminals 12 and 13 of the STO input according to chapter "Disconnection of a single drive" (→ 🗎 203).
- 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" (→ 🗎 203).
- 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.

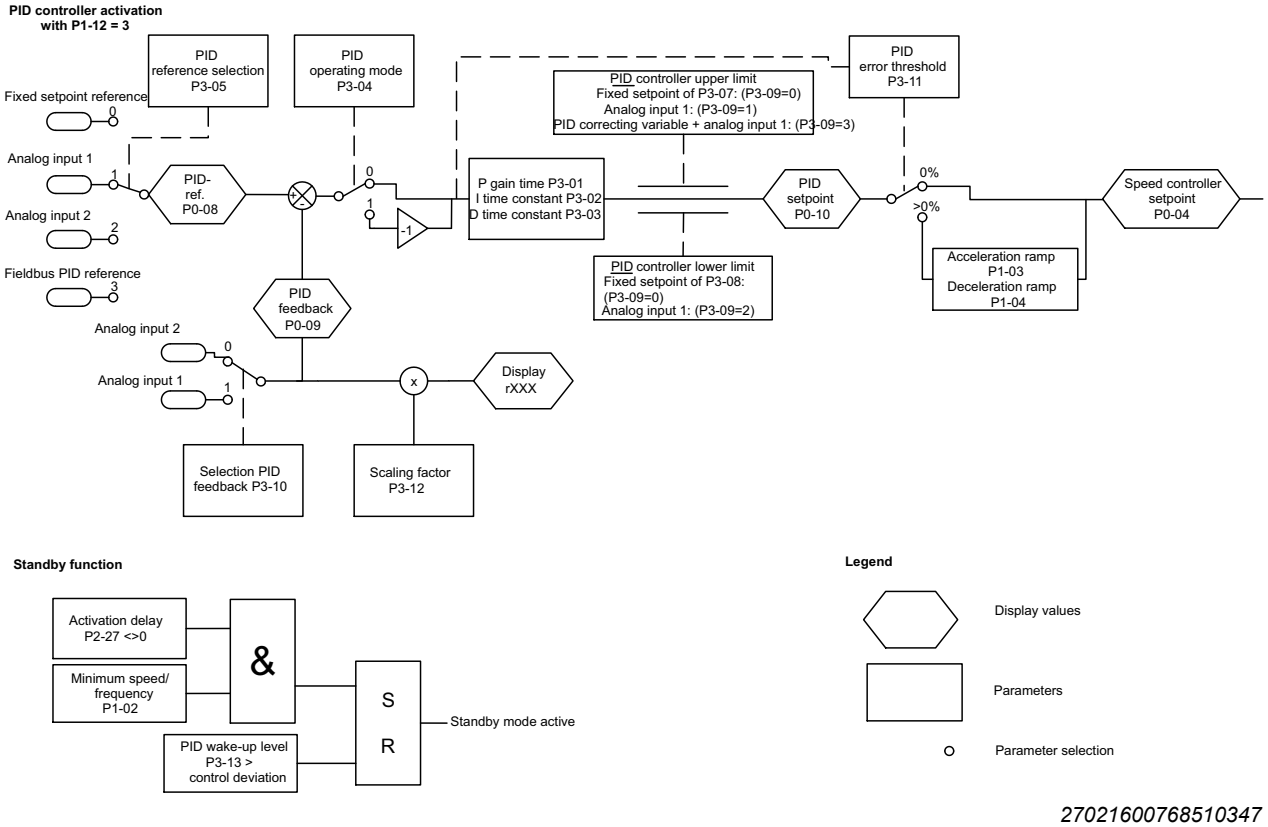
INFORMATION

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.

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



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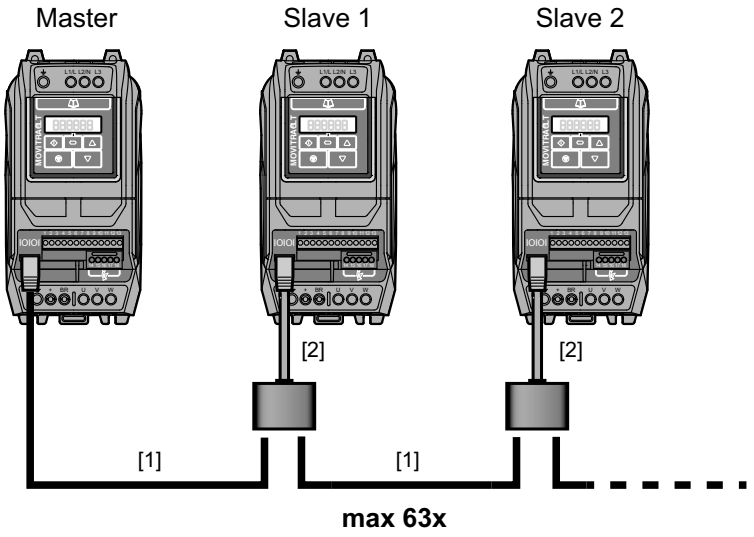
5.4.4 Master-slave mode (*P1-12* = 4)



9007212609546891

[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.

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 (such as stopped, running) and output frequency every 30 ms. The slave inverters then follow the state of the master frequency inverter.

Configuring the master inverter

The master inverter of each network must have the communication address "1". Set:

- *P1-12* ≠ 4 (control signal source)
- *P1-14* = 201 (extended parameter menu)
- *P5-01* = 1 (inverter address communication)

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Configuring the slave inverters

- Each connected slave must have a unique slave communication address that is set with the inverter address *P5-01*. You can assign slave addresses from 2 to 63. Set:
- *P1-12* = 4 (control signal source)
- *P1-14* = 201 (extended parameter menu)
- *P5-01* = 2 - 63 (inverter address communication)
- the type of speed scaling in *P2-28*
- the scaling factor in *P2-29*.
- Make sure that the ramps at the slave inverter are set equal to or smaller than the value at the master.

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.

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

See chapter "Fieldbus mode" (→ 🗎 92).

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" (→ 🗎 71).

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" (→ 🗎 23).
- 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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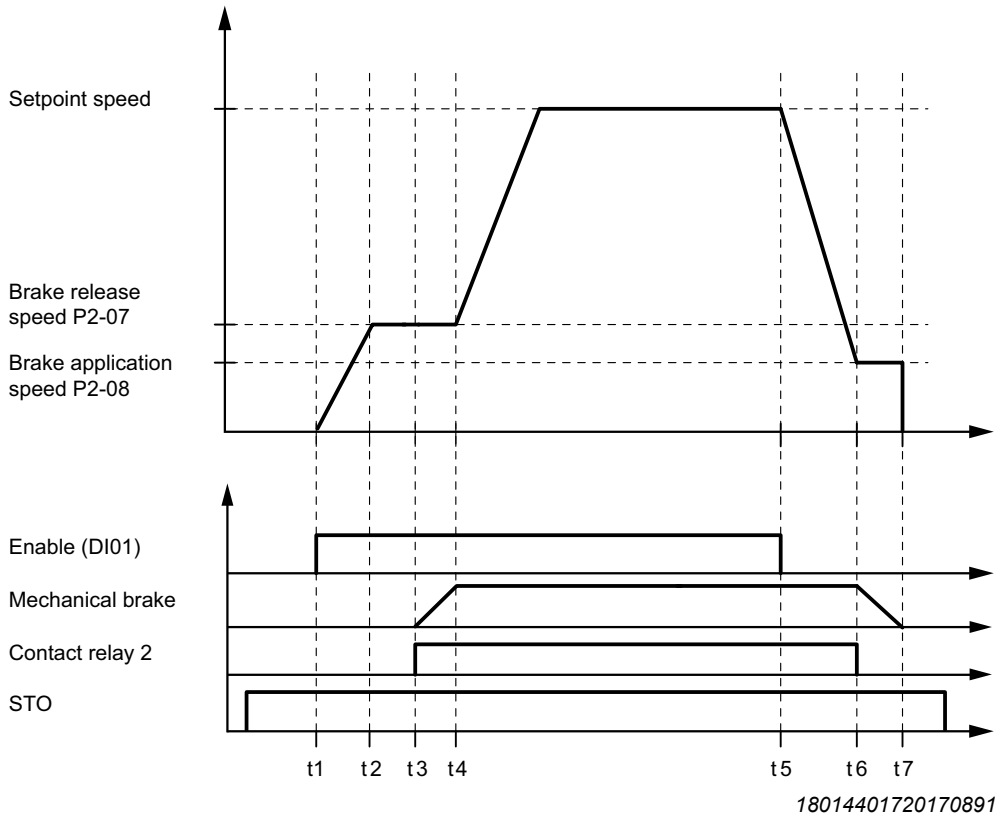
5.5.3 Hoisting mode

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

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 required input.
- Set parameter *P6-13* to "0" or "1" depending on the wiring.
- Set parameter *P6-14* to the speed that is to be used in fire mode/emergency mode. You can specify a positive or a negative speed setpoint.

For evaluating the fire mode/emergency modem, the following two indices can be read-out 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

Activating the fire mode/emergency mode has the inverter drive the motor with the preset values. In this mode, the inverter ignores all faults, shutdowns, setpoints and enable signals and operates the motor until it is destroyed or even until the loss of voltage supply. It is also not possible in this mode to perform a reset to the factory setting.

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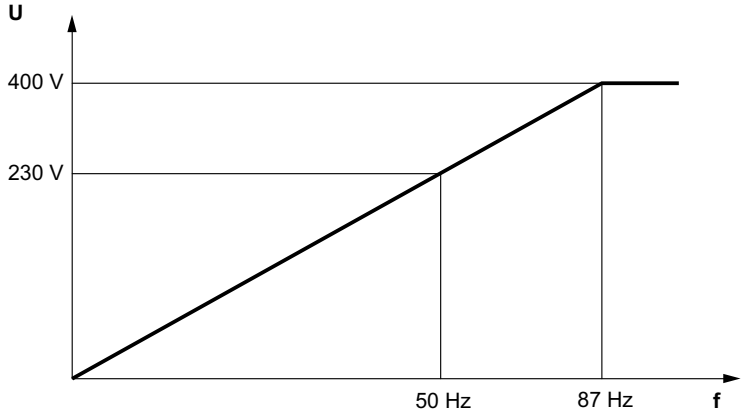
5.7 Operation at 87 Hz characteristic

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)".

Example for calculating P1-10:

DRN80M4: 0.75 kW, 50 Hz

Nominal speed 1440 1/min

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

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.

5.8 Motor potentiometer function – crane application

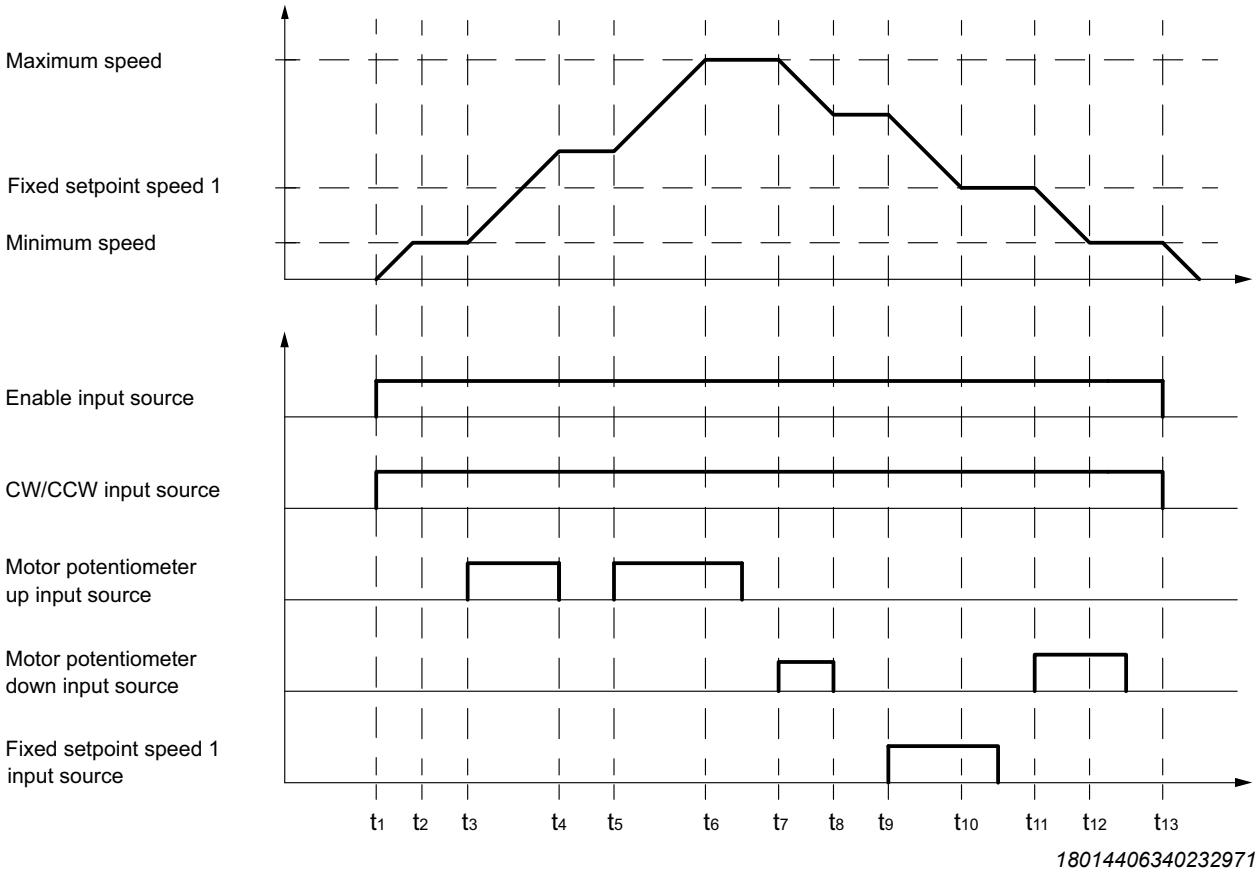
The motor potentiometer works like an electromechanical potentiometer that increases or decreases the internal value depending on the signals at the inputs, and consequently increases or decreases the motor speed.

INFORMATION

In case of deviating terminal assignment, the inputs can also be configured individually.

5.8.1 Motor potentiometer operation

The following figure shows the basic function of the motor potentiometer. The description in chapter "Parameter settings" (→ 🗎 77) is based on the frequently used crane function and works according to the terminal assignment in chapter "Terminal assignment" (→ 🗎 77).



t_1 Inverter enable
t_1 - t_2 Motor runs up to the set minimum speed (*P1-02*).
t_2 - t_3 Motor maintains minimum speed.
t_3 Motor potentiometer up (*P9-28*) is activated.
t_3 - t_4 As long as the signal is present at *P9-28*, the motor speed is increased along acceleration ramp *P1-03*.
t_4 - t_5 If no signal is present any longer at *P9-28*, the actual speed is maintained.
t_5 Motor potentiometer up (*P9-28*) is activated.
t_5 - t_6 As long as the signal is present at *P9-28*, the motor speed is increased 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 when the signal is no longer present at *P9-28*.
t_7 Motor potentiometer down (*P9-29*) is activated.
t_7 - t_8 As long as the signal is present at *P9-29*, the motor speed is decreased along deceleration ramp *P1-04*.
t_8 - t_9 If no signal is present any longer at *P9-28*, the actual 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 (*P9-29*) is activated.
t_{11} - t_{12} As long as the signal is present at *P9-29*, the motor speed is decreased along deceleration ramp *P1-04* but not below the minimum speed *P1-02*.

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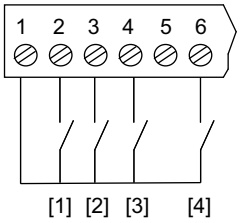
5.8.2 Terminal assignment



7834026891

[1] DI1 Reduce enable/speed

[2] DI2 Increase speed

[3] DI3 Fixed setpoint speed 1

[4] DI4 Change of direction (clockwise rotation/counterclockwise rotation)

5.8.3 Parameter settings

Start up the motor as described in chapter "Startup" (→ 🗎 59).

Make the following settings to being able to use the motor potentiometer:

- *P1-12* = 0 (control signal source terminal mode)
- *P1-14* = 201 (extended parameter menu)
- *P1-15* = 0 (digital input function selection)
- *P2-37* = 6 (keypad restart speed).

Input configuration:

- *P9-01* = din-1 (input source enable)
- *P9-03* = din-1 (input source for clockwise rotation)
- *P9-06* = din-4 (direction of rotation reversal)
- *P9-09* = on (terminal control enable source)
- *P9-10* = d-Pot (speed source 1)
- *P9-11* = PrE-1 (speed source 2)
- *P9-18* = din-3 (input speed selection 0)
- *P9-28* = din-2 (input source motor potentiometer open).

User settings:

- *P1-02* = minimum speed
- *P1-03* = acceleration ramp time
- *P1-04* = deceleration ramp time
- *P2-01* = fixed setpoint speed 1.

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5.9 Examples of analog input scaling and offset setting

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

Inverter setting:

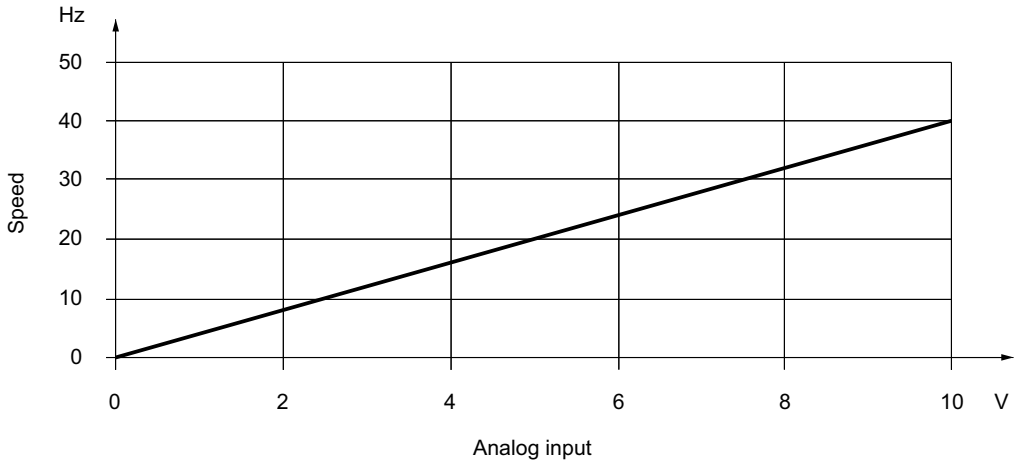
P1-01 = 50 Hz

5.9.1 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%



13627147915

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

13624278667

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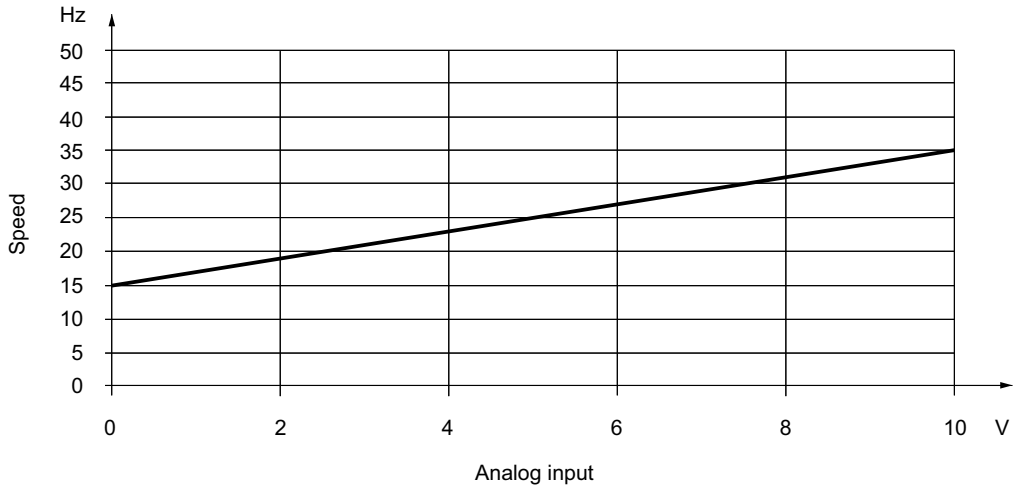
5.9.2 Example 2: Analog input offset

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

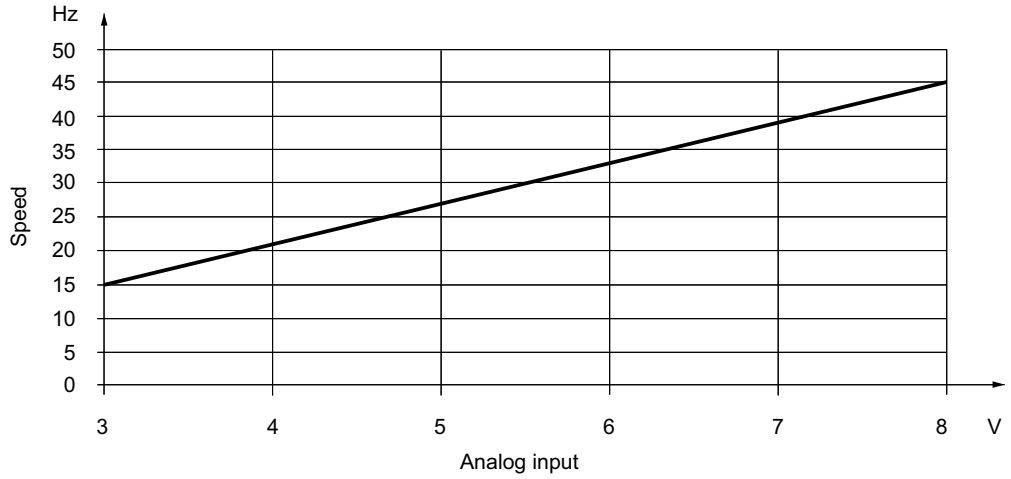
$$P2 - 32 = \frac{\frac{-n_{Offset}}{P1 - 01} \times 100\%}{P2 - 31} = \frac{\frac{-15\,Hz}{50\,Hz} \times 100\%}{0.40} = -75\%$$

13624284555

5.9.3 Example 3: Analog input scaling and offset

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

P2-31 = 120%, P2-32 = 5%



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

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

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

$$P2-32=5\%$$

18364573451

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5.10 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*)
- PID controller, see "Parameter group 3: PID controller (level 2)" (→ 🗎 142)
- Fire mode/emergency mode, see "Fire mode/emergency mode" (→ 🗎 74)
- Deactivating slip compensation via rated motor speed (*P1-10*)

5.11 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 ramp *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. See also 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.

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5.12 3-wire control

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

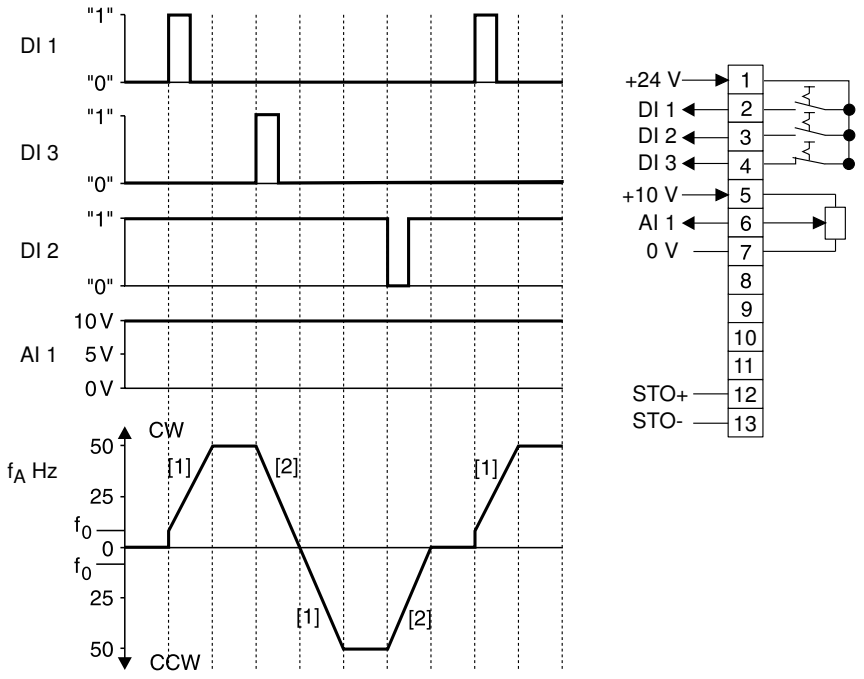
The 3-wire control principle determines the control.

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*.

5.12.1 Control signal source 3-wire control



18826070667

DI 1	CW/stop	CW	Clockwise 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_A	Output frequency		
f_0	Start/stop frequency		

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6 Operation

The following information is displayed to being able to read off the operating state of the inverter at any time:

Status	Abbreviation display
Drive OK	Static inverter status
Drive running	Operating state of the inverter
Fault / trip	Fault

6.1 Inverter status

6.1.1 Static inverter status

The list below shows the abbreviations that are displayed to indicate the inverter status when the motor is at standstill.

Abbreviation	Description
StoP	Power section of inverter disabled. This message is displayed when the inverter is at a standstill and no error is pending. The inverter is ready for normal operation. The inverter is not enabled.
P-deF	Preset parameters are loaded. This message appears when the user issues the command for loading the parameters set at the factory. You have to press the <Stop/reset> key before the inverter can resume operation.
Standby	The inverter is in standby mode. When *P2-27* > 0 s, this message appears when the inverter has stopped and the setpoint is also "0".
Inhibit	Is displayed when 24 V and GND are not present at the STO contacts. The output stage is inhibited.
ETL 24	External voltage supply is connected. The functions are limited, see also chapter "24 V backup mode" (→ 🗎 48).

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6.1.2 Operating state of the inverter

The list below shows the abbreviations that are displayed to indicate the inverter status when the motor is running.

Pressing the "Navigate" key on the keypad lets you toggle between output frequency, output current, output power and speed.

Abbreviation	Description
H xxx	Output frequency of the inverter (in Hz). This message is displayed while the inverter is running.
A xxx	Output current of the inverter (in Ampere). This message is displayed while the inverter is running.
P xxx	Current output power of the inverter (in kW). This message is displayed while the inverter is running.
L xxx	The parameter is locked for changes. Make sure that: - The parameter lock *P2-39* is not activated. - The inverter is not enabled. - The inverter is supplied with line voltage.
Auto-t	The motor parameters are measured automatically to configure the motor parameters. Auto tune runs automatically when receiving the first enable signal after operation with factory-set parameters. No hardware enable is required for running auto tune.
Ho-run	Reference travel started. Wait until the inverter has reached the reference position. After successful reference travel, "Stop" appears on the display.
xxxx	Output speed of the inverter (in 1/min). This message appears while the inverter is running if the rated speed of the motor was entered in parameter *P1-10*.
C xxx	Is the scaling factor "Speed" (*P2-21 / P2-22*).
. . . . . . (flashing dots)	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 indicates fault "I.t-trP" depending on the extent of the overload.
FirE	Fire mode/emergency mode is active.
Select language	List to select one of the available languages. To select a language, use the <Navigate> key.

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6.1.3 Status displays of the parameter module

The parameter module status is displayed on the frequency inverter display.

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

6.1.4 Fault reset

You can reset a fault by pressing the <Stop/reset> key or by opening and closing digital input 1. For further information, refer to chapter "Error codes" (→ 🗎 87).

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6.2 Troubleshooting

Symptom	Cause and solution
Overload or overcurrent error 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. 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 a heat source that keeps the ambient temperature on site above –10 °C.
No access to advanced menus	*P1-14* must be set to advanced access code. The value is "101" unless the user has changed the code in *P2-40*.

6.3 Error history

Parameter *P1-13* in parameter mode archives the 4 most recent errors and/or events. Each error is displayed in abbreviated form. The most recent error is shown first (when calling *P1-13*).

This means that any new error is entered at the top of the list followed by the subsequent errors in the order of their appearance. The oldest fault will be deleted from the error history.

- **INFORMATION**

  If the latest error in the error history is an undervoltage fault, no further undervoltage faults will be entered in the error history. The reason is to avoid that the error history is filled with undervoltage faults, which occur every time the inverter is switched off.

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6.4 Error codes

Error message Inverter display P0-13 error history		Error code status word if Bit5 = 1		CANopen Emergency Code	Explanation	Solution
Inverter display	MotionStudio coding dec	dec	hex	hex		
4-20 F	18	113	0x71	0x1012	Signal loss 4 – 20 mA	• Check whether the input current in *P2-30* and *P2-33* lies within the defined range. • Check the connection cable.
AtF-01	40	81	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 winding has the correct resistance and symmetry.
AtF-02	41	81	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	81	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	81	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	81	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	98	0x62	0x1013	Internal memory error (DSP)	Contact the SEW-EURODRIVE Service.
dAtA-F	17	98	0x62	0x1011	Internal memory error (IO)	Contact the SEW-EURODRIVE Service.
E-triP	11	26	0x1A	0x100B	External error at digital input 5.	NC contact was opened. • Check motor thermistor (if connected).
Enc-01	30	14	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/ SP-Err	31	14	0x0E	0x101F	Speed fault (*P6-07*)	The difference between actual speed and setpoint speed is perceptually larger than the value set in *P6-07*. This error applies only to vector control or control with encoder feedback. Set a higher value in *P6-07*. If you wish to deactivate the speed monitoring, set *P6-07* to 100%.
Enc-03	32	14	0x0E	0x1020	Incorrect PPR count setting.	Check the parameter settings in *P6-06* and *P1-10*.
Enc-04	33	14	0x0E	0x1021	Encoder channel A error	The A track of the encoder feedback is not present. Check the wiring.
Enc-05	34	14	0x0E	0x1022	Encoder channel B error	The B track of the encoder feedback is not present. Check the wiring.
Enc-06	35	14	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	14	0x0E	0x1024	RS485 data channel error, HIPERFACE® data channel error	Communication error between encoder card and encoder. Check the encoder card for correct seat and contact.

Error message Inverter display P0-13 error history		Error code status word if Bit5 = 1		CANopen Emergency Code	Explanation	Solution
Inverter display	**MotionStudio coding dec**	**dec**	**hex**	**hex**		
Enc-08	37	14	0x0E	0x1025	HIPERFACE® I/O communication channel error	Communication error between encoder card and inverter. Check the encoder card for correct seat and contact.
Enc-09	38	14	0x0E	0x1026	HIPERFACE® type 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 1/min. • The nominal motor voltage equals the nominal inverter voltage. • A HIPERFACE® encoder is used.
Enc-10	39	14	0x0E	0x1027	Trigger: KTY	KTY not triggered or not connected.
Er-LED					Display error	Contact the SEW-EURODRIVE Service.
Err-SC					The keypad lost the communication connection to the inverter.	Press the STOP key to reset. Check the address of the frequency 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	31	0x1F	0x1015	Motor protection triggered	The connected motor protection sensor is defined in *P2-33* (PTC, TF, TH, KTY or PT1000), and connected to the analog input 2 (terminal 10).
FAN-F	22	50	0x32	0x1016	Internal fan error.	Contact the SEW-EURODRIVE Service.
FLt-dc	13	7	0x07	0x320D	DC link ripple too high.	Check the current supply.
Ho-trP	27	39	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	42	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 cannot provide the current for acceleration/constant travel.

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Error message Inverter display P0-13 error history		Error code status word if Bit5 = 1		CANopen Emergency Code	Explanation	Solution
Inverter display	**MotionStudio coding dec**	**dec**	**hex**	**hex**		
I.t-trp	04	8	0x08	0x1004	Overload of inverter/motor (I2t error)	Make sure that: • The motor nameplate parameters are correctly inserted in *P1-07*, *P1-08* and *P1-09*. • In vector mode (*P4-01* = 0 or 1), the motor power factor in *P4-05* is correct. • Auto 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 faults (mechanically check the load). • The thermal motor protection to UL508C is activated in *P4-17*.
O-I	03	1	0x01	0x2303	Short-term overcurrent at the inverter output. High motor overload.	**Fault during stop procedure:** Check for premature brake application. **Fault while enabling the inverter:** Check to see, if: • The motor nameplate parameters are correctly inserted in *P1-07*, *P1-08* and *P1-09*. • In vector mode (*P4-01* = 0 or 1), the motor power factor in *P4-05* is correct. • Auto Tune has correctly been performed. • The load can move freely and there are no blockages or other mechanical faults (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. Reduce the settings of the voltage enhancement in *P1-11*. Set a longer run-up time in *P1-03*. Disconnect the motor from the inverter. Enable the inverter again. If this error occurs again, check the entire system and completely replace the inverter. **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.
hO-I	15	1	0x01	0x230F	Hardware overcurrent error at the inverter output (IGBT self-protection in case of overload).	
O-hEAt	23	124	0x7C	0x4117	Ambient temperature too high.	Check if the ambient conditions are within the range specified for inverters.
O-t	8	11	0x0B		Heat sink overtemperature	The heat sink temperature can be displayed via *P0-21*. A historical protocol is saved in parameter *P0-38* in 30 s intervals prior to a switch off with error. This error 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 motor/inverter.

Error message Inverter display P0-13 error history		Error code status word if Bit5 = 1		CANopen Emergency Code	Explanation	Solution
Inverter display	MotionStudio coding dec	dec	hex	hex		
O-torq	24	52	0x34	0x1018	Maximum torque limit timeout.	Check the motor load. Set a higher value in *P6-17* if required. If you wish to deactivate the torque monitoring, set *P6-07* to 0.0 s.
O-Volt	06	7	0x07	0x3206	DC link overvoltage	The error occurs if a high flywheel load or overhauling load is connected, and the excess regenerative energy is transferred back to the inverter. If an error occurs while stopping or during deceleration, increase the deceleration ramp time *P1-04* or connect a suitable braking resistor to the inverter. The proportional gain in *P4-03* is reduced in vector mode. In PID control mode ensure that the ramps are active by reducing *P3-11*. Additionally check if the supply voltage is within the specified range. Information: The value of the DC bus voltage can be displayed 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	4	0x04	0x2301	Brake channel overcurrent, Brake 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 wiring for possible short circuits.
OL-br	02	4	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 loads mass moment of inertia, or connect additional braking resistors in parallel. Note the minimum resistor values for the used inverter.
OF-01	60	28	0x1C	0x103C	Internal connection to option module error.	Contact the SEW-EURODRIVE Service.
OF-02	61	28	0x1C	0x103D	Option module error	Contact the SEW-EURODRIVE Service.
Out-F	26	82	0x52	0x101A	Inverter output stage error	Contact the SEW-EURODRIVE Service.
P-LOSS	14	6	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	9	0x09	0x100A	Factory settings are restored.	
Ph-lb					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	200	0xC8	0x1005	Output stage error (IGBT self-protection in case of overload)	See error **O-I**.
SC-0b5	12	29	1D		Connection between inverter and keypad interrupted.	Connection between inverter and keypad.
SC-F03	52	41	0x29	0x1034	Fieldbus module communication error (fieldbus side)	Contact the SEW-EURODRIVE Service.
SC-F04	53	41	0x29	0x1035	Communication error IO option card	Contact the SEW-EURODRIVE Service.

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Error message Inverter display P0-13 error history		Error code status word if Bit5 = 1		CANopen Emergency Code	Explanation	Solution
Inverter display	**MotionStudio coding dec**	**dec**	**hex**	**hex**		
SC-F05	54	41	0x29	0x1036	LTX module communication error	Contact the SEW-EURODRIVE Service.
SC-F01	50	43	0x2B	0x1032	Modbus communication error	Check the communication settings.
SC-F02	51	47	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 frequency inverter.	Press the <Stop> key to reset. Check the address of the inverter.
Sto-F	29	115	0x73	0x101D	STO circuit error	Inverter is defective, replace device.
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	31	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	52	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	117	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	198	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

7.1 General information

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*			
PO4	No function, freely configurable via *P5-11*			

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Process input words

Description		Bit		Settings	Byte
PI1	Status word	0	Output stage enable	0: Disabled 1: Enabled	Low byte
		1	Frequency inverter ready for operation	0: Not ready 1: Ready	
		2	PO data enabled	1 if *P1-12* = 5	
		3 – 4	Reserved		
		5	Fault/warning	0: No error 1: Fault	
		6	Positive limit switch active (limit switch assignment can be set via *P1-15* or *P9-30/P9-31*).[1)]	0: Disabled 1: Enabled	
		7	Negative limit switch active (limit switch assignment can be set via *P1-15* or *P9-30/P9-31*).	0: Disabled 1: Enabled	
		8 – 15	Frequency 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
			Frequency inverter status if bit 5 = 1		
PI2	Actual speed	Freely configurable via *P5-12*			
PI3	Actual current	Freely configurable via *P5-13*			
PI4	No function, freely configurable via *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	Coast to a stop
		0x0002	Stop along the process ramp (*P1-04)* or (PO3).
		0x0003 - 0x0005	Reserved
		0x0006	Accelerate along a ramp (*P1-03*) or (PO3) and run at setpoint speed (PO2)
PO2	Setpoint speed	0x4000	= 16384 = max. speed, e.g. 50 Hz (*P1-01*) CW
		0x2000	= 8192 = 50% of the max. speed, e.g. 25 Hz CW
		0xC000	= -16384 = max. speed, e.g. 50 Hz (*P1-01*) CCW
		0x0000	= 0 = min. speed, set in *P1-02*
		0xF100	= 8192 = 50% of the max. speed, e.g. 25 Hz CCW

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
PI2	Actual speed	Should correspond to PO2 (setpoint speed)	
PI3	Actual current	Depends on speed and load	

7.1.3 Parameter settings for the inverter

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

Parameters	SBus	CANopen	Modbus RTU[1)]
P1-12 (control signal source)	5	6	7
P1-14 (extended parameter menu)	201	201	201
P1-15 (function selection digital inputs)	1[2)]	1[2)]	1[2)]
P5-01 (inverter address)	1 – 63	1 – 63	1 – 63
P5-02 (SBus baud rate)	Baud rate	Baud rate	--
P5-03 (Modbus baud rate)	--	--	Baud rate
P5-04 (Modbus data format)	--	--	Data format
P5-05[3)] (behavior in the event of communication failure)	0-1-2-3	0-1-2-3	0-1-2-3
P5-06[3)] (communication failure timeout)	0.0 – 1.0 – 5.0 s	Communication monitoring is covered by the Lifetime or Heartbeat functions integrated in CANopen.	0.0 – 1.0 – 5.0 s
P5-07[3)] (ramp specified via fieldbus)	0 = Specified via P1-03/04 1 = specified via fieldbus[4)]	0 = specified via *P1-03/04* 1 = specified via fieldbus[4)]	0 = specified via *P1-03/04* 1 = specified via fieldbus[4)]
P5-XX (fieldbus parameter)	More setting options[5)] .	More setting options[5)]	More setting options[5)]

1) Modbus RTU 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) These parameters can remain set to their default values for the time being.
4) When specifying the ramp via fieldbus, P5-10 =3 must be set (PO3 = ramp time).
5) You can make more fieldbus settings and define the process data in detail in parameter group P5-xx, see chapter "Parameter group 5"

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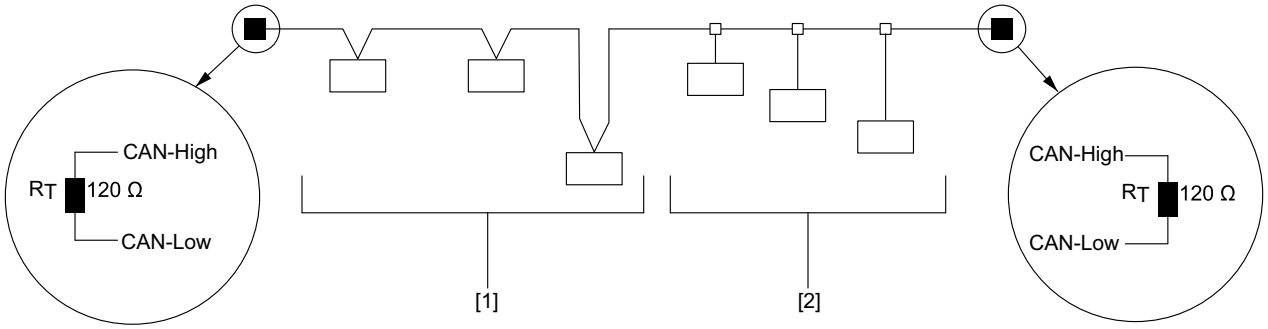
7.1.4 Connecting the signal terminals at the inverter

For bus mode, you can connect the signal terminals using the default setting of *P1-15* as described in chapter "Overview of signal terminals" (→ 🗎 44). 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

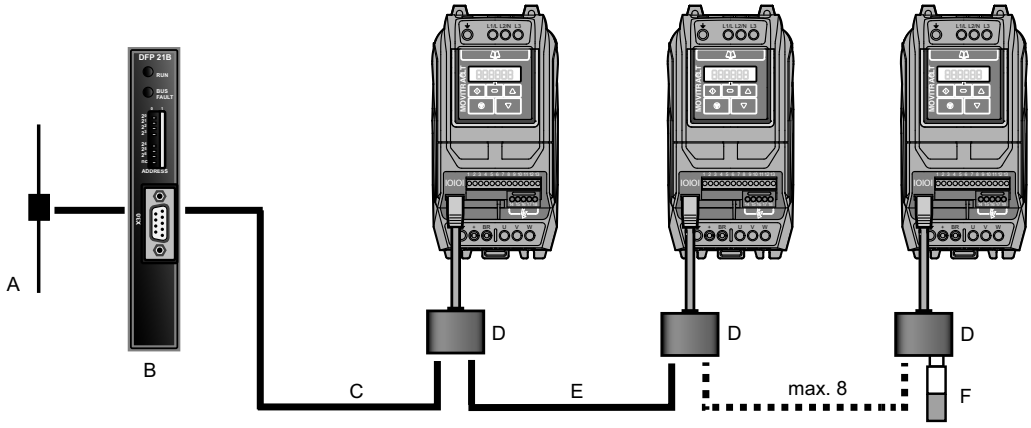
The MOVILINK® profile via CAN/SBus is an application profile from SEW-EURODRIVE specifically adjusted to SEW inverters. For detailed information, refer to the "MOVIDRIVE® MDX60B/61B Communication and Fieldbus Device Profile" manual.

For using SBus, configure the inverter as described in chapter "Parameter settings for the inverter" (→ 🗎 94). 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" (→ 🗎 116).

7.2.2 Electrical installation

Connecting gateway and MOVI-PLC®.



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[A] Bus connection
[B] Gateway, e.g. DFx/UOH
[C] Connection cable
[D] Splitter
[E] Connection cable
[F] Y 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" (→ 🗎 48).

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.

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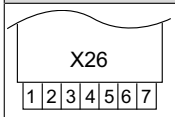
Wiring from the control to the "communication socket RJ45" (→ 🗎 47) of the inverter:

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" (→ 🗎 96).
- 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" (→ 🗎 94). 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.

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. Holding registers (03) are used for reading, and single holding registers (06) for writing. For using Modbus RTU, configure the inverter as described in chapter "Parameter settings for the inverter" (→ 🗎 94).

Note: Modbus RTU is not available when the LTX encoder module is plugged.

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" (→ 🗎 47).

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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 configured as required in parameter group *P5-xx*.

The table shows the default allocation 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.

Register	Upper byte	Lower byte	Com-mand	Type
1	PO1 control word (fixed)		03, 06	Read / Write
2	PO2 (default setting in *P5-09 =1*; speed setpoint)		03, 06	Read / Write
3	PO3 (default setting in *P5-10 =7*; no function)		03, 06	Read / Write
4	PO4 (default setting in *P5-11 =7*; no function)		03, 06	Read / Write
5	Reserved	-	03	Read
6	PI1 status word (fixed)		03	Read
7	PI2 (defafult setting in *P5-12 =1*; actual speed)		03	Read
8	PI3 (default setting in *P5-13 =2*; actual current)		03	Read
9	PI4 (default setting in *P5-14 =4*; power)		03	Read
…	For more registers, refer to chapter "Parameter registers" (→ 🗎 116).			

You find the complete allocation of parameters and registers as well as the scaling of data in the memory allocation plan in chapter "Parameter registers" (→ 🗎 116).

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.

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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

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" (→ 🗎 94).

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" (→ 🗎 95).

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.

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	

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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.

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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.

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

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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" (→ 🗎 87).

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8 Service

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

8.1 Electronics Service by SEW-EURODRIVE

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

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

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

8.2 Extended storage

If the device is stored for a long time, connect it to the supply system voltage for at least 5 minutes every 2 years. Otherwise, the service life of the device may be reduced.

Procedure when maintenance has been neglected:

Electrolytic capacitors are used in the frequency inverters. They are subject to aging effects when de-energized. This effect can damage the capacitors if the device is connected using 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 steps are recommended:

AC 230 V devices:

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

AC 400 V devices:

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

AC 575 V devices:

- Step 1: AC 0 V to AC 350 V within a few seconds
- Step 2: AC 350 V for 15 minutes

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- Step 3: AC 420 V for 15 minutes
- Step 3: AC 500 V for 15 minutes
- Step 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".

Parameters	SEW index	Modbus register	Description	Display range	Explanation
	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).
P0-01	11210	20	Value of analog input 1	0 – 100 %	1000 = 100% ≙ max input voltage or input current.
P0-02	11211	21	Value of analog input 2	0 – 100 %	1000 = 100% ≙ max input voltage or input current.
P0-03	11212	11	Digital input state	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	0 – 100 %	68 = 6.8 Hz; 100% = base frequency (*P1-09*)
P0-05	11214	41	Torque controller setpoint	0 – 100 %	2000 = 200.0%; 100% = nominal motor torque
P0-06	11215		Digital speed setpoint in keypad mode	*-P1-01 – P1-01* in Hz	Speed displayed in Hz or 1/min
P0-07	11216		Speed setpoint via communication connection	*-P1-01 – P1-01* in Hz	–
P0-08	11217		PID reference	0 – 100 %	PID reference
P0-09	11218		Actual PID value	0 – 100 %	Actual PID value
P0-10	11219		PID output	0 – 100 %	PID output
P0-11	11270		Present motor voltage	V rms	Effective voltage value at the motor
P0-12	11271		Output torque	0 – 200.0%	Torque output in %
P0-13	11272 – 11281		Error log	Latest 4 error messages with time stamp	Shows the last 4 errors. You can toggle between sub-items by pressing the <Up>/<Down> keys.
P0-14	11282		Magnetizing current (Id)	A rms	Magnetizing current in A rms
P0-15	11283		Rotor current (Iq)	A rms	Rotor current in A rms
P0-16	11284		Magnetic field strength	0 – 100 %	Magnetic field strength
P0-17	11285		Reserved		
P0-18	11286		Reserved		
P0-19	11287		Reserved		
P0-20	11220	23	DC link voltage	V DC	600 = 600 V (internal DC link voltage)
P0-21	11221, 11222	24	Inverter temperature	°C	40 = 40 °C (temperature inside the inverter)
P0-22	11288		DC link voltage ripple	V rms	Internal DC link voltage ripple
P0-23	11289, 11290		Total time over 80 °C (heat sink)	Hours and minutes	Time during which the inverter was operated at > 80 °C
P0-24	11237, 11238		Total time over 60 °C (ambient)	Hours and minutes	Time during which the inverter was operated at > 60 °C
P0-25	11291		Rotor speed (calculated via motor model)	Hz	Applies only to vector mode Accuracy 0.5%
P0-26	11292, 11293	30	kWh counter (can be reset)	0.0 – 999.9 kWh	100 = 10.0 kWh (cumulative energy consumption)
		32	kWh counter		

Parameters	SEW index	Modbus register	Description	Display range	Explanation
P0-27	11294, 11295	31	MWh counter	0.0 – 65535 MWh	100 = 10.0 MWh (cumulative energy consumption)
		33	MWh counter (can be reset)		
P0-28	11247 – 11250		Software version and checksum	e.g. "1 1.00", "1 4F3C" "2 1.00", "2 Ed8A"	Version number and checksum, firmware.
P0-29	11251 – 11254		Inverter type	e.g. "HP 2", "2 400", "3-PhASE"	Version number and checksum.
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
		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* bis *P5-20*.
P0-31	11296, 11297	34	Inverter operating time (hours)	Hours and minutes	Ex: 6 = **6h** 39m 07s
		35	Inverter operating time (minutes/seconds)		Ex: 2347 = 2347s = 39m 07s → 6h **39m 07s**
P0-32	11298, 11299		Runtime since the last fault (1)	Hour/min/sec	Runtime after the inverter enable until the first fault occurred. If the inverter is not enabled, the runtime clock is stopped. The counter is reset the first time the inverter is enabled after an error is acknowledged or the first time the inverter is enabled after a power failure
P0-33	11300, 11301		Runtime since the last fault (2)	Hour/min/sec	Runtime after the inverter enable until the first fault occurred. If the inverter is not enabled, the runtime clock is stopped. The counter is reset the first time the inverter is enabled after an error is acknowledged or the first time the inverter is enabled after a power failure.
P0-34	11302, 11303	36	Inverter runtime after last controller inhibit (hours)	Hour/min/sec	6 = **6h** 11s − runtime clock is reset after inverter inhibit.
		37	Inverter runtime after last controller inhibit (minutes/ seconds)		11 = 6h **11s** − runtime clock is reset after inverter inhibit.
P0-35	11304, 11305		Inverter inhibit, inverter fan runtime	Hour/min/sec	Runtime clock for internal fan.
P0-36	11306 – 11313		DC link voltage log (256 ms)	The last 8 values prior to the fault	The last 8 values prior to the fault.
P0-37	11314 – 11321		DC link voltage ripple log (20 ms)	The last 8 values prior to the fault	The last 8 values prior to the fault.
P0-38	11322 – 11329		Temperature sensor power electronics	The last 8 values prior to the fault	The last 8 values prior to the fault.
P0-39	11239 – 11246		Temperature sensor control electronics	The last 8 values prior to the fault	The last 8 values prior to the fault.
P0-40	11330 – 11337		Motor current log (256 ms)	The last 8 values prior to the fault	The last 8 values prior to the fault.
P0-41	11338		Counter for critical faults -O-I	–	Counter for overcurrent faults.
P0-42	11339		Counter for critical faults -O-Volt	–	Counter for overvoltage faults.
P0-43	11340		Counter for critical faults -U-Volt	–	Counter for undervoltage faults. Also during power off.
P0-44	11341		Counter for critical faults -O-T	–	Counter for overtemperature faults of the heat sink.
P0-45	11342		Counter for critical faults -b O-I	–	Counter for short-circuit faults of the brake chopper.
P0-46	11343		Counter for critical faults O-heat	–	Counter for overtemperature faults due to high ambient temperature.
P0-47	11223		Counter for internal I/O communication errors	0 – 65535	–
P0-48	11344		Counter for internal DSP communication errors	0 – 65535	–

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Parameters	SEW index	Modbus register	Description	Display range	Explanation
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 PI1, PI2, PI3	Hex value	3 entries; incoming process data from the perspective of the controller.
P0-52	11259 – 11261		Outgoing process data PO1, PO2, PO3	Hex value	3 entries; outgoing process data from the perspective of the controller.
P0-53			Current phase offset and reference value for U	Internal value	2 entries; first is reference value, second is measured value; no decimal place for both values.
P0-54			Current phase offset and reference value for V	Internal value	2 entries; first is reference value, second is measured value; no decimal place for both values.
P0-55			Current phase offset and reference value for W	Internal value (not available for some inverters)	2 entries; first is reference value, second is measured value; no decimal place for both values.
P0-56			Max. switch-on time of braking resistor, operating cycle of braking resistor	Internal value	2 entries
P0-57			Ud/Uq	Internal value	2 entries
P0-58	11345		Encoder speed	Hz, 1/min	Scaling with 3000 = 50.0 Hz with one decimal place. 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in 1/min if *P1-10* ≠ 0.
P0-59	11226		Frequency input speed	Hz, 1/min	Scaling with 3000 = 50.0 Hz with one decimal place. 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in 1/min if *P1-10* ≠ 0.
P0-60	11346		Calculated slip speed value	Internal value (only with V/f control) Hz, 1/min	Scaling with 3000 = 50.0 Hz with one decimal place. 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in 1/min if *P1-10* ≠ 0.
P0-61	11227		Value for speed hysteresis/ relay control	Hz, 1/min	Scaling with 3000 = 50.0 Hz with one decimal place. 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in 1/min if *P1-10* ≠ 0.
P0-62	11347, 11348		Speed static	Internal value	Scaling with 3000 = 50.0 Hz with one decimal place. 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in 1/min if *P1-10* ≠ 0.
P0-63	11349		Speed setpoint after the ramp	Hz, 1/min	Scaling with 3000 = 50.0 Hz with one decimal position. 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in 1/min if *P1-10* ≠ 0.
P0-64	11350		Internal PWM frequency	4 – 16 kHz	0 = 2 kHz 1 = 4 kHz 2 = 6 kHz 3 = 8 kHz 4 = 12 kHz 5 = 16 kHz
P0-65	11351, 11352		Inverter service life	Hour/min/sec	2 entries; first for hour, second for minute and second.
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	

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Parameters	SEW index	Modbus register	Description	Display range	Explanation
P0-68	11229		User ramp value		The indicating accuracy on the inverter display depends on the ramp time received via the fieldbus. For the inverters: • 230 V: 0.75 – 5.5 kW • 400 V: 0.75 – 11 kW • 575 V: 0.75 – 15 kW Ramp <0.1 s: Display with 2 decimal positions 0.1 s ≤ ramp <10 s: Display with 1 decimal position 10 s ≤ ramp <65 s: Display with 0 decimal positions For the inverters: • 230 V: 7.5 – 75 kW • 400 V: 15 – 160 kW • 575 V: 18.5 – 110 kW 0.0 s ≤ ramp <10 s: Display with 1 decimal position 10 s ≤ ramp <65 s: Display with 0 decimal positions
P0-69	11230		Counter for I2C faults	0 ~ 65535	
P0-70	11231		Module identification code	List	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	List / value	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	Process temperature Room temperature	C	42 = 42 °C
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: Bit 0=EnC-04 analog signal error (sin/cos) Bit 1=EnC-07 RS485 communication error Bit 2=EnC-08 IO communication error Bit 3=EnC-09 encoder type not supported Bit 4=EnC-10 KTY error Bit 5=incorrect motor combination Bit 6=system referenced Bit 7=system ready	Internal value	Displayed as decimal value.
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

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Parameters	SEW index	Modbus register	Description	Display range	Explanation
P0-79	11355, 11356		IO version and DSP bootloader version for motor control	Example: L 1.00 Example: b 1.00	2 entries; first for lib version of the motor control, second for DSP bootloader version. 2 decimal positions.
P0-80	11233, 11357		Code for valid motor data Servo module version		2 entries; first value is 1 if valid servomotor data is read via the LTX module. Second value is the SW version of the LTX card.

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.

Modbus register	SBus/ CANopen index	Associated parameter	Range/factory setting	
101	11020	"P1-01 Maximum speed" (→ 🗎 122)	*P1-02* – **50.0 Hz** – 5 × *P1-09*	
102	11021	"P1-02 Minimum speed" (→ 🗎 122)	**0** – P1-01 Hz	
103	11022	"P1-03 Acceleration ramp time" (→ 🗎 122)	IP20 For the inverters: • 230 V: 0.75 – 5.5 kW • 400 V: 0.75 – 11 kW • 575 V: 0.75 – 15 kW 0.00 – **5.0** – 600 s For the inverters: • 230 V: 7.5 – 75 kW • 400 V: 15 – 160 kW • 575 V: 18.5 – 110 kW 0.0 – **5.0** – 6000 s	IP66 For the inverters: • 230 V: 0.75 – 4 kW • 400 V: 0.75 – 7.5 kW • 575 V: 0.75 – 11 kW 0.00 – **5.0** – 600 s For the inverters: • 230 V: 5.5 – 75 kW • 400 V: 11 – 160 kW • 575 V: 15 – 110 kW 0.0 – **5.0** – 6000 s
104	11023	"P1-04 Deceleration ramp time" (→ 🗎 123)	IP20 For the inverters: • 230 V: 0.75 – 5.5 kW • 400 V: 0.75 – 11 kW • 575 V: 0.75 – 15 kW coast/0.01 – **5.0** – 600 s For the inverters: • 230 V: 7.5 – 75 kW • 400 V: 15 – 160 kW • 575 V: 18.5 – 110 kW coast/0.1 – **5.0** – 6000 s	IP66 For the inverters: • 230 V: 0.75 – 4 kW • 400 V: 0.75 – 7.5 kW • 575 V: 0.75 – 11 kW coast/0.01 – **5.0** – 600 s For the inverters: • 230 V: 5.5 – 75 kW • 400 V: 11 – 160 kW • 575 V: 15 – 110 kW coast/0.1 – **5.0** – 6000 s
105	11024	"P1-05 Stop mode" (→ 🗎 123)	**0: Stop ramp** / 1: Coast to a stop	
106	11025	"P1-06 Energy saving function" (→ 🗎 123)	**0: off** / 1: on	
107	11012	"P1-07 Rated motor voltage" (→ 🗎 124)	• 230 V inverter: 20 – **230** − 250 V • 400 V inverter: 20 – **400** – 500 V • 575 V inverter: 20 – **575** – 600 V	
108	11015	"P1-08 Rated motor current" (→ 🗎 124)	20 − 100% of the inverter current	
109	11009	"P1-09 Rated motor frequency" (→ 🗎 124)	25 – **50/60** – 500 Hz	
110	11026	"P1-10 Rated motor speed" (→ 🗎 124)	**0** – 30000 1/min	
111	11027	"P1-11 Voltage increase, boost" (→ 🗎 125)	0 – 30% (factory setting depends on inverter)	
112	11028	"P1-12 Control signal source" (→ 🗎 125)	**0: Terminal mode**	
113	11029	"P1-13 Error history" (→ 🗎 126)	Last 4 errors	
114	11030	"P1-14 Extended parameter access" (→ 🗎 126)	**0** – 30000	
115	11031	"P1-15 Digital input function selection" (→ 🗎 126)	0 – **1** – 26	
116	11006	"P1-16 Motor type" (→ 🗎 130)	In-Syn	
117	11032	"P1-17 Servo module function selection" (→ 🗎 131)	0 – **1** – 8	
118	11033	"P1-18 Motor thermistor selection" (→ 🗎 131)	**0: Inhibited**	
119	11105	"P1-19 Inverter address" (→ 🗎 131)	0 – **1** – 63	
120	11106	"P1-20 SBus baud rate" (→ 🗎 131)	125, 250, **500**, 1000 kBaud	
121	11017	"P1-21 Stiffness" (→ 🗎 131)	0.50 – **1.00** – 2.00	
122	11034	"P1-22 Motor load inertia ratio" (→ 🗎 131)	0 – **1** – 30	
201	11036	"P2-01 Fixed setpoint speed 1" (→ 🗎 132)	-P1-01 – **5.0 Hz** – P1-01	
202	11037	"P2-02 Fixed setpoint speed 2" (→ 🗎 132)	-P1-01 – **10.0 Hz** – P1-01	
203	11038	"P2-03 Fixed setpoint speed 3" (→ 🗎 132)	-P1-01 – **25.0 Hz** – P1-01	

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Modbus register	SBus/ CANopen index	Associated parameter	Range/factory setting	
204	11039	"P2-04 Fixed setpoint speed 4" (→ 🗎 132)	-P1-01 – **50.0 Hz** – P1-01	
205	11040	"P2-05 Fixed setpoint speed 5" (→ 🗎 132)	-P1-01 – **0.0 Hz** – P1-01	
206	11041	"P2-06 Fixed setpoint speed 6" (→ 🗎 133)	-P1-01 – **0.0 Hz** – P1-01	
207	11042	"P2-07 Fixed setpoint speed 7" (→ 🗎 133) /brake release speed	-P1-01 − 0.0 Hz − P1-01	
208	11043	"P2-08 Fixed setpoint speed 8" (→ 🗎 133) /brake application speed	-P1-01 − 0.0 Hz − P1-01	
209	11044	"P2-09 Skip frequency" (→ 🗎 133)	P1-02 – P1-01	
210	11045	"P2-10 Skip frequency range" (→ 🗎 133)	**0.0 Hz** – P1-01	
211	11046	"P2-11 Analog output 1 function selection" (→ 🗎 134)	0 – **8** – 13	
212	11047	"P2-12 Analog output 1 format" (→ 🗎 134)	**0 – 10 V**	
213	11048	"P2-13 Analog output 2 function selection" (→ 🗎 134)	0 – **9** – 13	
214	11049	"P2-14 Analog output 2 format" (→ 🗎 134)	**0 – 10 V**	
215	11050	"P2-15 User relay output 1 function selection" (→ 🗎 135)	0 – **1** – 11	
216	11051	"P2-16 Upper limit of user relay 1: Analog output 1" (→ 🗎 135)	0.0 – **100.0** – 200.0 %	
217	11052	"P2-17 Lower limit of user relay 1: Analog output 1" (→ 🗎 135)	**0.0** – P2-16	
218	11053	"P2-18 User relay output 2 function selection" (→ 🗎 136)	0 – **3** – 11	
219	11054	"P2-19 Upper limit of user relay 2: Analog output 2" (→ 🗎 136)	0.0 – **100.0** – 200.0 %	
220	11055	"P2-20 Lower limit of user relay 2: Analog output 2" (→ 🗎 136)	**0.0** – P2-19	
221	11056	"P2-21 Display scaling factor" (→ 🗎 136)	-30000 – **0,000** – 30000	
222	11057	"P2-22 Display scaling source" (→ 🗎 136)	0 − 2	
223	11058	"P2-23 Zero speed holding time" (→ 🗎 136)	0.0 – **0.2** – 60.0 s	
224	11003	"P2-24 PWM switching frequency" (→ 🗎 136)	2 – 16 kHz (depends on inverter)	
225	11059	"P2-25 Second deceleration ramp, rapid stop ramp" (→ 🗎 137)	IP20 For the inverters: • 230 V: 0.75 – 5.5 kW • 400 V: 0.75 – 11 kW • 575 V: 0.75 – 15 kW coast/0.01 – **2.0** – 600 s For the inverters: • 230 V: 7.5 – 75 kW • 400 V: 15 – 160 kW • 575 V: 18.5 – 110 kW coast/0.1 – **2.0** – 6000 s	IP66 For the inverters: • 230 V: 0.75 – 4 kW • 400 V: 0.75 – 7.5 kW • 575 V: 0.75 – 11 kW coast/0.01 – **2.0** – 600 s For the inverters: • 230 V: 5.5 – 75 kW • 400 V: 11 – 160 kW • 575 V: 15 – 110 kW coast/0.1 – **2.0** – 6000 s
226	11060	"P2-26 Flying start enable" (→ 🗎 137)	**0: Disabled**	
227	11061	"P2-27 Standby mode" (→ 🗎 137)	**0.0** – 250 s	
228	11062	"P2-28 Slave speed scaling" (→ 🗎 138)	**0: Disabled**	
229	11063	"P2-29 Slave speed scaling factor" (→ 🗎 138)	-500 – **100** – 500 %	
230	11064	"P2-30 Analog input 1 format" (→ 🗎 138)	**0 – 10 V**	
231	11065	"P2-31 Analog input 1 scaling" (→ 🗎 139)	0 – **100** – 500 %	
232	11066	"P2-32 Analog input 1 offset" (→ 🗎 139)	-500 – **0** – 500 %	
233	11067	"P2-33 Analog input 2 format / motor protection" (→ 🗎 140)	**0 – 10 V**	
234	11068	"P2-34 Analog input 2 scaling" (→ 🗎 140)	0 – **100** – 500 %	
235	11069	"P2-35 Analog input 2 offset" (→ 🗎 140)	-500 – **0** – 500 %	
236	11070	"P2-36 Start mode selection" (→ 🗎 140)	**Auto – 0**	
237	11071	"P2-37 Keypad restart speed" (→ 🗎 141)	0 – 7	
238	11072	"P2-38 Mains loss stop control" (→ 🗎 142)	**0** – 3	

Modbus register	SBus/ CANopen index	Associated parameter	Range/factory setting
239	11073	"P2-39 Parameter lock" (→ 142)	**0: Disabled**
240	11074	"P2-40 Extended parameter access code definition" (→ 142)	0 – **101** – 9999
301	11075	"P3-01 PID proportional gain" (→ 142)	0 – **1** – 30
302	11076	"P3-02 PID integral time constant" (→ 142)	0 – **1** – 30 s
303	11077	"P3-03 PID differential time constant" (→ 143)	**0.00** – 1.00 s
304	11078	"P3-04 PID operating mode" (→ 143)	**0: Direct operation**
305	11079	"P3-05 PID reference selection" (→ 143)	**0: Fixed setpoint reference**
306	11080	"P3-06 PID fixed setpoint reference 1" (→ 143)	**0.0** – 100.0%
307	11081	"P3-07 PID controller upper limit" (→ 143)	P3-08 – **100.0%**
308	11082	"P3-08 PID controller lower limit" (→ 143)	**0.0 %** – P3-07
309	11083	"P3-09 PID correcting variable limitation" (→ 143)	**0: Fixed setpoint reference**
310	11084	"P3-10 PID feedback selection" (→ 144)	**0: Analog input 2**
311	11085	"P3-11 PID ramp activation error" (→ 144)	**0.0** – 25.0%
312	11086	"P3-12 PID actual value display scaling factor" (→ 144)	**0.0** – 50000
313	11087	"P3-13 PID feedback wake-up level" (→ 144)	**0.0** – 100.0%
314	11088	"P3-14 PID fixed setpoint speed 2" (→ 144)	**0.0** – 100.0%
315	11376	"P3-15 PID fixed setpoint speed 3" (→ 144)	**0.0** – 100.0%
316	11377	"P3-16 PID fixed setpoint speed 4" (→ 144)	**0.0** – 100.0%
401	11089	"P4-01 Control mode" (→ 145)	**2: Speed control – Enhanced V/f**
402	11090	"P4-02 "Auto tune"" (→ 146)	**0: Inhibited**
403	11091	"P4-03 Speed controller proportional gain" (→ 146)	0.1 – **50** – 400 %
404	11092	"P4-04 Speed controller integral time constant" (→ 146)	0,001 – **0,100** – 1,000 s
405	11093	"P4-05 Motor power factor" (→ 146)	0.50 – 0.99 (depends on inverter)
406	11094	"P4-06 Torque reference/limit value source" (→ 146)	**0: Fixed torque reference/limit value**
407	11095	"P4-07 Max. motor torque limit" (→ 148)	P4-08 – **200** – 500%
408	11096	"P4-08 Min. torque limit" (→ 149)	**0.0%** – P4-07
409	11097	"P4-09 Max. regenerative torque limit" (→ 149)	P4-08 – **200** – 500%
410	11098	"P4-10 V/f characteristic adjustment frequency" (→ 150)	**0.0** – 100.0 % of P1-09
411	11099	"P4-11 V/f characteristic adjustment voltage" (→ 150)	**0.0** – 100.0 % of P1-07
412	11100	"P4-12 Motor brake control" (→ 150)	**0: Disabled**
413	11101	"P4-13 Brake release time" (→ 150)	0.0 – 5.0 s
414	11102	"P4-14 Brake application time" (→ 150)	0.0 – 5.0 s
415	11103	"P4-15 Torque threshold for brake release" (→ 151)	0.0 – 200%
416	11104	"P4-16 Hoist torque threshold timeout" (→ 151)	0.0 – 25.0 s
417	11357	"P4-17 Thermal motor protection to UL508C" (→ 151)	**0: Disabled**
501	11105	"P5-01 Inverter address" (→ 151)	0 – **1** – 63
502	11106	"P5-02 SBus baud rate/CANopen" (→ 151)	125 – **500** – 1000 kBd
503	11107	"P5-03 Modbus RTU baud rate" (→ 152)	9.6 – **115.2 / 115200 Bd**
504	11108	"P5-04 Modbus RTU data format" (→ 152)	**n-1: no parity, 1 stop bit**
505	11109	"P5-05 Response to communication failure" (→ 152)	**2: Stop ramp (without fault)**
506	11110	"P5-06 Communication failure timeout for SBus and Modbus" (→ 152)	0.0 – **1.0** – 5.0 s

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Modbus register	SBus/ CANopen index	Associated parameter	Range/factory setting
507	11111	"P5-07 Ramp specified via fieldbus" (→ 🗎 152)	**0: Disabled**
508	11112	"P5-08 Synchronization duration" (→ 🗎 152)	**0**, 5 – 20 ms
509	11369	"P5-09 Fieldbus PO2 definition" (→ 🗎 153)	0 − 7
510	11370	"P5-10 Fieldbus PO3 definition" (→ 🗎 153)	0 − 7
511	11371	"P5-11 Fieldbus PO4 definition" (→ 🗎 153)	0 − 7
512	11372	"P5-12 Fieldbus PI2 definition" (→ 🗎 154)	0 − 11
513	11373	"P5-13 Fieldbus PI3 definition" (→ 🗎 154)	0 − 11
514	11374	"P5-14 Fieldbus PI4 definition" (→ 🗎 154)	0 − 11
515	11360	"P5-15 Expansion relay 3 function selection" (→ 🗎 154)	0 − 10
516	11361	"P5-16 Relay 3 upper limit" (→ 🗎 154)	0.0 – **100.0** – 200.0%
517	11362	"P5-17 Relay 3 lower limit" (→ 🗎 155)	**0.0** – 200.0%
518	11363	"P5-18 Expansion relay 4 function selection" (→ 🗎 155)	see *P5-15*
519	11364	"P5-19 Relay 4 upper limit" (→ 🗎 155)	0.0 – **100.0** – 200.0%
520	11365	"P5-20 Relay 4 lower limit" (→ 🗎 155)	**0.0** – 200.0%
601	11115	"P6-01 Firmware upgrade enable" (→ 🗎 155)	**0: Disabled**
602	11116	"P6-02 Automatic thermal management" (→ 🗎 155)	**1: Enabled**
603	11117	"P6-03 Auto-reset delay time" (→ 🗎 156)	1 – **20** – 60 s
604	11118	"P6-04 Hysteresis band user relay" (→ 🗎 156)	0.0 – **0.3** – 25.0%
605	11119	"P6-05 Encoder feedback enable" (→ 🗎 156)	**0: Disabled**
606	11120	"P6-06 Encoder PPR" (→ 🗎 156)	**0** – 65535 PPR
607	11121	"P6-07 Trigger threshold speed error/speed monitoring" (→ 🗎 156)	1.0 – **5.0** – 100%
608	11122	"P6-08 Max. frequency for speed setpoint" (→ 🗎 156)	0; **5** – 20 kHz
609	11123	"P6-09 Droop speed/load distribution control" (→ 🗎 157)	**0.0** – 25.0%
610	11124	"P6-10 Reserved" (→ 🗎 157)	
611	11125	"P6-11 Speed holding time on enable (fixed setpoint speed 7)" (→ 🗎 157)	**0.0** – 250 s
612	11126	"P6-12 Speed holding time on inhibit (fixed setpoint speed 8)" (→ 🗎 157)	**0.0** – 250 s
613	11127	"P6-13 Fire mode logic/emergency mode" (→ 🗎 158)	**0: Open trigger: Fire mode**
614	11128	"P6-14 Fire mode/emergency mode speed" (→ 🗎 158)	-P1-01 – **0** – P1-01 Hz
615	11129	"P6-15 Analog output 1 scaling" (→ 🗎 158)	0.0 – **100.0** – 500.0%
616	11130	"P6-16 Analog output 1 offset" (→ 🗎 158)	-500.0 – **0.0** – 500.0%
617	11131	"P6-17 Max. torque limit timeout" (→ 🗎 159)	0.0 – **0.5** − 25.0 s
618	11132	"P6-18 DC braking voltage level" (→ 🗎 159)	Auto, **0.0** – 30.0%
619	11133	"P6-19 Braking resistor value" (→ 🗎 159)	**0**, Min-R – 200 Ω
620	11134	"P6-20 Braking resistor power" (→ 🗎 159)	**0.0** – 200 kW
621	11135	"P6-21 Brake chopper operating cycle at undertemperature" (→ 🗎 160)	**0.0** – 20.0%
622	11136	"P6-22 Reset fan runtime" (→ 🗎 160)	**0: Disabled**
623	11137	"P6-23 Reset kWh meter" (→ 🗎 160)	**0: Disabled**
624	11138	"P6-24 Parameter default settings" (→ 🗎 160)	**0: Disabled**
625	11139	"P6-25 Access code level 3" (→ 🗎 160)	0 – **201** – 9 999
626	11378	"P6-26 Parameter backup" (→ 🗎 160)	0: Basic setting of the parameter
701	11140	"P7-01 Motor stator resistance (Rs)" (→ 🗎 161)	depending on the motor
702	11141	"P7-02 Motor rotor resistance (Rr)" (→ 🗎 161)	depending on the motor
703	11142	"P7-03 Motor stator inductance (Lsd)" (→ 🗎 161)	depending on the motor

Modbus register	SBus/ CANopen index	Associated parameter	Range/factory setting
704	11143	"P7-04 Motor magnetization current (Id rms)" (→ 🗎 162)	10% × P1-08 − 80% × P1-08
705	11144	"P7-05 Motor leakage loss coefficient (sigma)" (→ 🗎 162)	0,025 – **0.10** – 0.25
706	11145	"P7-06 Motor stator inductance (Lsq) − only for synchronous motors" (→ 🗎 162)	depending on the motor
707	11146	"P7-07 Enhanced generator control" (→ 🗎 162)	**0: Disabled**
708	11147	"P7-08 Parameter adjustment" (→ 🗎 162)	**0: Disabled**
709	11148	"P7-09 Overvoltage current limit" (→ 🗎 162)	0.0 – **1.0** – 100%
710	11149	"P7-10 Stiffness (for vector control)" (→ 🗎 163)	0 – **10** – 600
711	11150	"P7-11 Pulse width min. limit" (→ 🗎 163)	0 – 500
712	11151	"P7-12 Premagnetization time" (→ 🗎 163)	0 – 5000 ms
713	11152	"P7-13 D-gain vector speed controller" (→ 🗎 163)	**0.0** – 400%
714	11153	"P7-14 Low-frequency torque boost/ premagnetization current" (→ 🗎 163)	**0.0** – 100%
715	11154	"P7-15 Torque boost frequency limit" (→ 🗎 164)	**0.0** – 50%
716	11155	"P7-16 Motor nameplate speed" (→ 🗎 164)	**0.0** – 6000 1/min
801	11156	"P8-01 Simulated encoder scaling" (→ 🗎 164)	$\mathbf{2}^0$ – 2^3
802	11157	"P8-02 Input pulse scaling value" (→ 🗎 164)	2^0 – $\mathbf{2}^{16}$
803	11158	"P8-03 Lag error low word" (→ 🗎 165)	0 – **65535**
804	11159	"P8-04 Lag error high word" (→ 🗎 165)	**0** – 65535
805	11160	"P8-05 Reference travel type" (→ 🗎 165)	**0: Disabled**
806	11161	"P8-06 Position controller proportional gain" (→ 🗎 165)	0.0 – **1.0** – 400%
807	11162	"P8-07 Touch probe trigger mode" (→ 🗎 165)	**0: TP1 P edge TP2 P edge**
808	11163	"P8-08 Reserved" (→ 🗎 165)	
809	11164	"P8-09 Velocity precontrol gain" (→ 🗎 165)	0 – **100** – 400%
810	11165	"P8-10 Acceleration precontrol gain" (→ 🗎 166)	**0** – 400%
811	11166	"P8-11 Reference offset low word" (→ 🗎 166)	**0** – 65535
812	11167	"P8-12 Reference offset high word" (→ 🗎 166)	**0** – 65535
813	11168	"P8-13 Reserved" (→ 🗎 166)	
814	11169	"P8-14 Reference enable torque" (→ 🗎 166)	0 – **100** – 500%
901	11171	"P9-01 Enable input source" (→ 🗎 168)	SAFE, din-1 – din-8
902	11172	"P9-02 Rapid stop input source" (→ 🗎 168)	OFF, din-1 – din-8, On
903	11173	"P9-03 Input source for clockwise rotation (CW)" (→ 🗎 168)	OFF, din-1 – din-8, On
904	11174	"P9-04 Input source for counterclockwise rotation (CCW)" (→ 🗎 168)	OFF, din-1 – din-8, On
905	11175	"P9-05 Latch function enable" (→ 🗎 168)	OFF, ON
906	11176	"P9-06 Direction of rotation reversal" (→ 🗎 168)	OFF, din-1 – din-8, On
907	11177	"P9-07 Reset input source" (→ 🗎 168)	OFF, din-1 – din-8, On
908	11178	"P9-08 External fault input source" (→ 🗎 169)	OFF, din-1 – din-8, On
909	11179	"P9-09 Terminal control enable source" (→ 🗎 169)	OFF, din-1 – din-8, On
910	11180	"P9-10 Speed source 1" (→ 🗎 169)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
911	11181	"P9-11 Speed source 2" (→ 🗎 169)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
912	11182	"P9-12 Speed source 3" (→ 🗎 169)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
913	11183	"P9-13 Speed source 4" (→ 🗎 169)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
914	11184	"P9-14 Speed source 5" (→ 🗎 169)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
915	11185	"P9-15 Speed source 6" (→ 🗎 169)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
916	11186	"P9-16 Speed source 7" (→ 🗎 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
917	11187	"P9-17 Speed source 8" (→ 🗎 170)	Ain-1, Ain-2, speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
918	11188	"P9-18 Input speed selection 0" (→ 🗎 170)	OFF, din-1 – din-8, On

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Modbus register	SBus/ CANopen index	Associated parameter	Range/factory setting
919	11189	"P9-19 Input speed selection 1" (→ 🗎 170)	OFF, din-1 – din-8, On
920	11190	"P9-20 Input speed selection 2" (→ 🗎 170)	OFF, din-1 – din-8, On
921	11191	"P9-21 Fixed setpoint speed selection input 0" (→ 🗎 171)	OFF, din-1 – din-8, On
922	11192	"P9-22 Fixed setpoint speed selection input 1" (→ 🗎 171)	OFF, din-1 – din-8, On
923	11193	"P9-23 Fixed setpoint speed selection input 2" (→ 🗎 171)	OFF, din-1 – din-8, On
924	11194	"P9-24 Positive jog mode input" (→ 🗎 171)	OFF, din-1 – din-8
925	11195	"P9-25 Negative jog mode input" (→ 🗎 171)	OFF, din-1 – din-8
926	11196	"P9-26 Reference travel enable input" (→ 🗎 171)	OFF, din-1 – din-8
927	11197	"P9-27 Reference cam input" (→ 🗎 171)	OFF, din-1 – din-8
928	11198	"P9-28 Motor potentiometer up input source" (→ 🗎 171)	OFF, din-1 – din-8
929	11199	"P9-29 Motor potentiometer down input source" (→ 🗎 172)	OFF, din-1 – din-8
930	11200	"P9-30 Positive limit switch CW" (→ 🗎 172)	OFF, din-1 – din-8
931	11201	"P9-31 Negative limit switch CCW" (→ 🗎 172)	OFF, din-1 – din-8
932	11202	"P9-32 Enable second deceleration ramp, rapid stop ramp" (→ 🗎 172)	OFF, din-1 – din-8
933	11203	"P9-33 Fire mode/emergency mode input selection" (→ 🗎 172)	OFF, din-1 – din-5
934	11204	"P9-34 PID fixed setpoint reference selection input 0" (→ 🗎 172)	**OFF**, din-1 – din-8
935	11205	"P9-35 PID fixed setpoint reference selection input 1" (→ 🗎 172)	**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 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 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:

For the inverters:

IP20	IP66
• 230 V: 0.75 – 5.5 kW • 400 V: 0.75 – 11 kW • 575 V: 0.75 – 15 kW 0.00 – **5.0** – 600 s	• 230 V: 0.75 – 4 kW • 400 V: 0.75 – 7.5 kW • 575 V: 0.75 – 11 kW 0.00 – **5.0** – 600 s

For the inverters:

IP20	IP66
• 230 V: 7.5 – 75 kW • 400 V: 15 – 160 kW • 575 V: 18.5 – 110 kW 0.0 – **5.0 –** 6000 s	• 230 V: 5.5 – 75 kW • 400 V: 11 – 160 kW • 575 V: 15 – 110 kW 0.0 – **5.0 –** 6000 s

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.*

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P1-04 Deceleration ramp time

Setting range:

For the inverters:

IP20	IP66
• 230 V: 0.75 – 5.5 kW • 400 V: 0.75 – 11 kW • 575 V: 0.75 – 15 kW Coast – 0.01 – **5.0** – 600 s	• 230 V: 0.75 – 4 kW • 400 V: 0.75 – 7.5 kW • 575 V: 0.75 – 11 kW Coast – 0.01 – **5.0** – 600 s

For the inverters:

IP20	IP66
• 230 V: 7.5 – 75 kW • 400 V: 15 – 160 kW • 575 V: 18.5 – 110 kW Coast – 0.1 – **5.0** – 6000 s	• 230 V: 5.5 – 75 kW • 400 V: 11 – 160 kW • 575 V: 15 – 110 kW Coast – 0.1 – **5.0** – 6000 s

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 s is displayed as "coast" as this value leads to coast to a stop.

P1-05 Stop mode

- **0: Stop ramp**: The speed is decreased to zero along the ramp set in *P1-04* when the inverter enable signal is removed. The output stage is only inhibited when the output frequency is zero. If a zero speed holding time is set in *P2-23*, the inverter will hold zero speed during this time before it is disabled.
- 1: Coast to a stop: In this case, the inverter output is disabled as soon as the enable signal is removed. The motor then coasts to stop 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** – 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.

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.

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 1/min

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

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.

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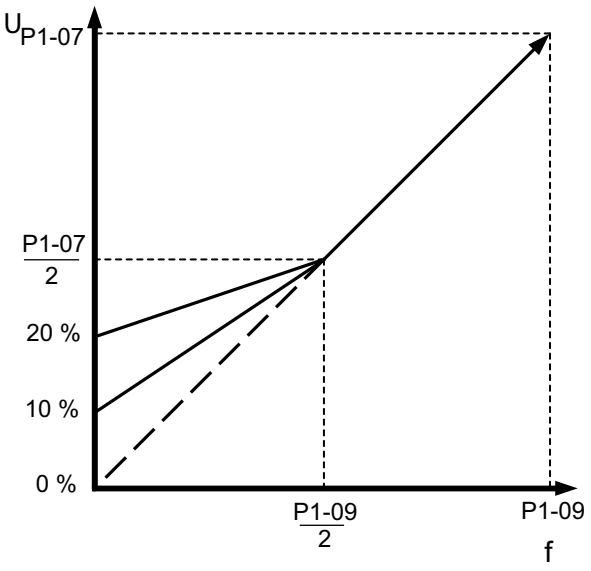
P1-11 Voltage increase, boost

Setting range: Auto / 0 – 30% (default value depends on inverter voltage and power rating)

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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For the "Auto" setting, a value based on the motor data measured during auto tune is set automatically.

P1-12 Control signal source

The user can use this parameter to determine whether the inverter is controlled by the:

- User terminals
- Keypad at the front of the device
- Internal PID controller
- Fieldbus

See also chapter "Startup of control" (→ 🗎 65).

- **0: Terminal mode**
- 1: Keypad mode unipolar
- 2: Keypad mode bipolar
- 3: PID controller mode
- 4: Master-slave operation
- 5: SBus MOVILINK®
- 6: CANopen
- 7: Fieldbus, Modbus, communication option
- 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

Includes the 4 most recent faults and/or events that have occurred. Each fault is displayed with abbreviated text. The most recent fault is displayed first. When a new fault occurs, it will be entered at the top of the list. All other faults are shifted downwards. The oldest fault will be deleted from the error history. Undervoltage faults are only archived if the inverter is enabled. If the inverter is separated from the supply system without enable, no undervoltage fault is archived.

P1-14 Extended parameter access

Setting range: **0** – 30000

This parameter allows users to access parameter groups other than the basic parameters (parameters *P1-01 – P1-15*). 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: *P0-01 – P5-20* (extended parameters)
- 201: *P0-01 – P9-33* (extended parameter menu → full access)

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 select 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).

INFORMATION

Individual configuration of digital inputs:

To individually configure the digital input assignment, set parameter *P1-15* to "0". This setting means that the input terminals for DI1 – DI5 (with LTX option DI1 – DI8) are set to "no function".

P1-15	Digital input 1	Digital input 2	Digital input 3	Analog input 1: Digital input 4	Analog input 2: Digital input 5	Remarks / preset value
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 (controller inhibit)** **1: Start (enable)**	**0: Clockwise rotation** **1: Counterclockwise rotation**	**0: Selected speed setpoint** **1: Fixed setpoint speed 1, 2**	**Analog 1 speed setpoint**	**0: Fixed setpoint speed 1** **1: Fixed setpoint speed 2**	**–**

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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	Remarks / preset value
2	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: CCW rotation	0: Open	0: Open	0: Open	Fixed setpoint speed 1
			1: Closed	0: Open	0: Open	Fixed setpoint speed 2
			0: Open	1: Closed	0: Open	Fixed setpoint speed 3
			1: Applied	1: Closed	0: Open	Fixed setpoint speed 4
			0: Open	0: Open	1: Applied	Fixed setpoint speed 5
			1: Closed	0: Open	1: Closed	Fixed setpoint speed 6
			0: Open	1: Closed	1: Closed	Fixed setpoint speed 7
			1: Closed	1: Closed	1: Closed	Fixed setpoint speed 8
3	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: CCW rotation	0: Selected speed setpoint 1: Fixed setpoint speed 1	Analog 1 speed setpoint	Analog torque reference Set *P4-06* = 2 here.	–
4	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: CCW rotation	0: Selected speed setpoint 1: Fixed setpoint speed 1	Analog 1 speed setpoint	0: Decel. ramp 1 1: Decel. ramp 2	–
5	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: CCW rotation	0: Selected speed setpoint 1: Analog input 2	Analog 1 Speed setpoint	Analog 2 speed setpoint	–
6	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: CCW rotation	0: Selected speed setpoint 1: Fixed setpoint speed 1	Analog 1 speed setpoint	External fault[1)] 0: Error 1: Start	–
7	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: CCW rotation	0: Open	0: Open	External fault[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
8	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: CCW rotation	0: Open	0: Open	0: Decel. ramp 1 1: Decel. ramp 2	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 (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: CCW rotation	0: Open	0: Open	0: Selected speed setpoint 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 (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: CCW rotation	N.O. contact The speed increases when closing.	N.O. contact The speed decreases when closing.	0: Selected speed setpoint 1: Fixed setpoint speed 1	–
11	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 1: CCW rotation	0: Selected speed setpoint 1: Fixed setpoint speed 1, 2	Analog 1 speed setpoint	0: Fixed setpoint speed 1 1: Fixed setpoint speed 2	–

P1-15	Digital input 1	Digital input 2	Digital input 3	Analog input 1: Digital input 4	Analog input 2: Digital input 5	Remarks / preset value
12	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 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
13	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 1: CCW rotation	0: Selected speed setpoint 1: Fixed setpoint speed 1	Analog 1 speed setpoint	Analog torque reference Set *P4-06* = 2 here.	–
14	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 1: CCW rotation	0: Selected speed setpoint 1: Fixed setpoint speed 1	Analog 1 speed setpoint	0: Decel. ramp 1 1: Decel. ramp 2	–
15	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 1: CCW rotation	0: Selected speed setpoint 1: Analog input 2	Analog 1 speed setpoint	Analog 2 speed setpoint	–
16	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 1: CCW rotation	0: Selected speed setpoint 1: Fixed setpoint speed 1	Analog 1 speed setpoint	External fault[1)] 0: Error 1: Start	–
17	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 1: CCW rotation	0: Open	0: Open	External fault[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
18	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 1: CCW rotation	0: Open	0: Open	0: Decel. ramp 1 1: Decel. ramp 2	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
19	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 1: CCW rotation	0: Open	0: Open	0: Selected speed setpoint 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
20	0: Stop (controller inhibit) 1: CW rotation	0: Stop (controller inhibit) 1: CCW rotation	N.O. contact The speed increases when closing.	N.O. contact The speed decreases when closing.	0: Selected speed setpoint 1: Fixed setpoint speed 1	Used for motor potentiometer operation.
21	0: Stop (controller inhibit) 1: Clockwise rotation (latching)	0: Stop (controller inhibit) 1: Start	0: Stop (controller inhibit) 1: Counterclockwise rotation (latching)	Analog 1 speed setpoint	0: Selected speed setpoint 1: Fixed setpoint speed 1	Function enabled if *P1-12* = 0

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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	Remarks / preset value
22	0: Normal mode 1: Reference cam	0: Normal mode 1: Jog speed +	0: Normal mode 1: Jog speed –	Speed setpoint	0: Normal mode 1: Reference travel start	Only in combination with LTX encoder card
23	0: Normal mode 1: Reference cam	0: Limit switch + 1: Normal mode	0: Limit switch – 1: Normal mode	Speed setpoint	0: Normal mode 1: Reference travel start	Only in combination with LTX encoder card
24	0: Controller inhibit 1: Enable	0: Normal mode 1: Jog speed +	0: Normal mode 1: Jog speed –	Speed setpoint	0: Normal mode 1: Reference cam	Only in combination with LTX encoder card
25	0: Controller inhibit 1: Enable	0: Limit switch + 1: Normal mode	0: Limit switch – 1: Normal mode	Speed setpoint	0: Normal mode 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 fault is defined in parameter P2-33.

INFORMATION

When using a TF/TH, KTY or PT1000, set *P2-33* to PTC-th, KTY or PT1000. Also observe 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

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 have to 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 s and 250% for 2 s. Only motor data of CMP.. motors of speed class 4500 1/min with 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 / 400V 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	
gf-2	MGF..2-DSM	If a MGF..-DSM is selected, the torque limit in *P4-07* is automatically set to 200%. This value has to be adapted 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	
gf-4Ht	MGF..4/XT-DSM	

Using this parameter lets you select preset motors (CMP.. and MGF..-DSM). This parameter is set automatically if HIPERFACE® encoder information is read-in via LTX encoder card.

When a permanent magnet motor is connected and the drive is operating in inverter mode, *P1-16* does not have to be changed. In this case *P4-01* determines the motor type ("auto tune" required).

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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

P1-17 Servo module function selection

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

- **0: Inhibited**
- 1: KTY

If a motor is selected via *P1-16*, this parameter will change to 1. Only available with the LTX servomodule.

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

This parameter is a 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

Setting range: 0.50 – **1.00** – 2.00

Only if used with the LTX encoder module. Always use *P7-10* in the open control loop.

Only use in connection with the LTX encoder card.

P1-22 Motor load inertia ratio

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", parameters *P2-01* to *P2-08* can be changed in steps of 0.1 Hz each.

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

- *P1-09* ≤ 100 Hz → in 1 (rpm)
- 100 Hz < *P1-09* ≤ 200 Hz → in 2 (rpm)
- *P1-09* > 200 Hz → in 4 (rpm)

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.

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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*

Used for brake release speed in hoist mode.

P2-08 Fixed setpoint speed 8

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

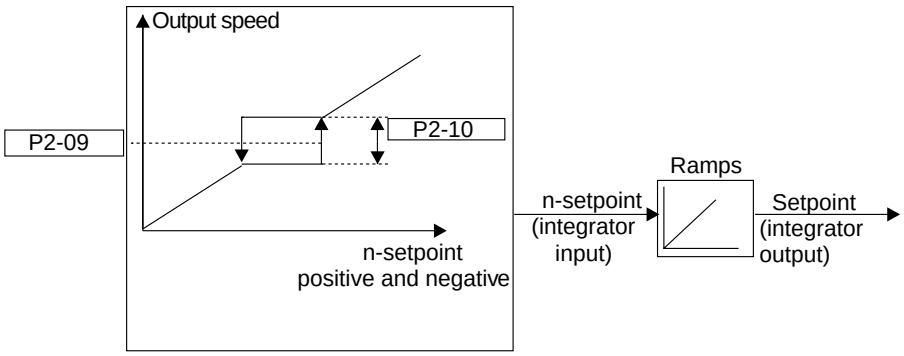
Used for brake application speed in hoist mode.

P2-09 Skip frequency

Setting range: *P1-02* – *P1-01*

The skip window center and skip width are values and automatically have an effect on positive and negative setpoints when activated. You can disable the function by setting the skip width to 0.

If the upper or lower limit values are violated, the hidden frequency band will travel through using the ramp times set in *P1-03* / *P1-04*.



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P2-10 Skip frequency range

Setting range: **0.0 Hz** – *P1-01*

P2-11: P2-13 analog outputs

Digital output mode: 0 V / 24 V

Setting	Function	Explanation
0	Inverter enabled	Logic 1 when inverter is enabled (running).
1	Inverter ok (digital)	Logic 1 when there is no inverter fault.
2	Motor operates at setpoint speed (digital)	Logic 1 when motor speed corresponds to setpoint.
3	Motor speed > 0 (digital)	Logic 1 when motor runs above 0 speed.
4	Motor speed ≥ limit value (digital)	Digital output enabled with level set in "User relay/analog output upper limit" and "User relay/analog output lower limit".
5	Motor current ≥ limit value (digital)	
6	Motor torque ≥ limit value (digital)	
7	Analog input 2 ≥ limit value (digital)	
13	Fieldbus/SBus (digital)	Digital output value controlled via SBus, if P1-12 = 5 (value 1 corresponds to 24 V, all other values correspond to 0 V)

Analog output mode: 0 – 10 V oder 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)	Analog output value is controlled via SBus if *P1-12* = 5 or 8.

P2-11 Analog output 1 function selection

Setting range: 0 – **8** – 13

See table "P2-11: P2-13 analog outputs" (→ 🗎 133).

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 – P2-14" (→ 🗎 133).

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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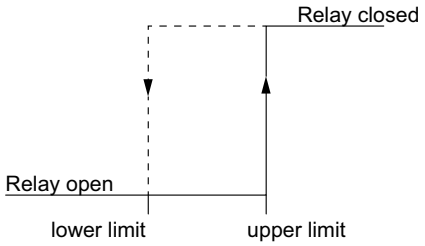
P2-15 – P2-20 Relay outputs

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 contacts closed when inverter is enabled.
1	Inverter ok (digital) = no error	Relay contacts closed when inverter is ok (no error).
2	Motor operates at setpoint speed (digital)	Relay contacts closed when output frequency = setpoint frequency ± 0.1 Hz.
3	Motor speed ≥ 0 (digital)	Relay contacts closed when output frequency is greater than "zero frequency" (0.3% of base frequency)
4	Motor speed ≥ limit value (digital)	Relay contacts closed when output frequency is greater than the value set in parameter "User relay upper limit". Relay contacts open when the value is smaller than the value set in parameter "User relay lower limit"
5	Motor current ≥ limit value (digital)	Relay contacts closed when motor current/torque is greater than the current limit set in parameter "User relay upper limit". Relay contacts open when the value is smaller than the value set in parameter "User relay lower limit"
6	Motor torque ≥ limit value (digital)	
7	Analog input 2 ≥ limit value (digital)	Relay contacts closed when second analog input value is greater than the value set in parameter "User relay upper limit". Relay contacts open when the value is smaller than the value set in parameter "User relay lower limit"
8	Hoist (only for *P2-18*)	This parameter is displayed when *P4-12* hoist function is set to 1. The inverter now controls the relay contact for hoist mode. (Value cannot be changed if *P4-12* = 1)
9	STO status	Relay contacts open if STO circuit is open (inverter indicates "inhibit")
10	PID error ≥ limit value	If the control error is greater than the "user relay upper limit", the relay output is closed. If the control error is lower than the "user relay lower limit", the relay output is opened. The relay opens also with negative control errors.
11[1)]	Drive referenced	If the LTX servo module is connected and the inverter is referenced, the relay output contact is closed. This option is only available for the following inverters: • 230 V: 0.75 – 5.5 kW • 400 V: 0.75 – 11 kW • 575 V: 0.75 – 15 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" (→ 🗎 135).

P2-16 Upper limit of user relay 1: Analog output 1

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

P2-17 Lower limit of user relay 1: Analog output 1

Setting range: **0.0** – P2-16%

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P2-18 User relay output 2 function selection

Setting range: 0 – **3** – 11

See table "P2-15 – P2-20 Relay outputs" (→ 🗎 135).

P2-19 Upper limit of user relay 2: Analog output 2

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

P2-20 Lower limit of user relay 2: Analog output 2

Setting range: **0.0** – P2-19%

P2-21: P2-22 Display scaling

P2-21 lets users scale the data from a selected source to provide a displayed value that better represents the controlled process. The source value to be used for scaling calculation is defined in *P2-22*.

If *P2-21* ≠ 0, the scaled value will be shown on the display in addition to motor speed, motor current, and motor power. Pressing the "Navigate" key toggles the display between real-time values. A lowercase letter "c" on the left side of the display indicates that the scaled value is being displayed. The scaled display value is calculated using the following equation:

Scaled display value = *P2-21* × scaling source

P2-21 Display scaling factor

Setting range: -30,000 – **0,000** – 30,000

Also serves as a factor for the direction of rotation reversal in connection with a CCU or MultiMotion. If the value is negative, the velocity control is inverted. Restart the CCU after a change.

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 s

You can use this parameter to have the motor hold zero speed (0 Hz) for a certain time before it is shut down whenever it receives a stop command and reduces the output speed to zero.

When *P2-23* = 0, the output of the inverter is disabled immediately once the output speed reaches zero.

When *P2-23* ≠ 0, the motor holds zero speed for a certain time (defined in *P2-23* in seconds) before the output of the inverter is disabled. This function is usually used together with the relay output function to have the inverter issue a relay control signal before the inverter output is disabled.

P2-24 PWM switching frequency

Setting range: 2 – 16 kHz (depending on rated inverter power)

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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.

P2-25 Second deceleration ramp, rapid stop ramp

Setting range:

For the inverters:

IP20	IP66
• 230 V: 0.75 – 5.5 kW	• 230 V: 0.75 – 4 kW
• 400 V: 0.75 – 11 kW	• 400 V: 0.75 – 7.5 kW
• 575 V: 0.75 – 15 kW	• 575 V: 0.75 – 11 kW
Coast – 0.01 – **2.0** – 600 s	Coast – 0.01 – **2.0** – 600 s

For the inverters:

IP20	IP66
• 230 V: 7.5 – 75 kW	• 230 V: 5.5 – 75 kW
• 400 V: 15 – 160 kW	• 400 V: 11 – 160 kW
• 575 V: 18.5 – 110 kW	• 575 V: 15 – 110 kW
Coast – 0.1 – **2.0** – 6000 s	Coast – 0.1 – **2.0** – 6000 s

Ramp time 2nd deceleration ramp, rapid stop ramp. 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. If set to "0", the motor decelerates as quickly as possible without overvoltage fault.

P2-26 Flying start enable

When this function is enabled, the motor starts from the detected rotor speed. Short delay possible if rotor is at standstill. Only possible, if *P4-01* = 0 or 2. If the motor rotates against the speed enabled by the inverter, the flying start function is enabled. The motor then decelerates to zero speed before accelerating in the opposite direction.

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

P2-27 Standby mode

Setting range: **0.0** – 250 s

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

P2-28: P2-29 Master/slave parameter

The inverter uses parameter *P2-28: P2-29* to scale the setpoint speed received from the master of the network.

This function is particularly suited for applications where all motors in a network are synchronized but run at different speeds based on a fixed scaling factor.

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For example, if a slave motor is set in *P2-29* = 80% and *P2-28* = 1 and the master motor in the network runs at 50 Hz, then the slave motor will run at 40 Hz after being enabled.

P2-28 Slave speed scaling

- **0: Disabled**
- 1: Actual speed = digital speed × *P2-29*
- 2: Actual speed = (digital speed × *P2-29*) + analog input 1 reference
- 3: Actual speed = digital speed × *P2-29* × analog input 1 reference

P2-29 Slave speed scaling factor

Setting range: -500 – **100** – 500%

P2-30 – P2-35 Analog inputs

These parameters enable users to configure analog inputs 1 and 2 to suit the signal format present at the analog input control terminals. When set to 0 – 10 V, all negative input voltages result in zero speed. When set to -10 – 10 V, all negative voltages result in the inverter running at negative speed, which is proportional to the magnitude of the input voltage.

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

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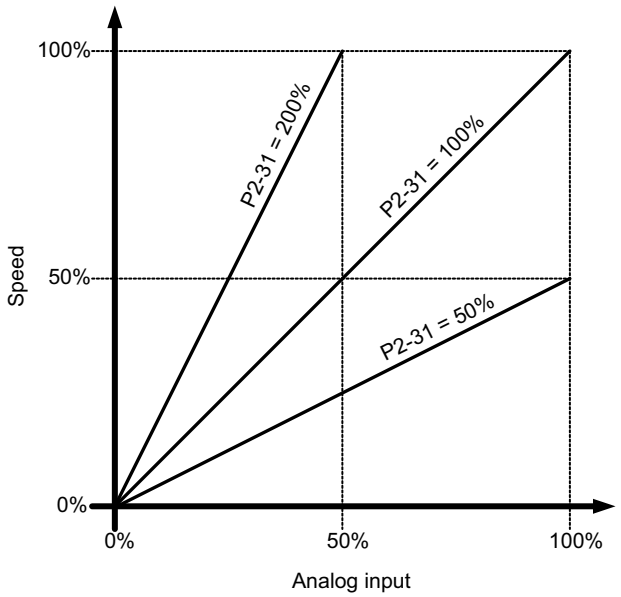
P2-31 Analog input 1 scaling

Setting range: 0 – **100** – 500%



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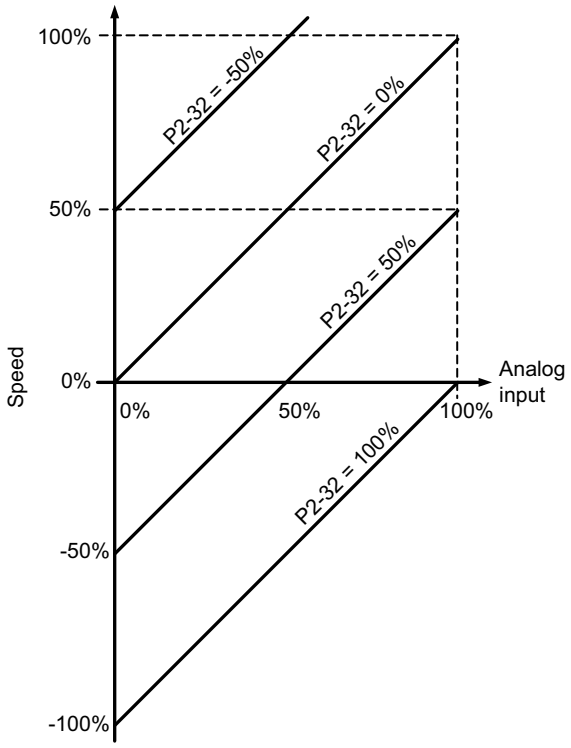
P2-32 Analog input 1 offset

Setting range: -500 – **0** – 500%

Specifies an offset as a percentage of the entire input range applied to the analog input signal.



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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.

"r.." indicates that the inverter moves along a ramp to *P1-02* when the signal is removed while the inverter is enabled.

P2-34 Analog input 2 scaling

Setting range: 0 – **100** – 500%

P2-35 Analog input 2 offset

Setting range: -500 – **0** – 500%

Specifies an offset as a percentage of the entire input range applied to the analog input signal.

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.

Selection:

- Edge-r

- **Auto-0** – Auto-5

Edge-r

- Edge-r: The inverter does not start after switching-on or reset if digital input 1 remains closed. To start the inverter, the input must be closed after switching on or resetting the inverter.

Auto-0

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⚠ WARNING

With the setting "Auto-0" and set enable signal, there is a danger of an automatic re-start 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 power supply 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**: The inverter starts automatically after switching-on or reset and set enable signal if digital input 1 is closed.

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 power supply 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: After a switch off with error (trip) the inverter tries to restart up to 5 times (in intervals of 20 seconds). The duration of the intervals is defined in *P6-03*. The number of attempted restarts is counted. If the inverter fails to start with the final attempt, the inverter goes to error state and prompts the user to reset the fault manually. Upon reset, the counter is reset.

P2-37 Keypad restart speed

This parameter is only active if *P1-12* = "1" or "2".

- 0: Minimum speed. Following a stop or restart, the motor runs at the minimum speed set in *P1-02*.
- **1**: Last speed. Following a stop or restart, the inverter returns to the value prior to stopping that was last set using the keypad.
- 2: Current speed. If the inverter is configured for several speed references (generally manual/automatic control or local/decentralized control), a digital input ensures that, when switching the keyboard mode, the inverter continues to run with the last operating speed.
- 3: Fixed setpoint speed 8. Following a stop or restart, the inverter always runs at the fixed setpoint speed 8 (*P2-08*).

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- 4: Minimum speed (terminal mode). Following a stop or restart, the inverter always runs at the minimum speed set in *P1-02*.
- 5: Last speed (terminal mode). Following a stop or restart, the inverter returns to the value prior to stopping that was last set.
- 6: Current speed (terminal mode). If the inverter is configured for several speed references (generally manual/automatic control or local/decentralized control), a digital input ensures that, when switching the keyboard mode, the inverter continues to run with the last operating speed.
- 7: Fixed setpoint speed 8 (terminal mode). Following a stop or restart, the inverter always runs at the fixed setpoint speed 8 (*P2-08*).

The option 4 – 7 "Operation with terminal" applies to all operating modes.

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

Locking parameters means that no parameters can be changed (indicated by "L").

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

P2-40 Extended parameter access code definition

Setting range: 0 – **101** – 9999

Access to the advanced menu (parameter groups 2, 3, 4, 5) is only possible when the value entered in *P1-14* is the same as the one in *P2-40*. In this way, users can change the default value "101" of the code to any other value.

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 s

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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 s

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*) or *P3-06*, *P3-14* - *P3-16* (depending on the PID controller setting).
- 1: Analog input 1
- 2: Analog input 2
- 3: Fieldbus PID reference see "P5-09 – P5-11 Fieldbus process output data (POx) 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%**

PID controller upper limit output. 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*

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

Lower limit = *P3-08* × P1-01.

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.

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P3-10 PID feedback selection

Selects the source for the PID feedback signal.

- **0: Analog input 2**
- 1: Analog input 1

P3-11 PID ramp activation error

Setting range: **0.0** – 25.0%

Defines a PID error threshold. If the difference between setpoint and actual value is less than the threshold, the internal ramps of the inverter are disabled.

If the PID deviation is greater, the ramps are activated to limit the the rate of change of the motor speed and to respond quickly to minor deviations.

P3-12 PID actual value display scaling factor

Setting range: **0,000** – 50,000

This parameter is used to scale the actual value of the PID display. This enables users to have displayed the current signal level of a transducer, for instance 0 - 10 bar, etc. Scaled display value = *P3-12* × PID output (= actual value), scaled display value (rxxx).

P3-13 PID feedback wake-up level

Setting range: **0.0** – 100.0%

Sets a programmable level. When the inverter is in standby or PID mode, the selected feedback signal must fall below this threshold before the inverter returns to normal operation.

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.

P3-16 PID fixed setpoint reference 4

Setting range: **0.0** – 100%

Sets the preset digital PID reference/setpoint.

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9.2.5 Parameter group 4: Motor control (level 2)

P4-01 Control mode

- 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 effectively provides a closed loop control without physical encoder. With a properly tuned speed controller, the static speed change is usually better than 1%. 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: Speed control – Enhanced V/f**

  This operating mode basically corresponds to voltage control where the applied motor voltage is controlled rather than the torque-generating current. The magnetizing current is controlled directly, which means no voltage increase is required. The voltage characteristics can be selected using the energy saving function in parameter *P1-06*. The default setting provides a linear characteristic where the voltage is proportional to the frequency. The magnetizing current is controlled independently. Enabling the energy saving function selects a reduced voltage characteristics where the applied motor voltage is reduced at low speeds. The function is usually used for fans to save energy consumption. The "auto tune" function should also be enabled in this operating mode. In this case, the tuning process is less complex and can be carried out more quickly.

- 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.

INFORMATION

"Auto tune" has to be performed after each control mode change.

P4-02 "Auto tune"

- **0: Inhibited**
- 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 the parameter *P4-02* after entering 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.

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: 0.001 – **0.100** – 1.000 s

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.

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

Setting range: 0.00, 0.50 – 0.99 (depending on the motor)

Power factor on the nameplate. Is required for vector control (*P4-01* = 0 or 1).

P4-06 Torque reference/limit value source

If *P4-01* = 0 or 3 (VFC speed control), this parameter defines the source for the maximum torque limit value.

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If *P4-01* = 1 or 4 (VFC torque control), this parameter defines the source for the torque reference value (setpoint).

If *P4-01* = 2 (V/f open-loop speed control), this parameter defines the source for the maximum torque limit value.

However, compliance with the torque limit is less dynamic in V/f control mode.

The torque reference/limit value source can be determined by the selection possibilities mentioned below.

The motor torque reference value is determined as a percentage of the rated motor torque in *P4-07*. The rated motor torque is determined automatically by "Auto tune".

The motor torque limit value is always specified as a percentage of 0 − *P4-07*.

- **0: Fixed torque reference/limit as defined in P4-07**.
- 1: Analog input 1 determines the torque reference/limit.
- 2: Analog input 2 determines the torque reference/limit.

  If an analog input is used as a torque reference/limit value source, observe the following:

  – Selection of the desired analog input signal format in parameter *P2-30* / *P2-33*. The input format must be unipolar. The scaling depends on the value set in *P4-07*. 0 – 10 V = 0 – 200% of *P4-07*.
  – Selection of the desired digital input function such as *P1-15* = 3 (torque specification via analog input 2).
  – Adjusting the timeout time for the maximum torque limit in *P6-17* analog input 2.
- 3: Fieldbus communication

  Fieldbus torque setpoint. When this option is selected, the torque limit is provided by the fieldbus master. A value between 0 and 200% can be entered in *P4-07*.
- 4: Master inverter

  The master inverter in a master slave network provides the torque setpoint.
- 5: PID output

  The output of the PID controller provides the torque setpoint.

P4-07 – P4-09 Motor torque limit settings

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

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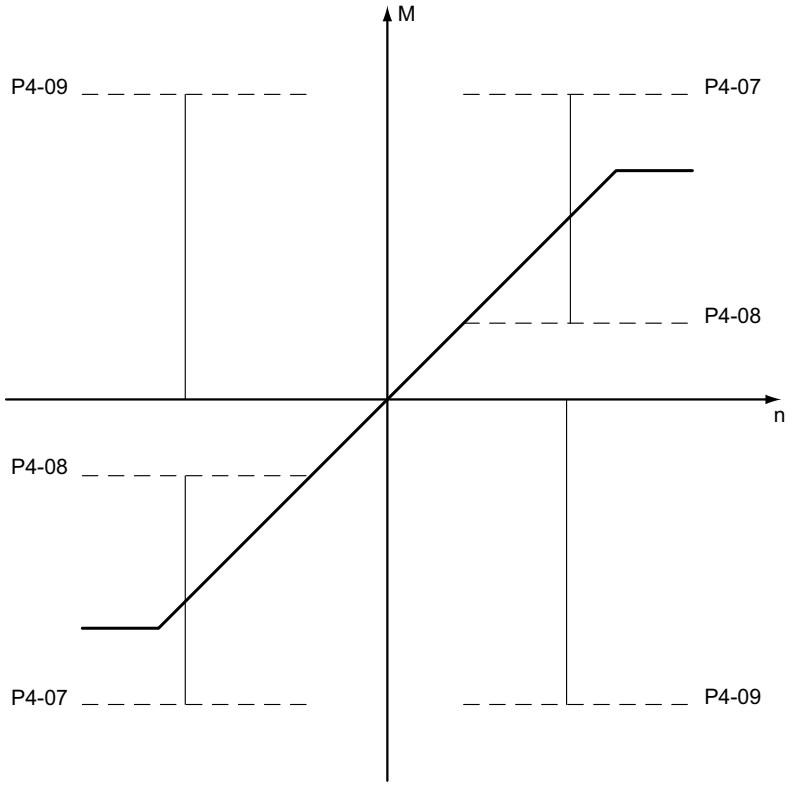
The maximum torque limit can also be specified directly via process data communication.



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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*.

Depending on the operating mode, the parameter refers to the torque-generating current (vector operation) or the apparent output current (V/f operation).

Vector operation: *P4-07* limits the torque-generating current Iq (*P0-15*).

V/f operation: *P4-07* limits the inverter output current to the specified limit value before the inverter output frequency is reduced for current limitation.

Example asynchronous motors:

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 1/min, 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:

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

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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 synchronous motors:

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, leads to $I_q \approx M$.

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.

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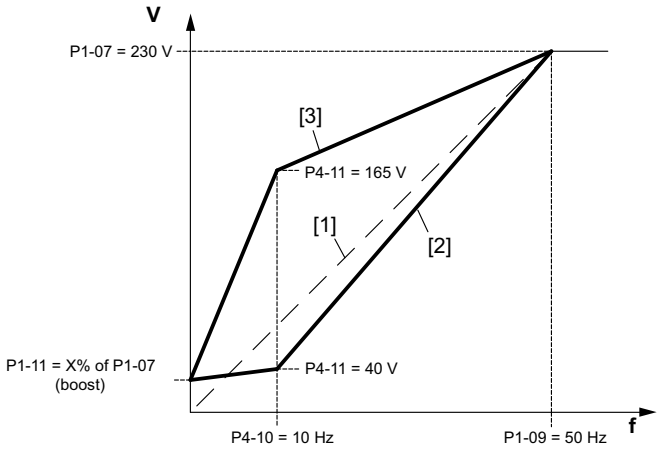
Parameter *P4-10* can be set to any frequency between 0 and the base frequency (*P1-09*). It represents the frequency at which the percentage adjustment level set in *P4-11* is used. This function is only active when *P4-01* = 2.



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[1] Normal V/f characteristic curve

[2] Adjusted V/f characteristic curve

[3] Adjusted V/f characteristic curve

P4-10 V/f characteristic adjustment frequency

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

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" (→ 🗎 70).

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.

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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. This is only recommended for applications with horizontal movement.

P4-16 Hoist torque threshold timeout

Setting range: 0.0 – 25.0 s

Sets 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 issues a fault.

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.

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.

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 baud rate/CANopen

Sets the SBus baud rate. This parameter must be used for operation with gateways or MOVI-PLC®.

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

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P5-03 Modbus RTU baud rate

Sets the expected Modbus baud rate.

- 0: 9.6: 9600 Bd
- 1: 19.2: 19200 Bd
- 2: 38.4: 38400 Bd
- 3: 57.6: 57600 Bd
- **4: 115.2: 115200 Bd**

P5-04 Modbus RTU data format

Sets the expected Modbus 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

This parameter is used to specify the inverter behavior after a communication failure and the following timeout set in *P5-06*.

- 0: Fault and coast to 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

This parameter is used to enable internal or external ramp control. If enabled, the inverter follows the external ramps specified by MOVILINK® process data (PO3).

- **0: Disabled**
- 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.

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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 U/min (1 = 0.2 1/min)→ only possible, if *P1-10* ≠ 0
- 1: Speed % (0x4000 = 100% *P1-01*)
- 2: Torque setpoint/limit value % (1 = 0.1%) → Set inverter to *P4-06* = 3.
- 3: Ramp time (1 = 1 ms) to maximum 65535 ms.
- 4: PID reference (0x1000 = 100%) → *P1-12* = 3 (control signal source).
- 5: Analog output 1 (0x1000 = 100%)[1)]
  Digital output 4 (0x0001 = 24 V, other values = 0 V))[2)]
- 6: Analog output 2 (0x1000 = 100%)[1)]
  Digital output 5 (0x0001 = 24 V, other values = 0 V)[2)]
- 7: No function

1) When the analog outputs are controlled by fieldbus or SBus, parameter P2-11 or P2-13 = 12 (fieldbus/ SBus (analog)) must be set additionally.
2) When 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[1)]: Speed: rpm (1 = 0.2 rpm)
- 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: 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

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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[2]: LTX position low byte (number of increments within one revolution)
- 11[2]: LTX position high byte (number of revolutions)

1) Only possible if P1-10 ≠ 0.
2) Only for inserted LTX module.

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.

- 0: Inverter enabled
- 1: Inverter ok
- 2: Motor operates 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%

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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%

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

Enables firmware upgrade mode that lets the user upgrade the firmware of the user interface and/or firmware for output stage control. Is usually performed by the PC software.

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

INFORMATION

This parameter should not be changed by the user. The firmware upgrade is performed automatically by the PC software.

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: Disabled
- **1: Activated**

Temperature limits	Action
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.

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Temperature limits	Action
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

Setting range: 0.0 – **0.3** – 25.0%

This parameter is used together with *P2-11* and *P2-13* = 2 or 3 to set a band around the setpoint speed (*P2-11* = *2*) or to set zero speed (*P2-11* = *3*). When the speed is within this band, the inverter runs at setpoint speed or at zero speed. This function prevents "chatter" on the relay output when the operating speed coincides with the value at which the state of the digital output/relay output changes.

Example: When *P2-13* = 3, *P1-01* = 50 Hz and *P6-04* = 5%, the relay contacts close above 2.5 Hz.

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)

Is used together with the LTX module or other encoder cards. When encoder feedback mode is enabled (*P6-05* = *1*), set the parameter to the number of impulses per revolution for the connected encoder. Improper setting of this parameter can result in loss of motor control and/or a fault. When set to "0", encoder feedback is disabled.

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 enabled for all operating modes with encoder feedback (HTL/TTL/LTX) and for the hoist function without encoder feedback. If the speed error exceeds this limit value, the inverter is switched off and goes to speed error depending on the firmware status (SP-Err or ENC02). When set to "100%", speed monitoring is disabled.

P6-08 Max. frequency for speed setpoint

Setting range: 0; **5** – 20 kHz

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Use this parameter if the motor speed setpoint is to be controlled by a frequency input signal (connected to digital input 3).

You can use this parameter to determine the input frequency that corresponds to the maximum motor speed (set in *P1-01*). The maximum frequency that can be set in this parameter must be within a range of 5 kHz and 20 kHz.

When set to "0", this function is disabled.

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 parameter only works in VFC speed control P4-01 = 0.

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

Actual speed = setpoint speed - P6-09 × P1-09 × (current application torque of the motor)/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 (fixed setpoint speed 7)

Setting range: **0.0** – 250 s

Defines the time during which the inverter runs at fixed setpoint speed 7 (*P2-07*) when the enable signal is applied to the drive. The fixed setpoint speed can be any value from the minimum to the maximum frequency and in either direction.

This function can be useful in applications where controlled start behavior is required regardless of normal system operation. This function allows the user to program the inverter in such a way that it always starts at the same frequency and in the same direction of rotation for a specified period of time before returning to normal operation.

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

P6-12 Speed holding time on inhibit (fixed setpoint speed 8)

Setting range: **0.0** – 250 s

Defines the time during which the inverter runs at fixed setpoint speed 8 (*P2-08*) after having removed the enable signal and before the stop ramp.

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.

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

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P6-13 Fire mode logic/emergency mode

Enables fire mode/emergency mode. In this mode, the inverter ignores most faults. When the inverter is in fault condition, it resets itself every 5 s until total failure or lack of power.

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

- **0: Open trigger: Fire mode/emergency mode**
- 1: Close trigger: Fire mode/emergency mode

P6-14 Fire mode/emergency mode speed

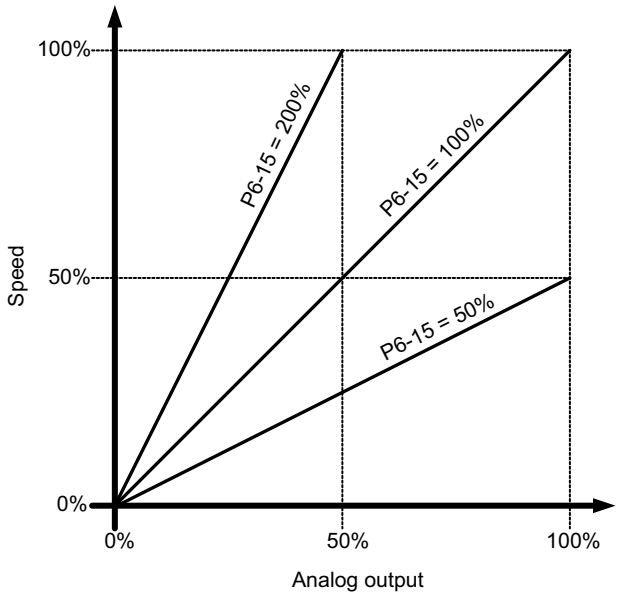
Setting range: -*P1-01* – **0** – *P1-01* Hz

The speed used in fire mode/emergency mode.

P6-15 Analog output 1 scaling

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

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



13089609099

P6-16 Analog output 1 offset

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

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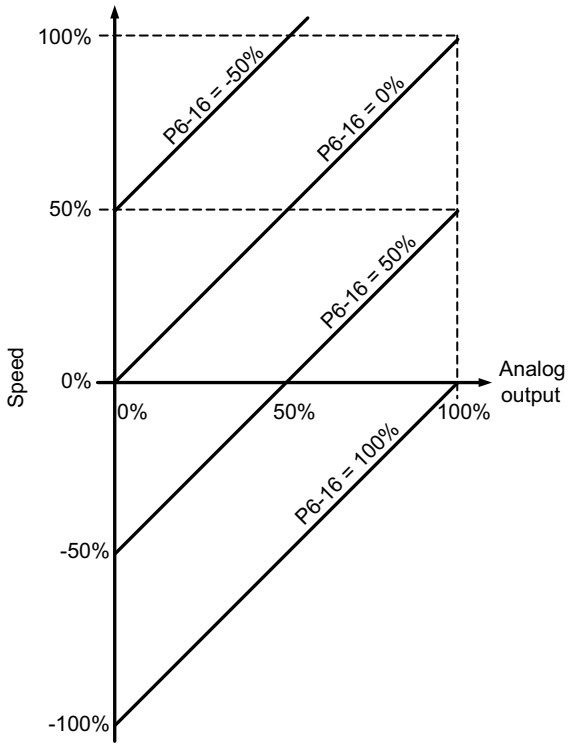
This parameter specifies the offset in % used for analog output 1.



13089606539

P6-17 Max. torque limit timeout

Setting range: 0.0 – **0.5** − 25.0 s

Specifies the maximum time allowed for the motor to run at the torque limit for motor/ generator mode (*P4-07: P4-09*) before issuing a fault. This parameter is only enabled for operation with vector control.

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

P6-18 DC braking voltage level

Setting range: Auto, **0.0** – 30.0%

Specifies the amount of DC voltage as a percentage of the nominal voltage (*P1-07*) applied to the motor when a stop command is received. This parameter is activated for V/f control only.

P6-19 Braking resistor value

Setting range: **0**; Min-R – 200 Ω

Sets the braking resistor value in ohms. This value is used for thermal protection of the braking resistor. Min-R 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

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%

This parameter is used to specify the duty cycle for the brake chopper when the inverter is in undertemperature fault state. To heat the inverter, install a braking resistor at the heat sink of the inverter until the correct operating temperature is reached.

Use this parameter with the utmost care. An incorrect setting might result in exceeding the rated power capacity of the braking resistor.

Use external thermal protection for the braking resistor to avoid this risk.

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

P6-22 Reset fan runtime

- **0: Disabled**
- 1: Reset runtime

Setting this parameter to "1" resets the internal runtime counter of the fan to "0" (as displayed in *P0-35*).

P6-23 Reset kWh meter

- **0: Disabled**
- 1: Reset kWh counter

Setting this parameter to "1" resets the internal kWh counter to "0" (as displayed in *P0-26* and *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

User-defined access code that has to be entered in *P1-14* to allow access to the advanced parameters in groups 6 to 9.

P6-26 Parameter backup

- **0: Output value**
- 1: Save parameters
- 2: Delete parameter

Selection 0: The output value is always displayed.

Selection 1: Saving the current parameterization.

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 also when the device is de-energized and when the factory settings are activated.

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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 four 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 settings (delivery state), press the three 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.

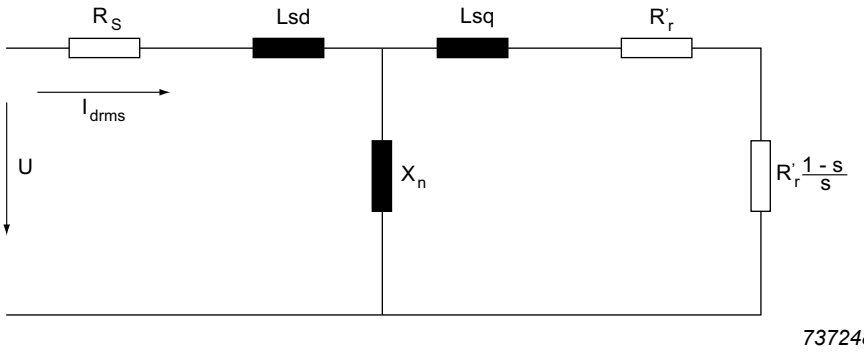
9.2.8 Parameter group 7: Motor control parameters (level 3)

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.



P7-01 Motor stator resistance (Rs)

Setting range: depends on the motor (Ω)

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

Instead, you can enter this value manually.

P7-02 Motor rotor resistance (Rr)

Setting range: depends on the motor (Ω)

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

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

P7-03 Motor stator inductance (Lsd)

Setting range: depends on the motor (H)

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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.

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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.

P7-11 Pulse width min. limit

Setting range: 0 – 500

This parameter is used to limit the minimum output pulse width. The minimum output pulse width can be used for applications with long cables. Increasing the value of this parameter reduces the risk of overcurrent faults with long motor cables. The reason is that the number of voltage edges and consequently load peaks are reduced. At the same time, however, also the maximum available output motor voltage is reduced for a certain input voltage.

The factory setting depends on the inverter.

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 when the acceleration ramp is very short.

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

The factory setting depends on the inverter.

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/premagnetization current

Setting range: **0.0** – 100%

The boost current applied at start-up as a % of the rated motor current (*P1-08*). The inverter has a boost function. Current can be injected into the motor at low speed in order to ensure that the rotor alignment is maintained and the motor operates efficiently at low speeds.

For a boost at a low speed, run the inverter at the lowest frequency required for the application. Increase the values to provide the required torque and to ensure smooth operation.

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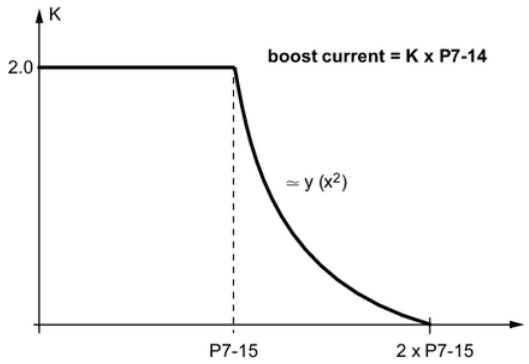
P7-14 is used in conjunction with *P7-12* to align the rotor initially.



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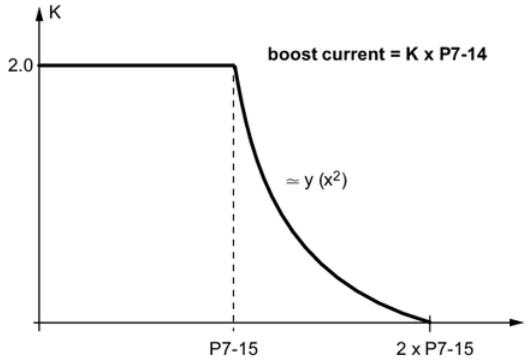
P7-15 Torque boost frequency limit

Setting range: **0.0** – 50%

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

This parameter works according to the figure below.



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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 – $\mathbf{2}^{16}$

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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*

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- 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

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.

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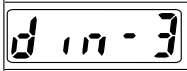
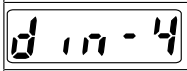
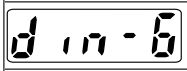
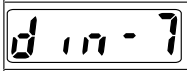
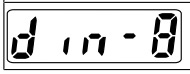
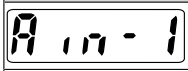
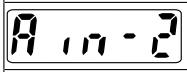
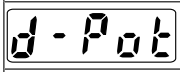
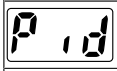
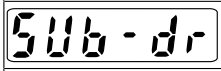
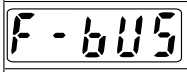
Inverter display	Setting	Function
	Always OFF	Function permanently disabled.
	Always ON	Function permanently enabled.
	Digital input 1	Function linked to digital input 1 status.
	Digital input 2	Function linked to digital input 2 status.
	Digital input 3	Function linked to digital input 3 status.
	Digital 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

Data source selection parameters

Parameters for selecting a data source define the signal source for speed 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).

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Inverter display	Setting	Function
PULSE	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 of the frequency inverter enable function. This function is usually assigned to digital input 1. It allows the use of a hardware enable signal in different situations where, for example, the commands for run forward or run reverse from external sources such as fieldbus controls signals or a PLC program.

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

Specifies the source of the rapid stop input. As response to a rapid stop command, the motor stops using the deceleration time set in *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

Specifies the source of the CW rotation command.

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

Specifies the source of the CCW rotation command.

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When the CW rotation and CCW rotation commands are applied to the motor simultaneously, the inverter executes a rapid stop.

P9-05 Latch function enable

Setting range: OFF, ON

Enables the latching function of the digital inputs.

The latching function makes it possible to use momentary start signals to start and stop the motor in any direction. In this case, the enable input source (*P9-01*) must be linked to a normally closed control source (open for stop).

This control source must be logic "1" to allow the motor to start. The inverter then responds to momentary or pulse start and stop signals as defined in parameters *P9-03* and *P9-04*.

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

Specifies the source of the input 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

Specifies the source of the reset command.

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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

Specifies the source of the external fault command.

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

Defines the source of the command used to select terminal control operation of the inverter. This parameter takes effect only when *P1-12* > 0. It allows terminal control to be selected in order to override the control signal source defined in *P1-12*.

P9-10 – P9-17 Speed source

Up to 8 speed 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 need not have to be stopped and restarted.

P9-10 Speed source 1

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Specifies the source of the speed.

P9-11 Speed source 2

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Specifies the source of the speed.

P9-12 Speed source 3

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Specifies the source of the speed.

P9-13 Speed source 4

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Specifies the source of the speed.

P9-14 Speed source 5

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Specifies the source of the speed.

P9-15 Speed source 6

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Specifies the source of the speed.

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P9-16 Speed source 7

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Specifies the source of the speed.

P9-17 Speed source 8

Setting range: Ain-1, Ain-2, fixed setpoint speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse

Specifies the source of the speed.

P9-18 – P9-20 Input speed selection

The active speed setpoint can be selected during operation by means of the status of the above mentioned parameters for the logic source. The speed setpoints are selected according to the following logic:

P9-20	P9-19	P9-18	Speed 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 speed selection 0

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

"Bit 0" logic source for selecting the speed setpoint

P9-19 Input speed selection 1

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

"Bit 1" logic source for selecting the speed setpoint

P9-20 Input speed selection 2

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8, On

"Bit 2" logic source for selecting the speed setpoint

P9-21–P9-23 Fixed speed selection input

When a fixed speed setpoint is to be used for the speed setpoint, you can select the active fixed speed setpoint based on the status of these parameters. The following logic is used for selection:

P9-23	P9-22	P9-21	Fixed setpoint speed
0	0	0	1 (*P2-01*)

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P9-23	P9-22	P9-21	Fixed setpoint speed
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

Specifies input source 0 for the fixed setpoint speed.

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

Specifies input source 1 for 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

Specifies input source 2 for 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

Specifies the signal source for operation in positive jog mode.

The jog speed is specified in 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

Specifies the signal source for operation in negative jog mode.

The jog speed is specified in parameter *P2-01*.

P9-26 Reference travel enable input

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

Specifies the source of the enable signal for the reference travel function.

P9-27 Reference cam input

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

Specifies the source of the cam input.

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

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Specifies the source of the logic signal used to increase the speed setpoint with the keypad/motorized potentiometer. When the specified signal source is logic 1, the value increases by 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

Specifies the source of the logic signal used to decrease the speed setpoint with the keypad/motorized potentiometer. When the specified signal source is logic 1, the value decreases by the rate 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 signal hat to be wired safe against wire breakage as NC contact. Upon activation of the limit switch, a 0 V level is present at the DI and the inverter reduces the speed along the 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.

P9-31 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 signal has to be wired safe against wire breakage as NC contact. Upon activation of the limit switch, a 0 V level is present at the DI and the inverter reduces the speed along the 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 Enable second deceleration ramp, rapid stop ramp

Setting range: OFF, din-1, din-2, din-3, din-4, din-5, din-6, din-7, din-8

Specifies the source of the logic signal used to enable the rapid deceleration ramp defined in *P2-25*.

P9-33 Fire mode/emergency mode input selection

Setting range: OFF, din-1, din-2, din-3, din-4, din-5. Specifies the source of the logic signal used to enable fire mode/emergency mode. In this mode, the inverter ignores all faults and/or disconnections and operates until total failure or power failure.

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.

Mark	Meaning
CE	CE mark 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.
FS 01	FS mark with code number to identify functional safety relevant components.
c UL us LISTED	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 drives – 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

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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)
Device 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 power 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		
	MC LTP-B..	0008-2B1-4-10	0015-2B1-4-10	0022-2B1-4-10
	Part number	18251390	18251536	18251668
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	mm²	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 - V_{line}		
Output current	A	4.3	7	10.5
PWM frequency	kHz	2/4/6/8/12/16		
Speed range	1/min	-30000 – 0 – +30000		
Maximum output frequency	Hz	500		
Cross section of motor cable Cu 75C	mm²	1.5		2.5
	AWG	14		12
Maximum motor cable length shielded	m	100		
Maximum motor cable length unshielded		150		
GENERAL INFORMATION				
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	mm²	10		
	AWG	8		
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 when observing a derating of 50% of the output current.

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					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
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 - V_{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	1/min	-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 INFORMATION							
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

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						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
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 - V_{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	1/min							
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 INFORMATION								
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		
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 - V_{line}				
Output current	A	30	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	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 INFORMATION						
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 - 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	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 INFORMATION					
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 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 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 - V_{line}		
Output current	A	202	240	302
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	120	150	185
	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	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 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		

10.3.4 3-phase system AC 500 – 600 V

Power 0.75 – 5.5 kW

MOVITRAC® LTPB – EMC filter class 0 according to EN 61800-3						
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				
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
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 - V_{line}				
Output current	A	2.1	3.1	4.1	6.5	9
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	1.5				2.5
	AWG	16				14
Max. motor cable length shielded	m	100				
Max. motor cable length unshielded		150				
GENERAL INFORMATION						
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 in brackets

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Power 7.5 – 30 kW

MOVITRAC® LTPB – EMC filter class 0 according to EN 61800-3							
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		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
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 - V_{line}				
Output current	A	12	17	22	28	34	43
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	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 INFORMATION							
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® LTPB – EMC filter class 0 according to EN 61800-3							
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 - V_{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	1/min	-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 INFORMATION							
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 M8 braking resistor connector max. 70 mm^2 Crimping 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

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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**	**Connection type**	**Rated frequency**
200 – 240 V ± 10%	0.75 – 2.2 kW	1-phase*	50 – 60 Hz ± 5%
200 – 240 V ± 10%	All	3-phase	
380 – 480 V ± 10%			
500 – 600 V ± 10%			

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 power supply system of 200 – 240 V.

10.5 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

Overload capacity based on nominal motor current	60 seconds	2 seconds
Asynchronous motors	150%	175%
Synchronous motors	200%	250%[1)]

1) Only 200% for inverters with 5.5 kW.

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.

10.6 Housing variants and dimensions

10.6.1 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.

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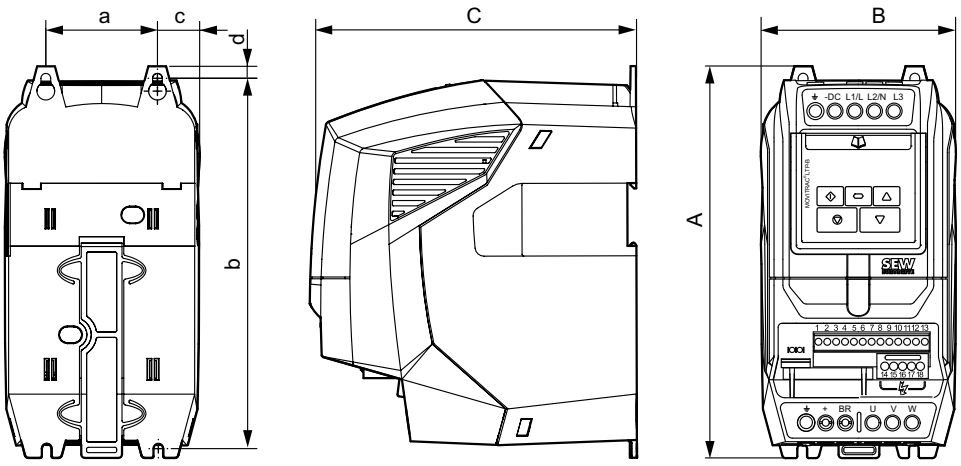
10.6.2 Dimensions

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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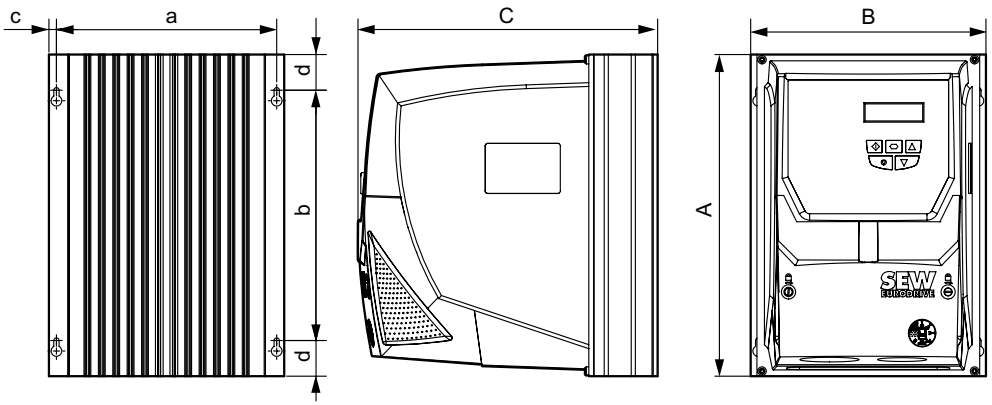
Dimension		230 V: 0.75 – 2.2 kW 400 V: 0.75 – 4 kW 575 V: 0.75 – 5.5 kW	230 V: 3 – 5.5 kW 400 V: 5.5 – 11 kW 575 V: 7.5 – 15 kW
Height (A)	mm	221	261
Width (B)	mm	110	131
Depth (C)	mm	185	205
Weight	kg	1.8	3.5
a	mm	63.0	80.0
b	mm	209	247
c	mm	23	25.5
d	mm	7.00	7.75
Recommended screw size		4 × M4	

10.6.3 Dimensions

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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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
Weight	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	

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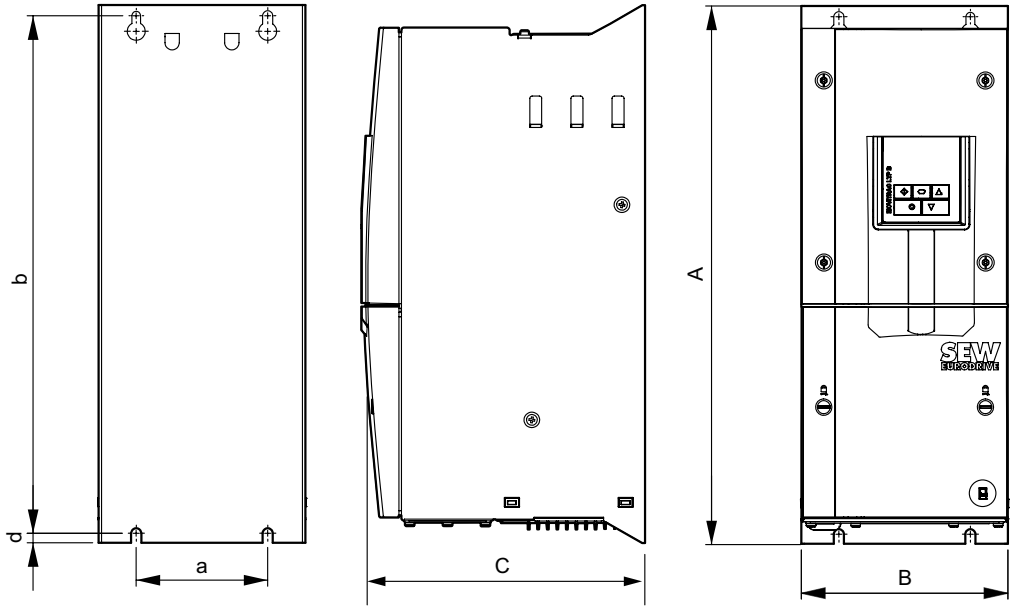
Inverters with degree of protection IP55/NEMA 12K

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



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	235	268	335	365
Weight	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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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" (→ 🗎 187).
- 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 of under -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

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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 61800-5-2:2007	SIL 2
EN ISO 13849-1:2006	PL d
EN 61508:2010 part 1 – 7	SIL 2
EN 60204-1:2006	Stop category 0
EN 62061:2005	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 case of danger, any potential risk to a machine must be eliminated as quickly as possible. Bringing the unit to a standstill and preventing a restart is generally the safe state for preventing dangerous movements.
- The STO function is available irrespective of the operating mode or parameter settings.
- It is possible to connect an external safety relay to the frequency inverter. This safety relay activates the STO function when a connected control device (for example, EMERGENCY STOP button with a latching function) is activated. The motor coasts to a halt and is now in the "Safe Torque Off" state.
- The active STO function prevents the frequency inverter from supplying a torque-generating rotating field to the motor.

Safe disconnection function (STO)

The safe disconnection function locks the frequency inverter's performance level, thus preventing it from supplying a torque-generating rotating field 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 frequency 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 frequency inverter meets the definition of "Safe Torque Off" in accordance with IEC 61800-5-2:2007.

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 STO function is recognized as a fail-safe method even if the STO signal is not present and an individual fault occurs in the drive. The frequency 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

Note: The above values are not achieved if the frequency inverter is installed in an environment whose limit values lie outside the values specified in chapter "Ambient conditions" (→ 🗎 174).

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 frequency 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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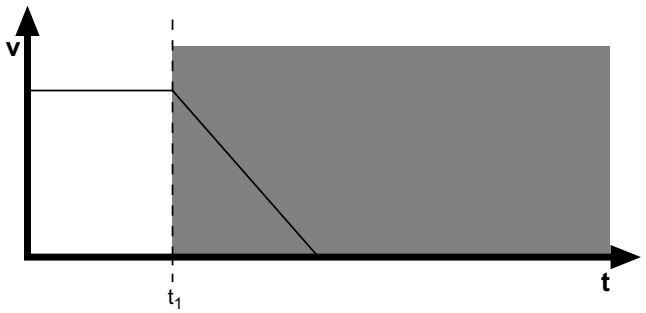
Safety functions

The following figure shows the STO function:



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v Speed
t Time
t_1 Time at which STO is triggered
Switch-off range

STO status and diagnostics

Frequency inverter display

Frequency inverter display **"Inhibit"**: The STO function is active due to signals present at the safety inputs. If, at the same time, the frequency inverter switches to a fault status, the relevant error message is displayed instead of "Inhibit".

Frequency inverter display **"STo-F"**: See chapter "Error codes" (→ 🗎 87).

Frequency inverter output relay

Frequency inverter relay 1: If *P2-15* is set to "9", the relay opens when the STO function is activated.

Frequency 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 frequency 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 the system/machine components.

If the STO signal is disconnected, the line voltage is still present at the frequency 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 unintentional restart. As soon as the STO inputs receive the corresponding signal, the drive can restart automatically. Do not use the STO function for maintenance work.

- The STO function does not have a motor brake. If the motor coasts to a halt, this must not cause a further hazard. Take this into account during a risk assessment of the system/machine. Additional safety measures (for example, safety brake system) may need to be implemented.

  In the case of application-specific safety functions that require active deceleration (braking) of a dangerous movement, the frequency inverter cannot be used without an additional brake system.
- When using a permanent-field motor, a multiple output stage error – which is extremely rare – may cause the rotor to rotate by 180°/p (p = number of pole pairs).

INFORMATION

The brake is always applied if a safety-related disconnection of the DC 24 V supply voltage occurs at terminal 12 (STO activated). The brake control in the frequency 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 frequency inverter are properly integrated into an application-specific higher-level safety function. In each case, a system/machine-specific risk assessment must be carried out by the system/machine manufacturer and taken into account when using the drive system with a frequency inverter.

The system/machine manufacturer and the operator are responsible for ensuring that the system/machine complies with the relevant safety regulations.

Approved devices:

All available MOVITRAC® LTP-B inverters have the STO function.

The requirements below are mandatory when installing and operating the frequency 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" (→ 🗎 38) 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: Individual conductors can be routed.
  - Adhere to the relevant 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.
- The wiring technology used must comply with EN 60204-1.

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- Use only grounded voltage sources with safe isolation (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.
- 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 frequency inverter.
- Observe the values specified for safety components when designing the safety circuits.
- Frequency 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 two conductors" can be excluded in accordance with 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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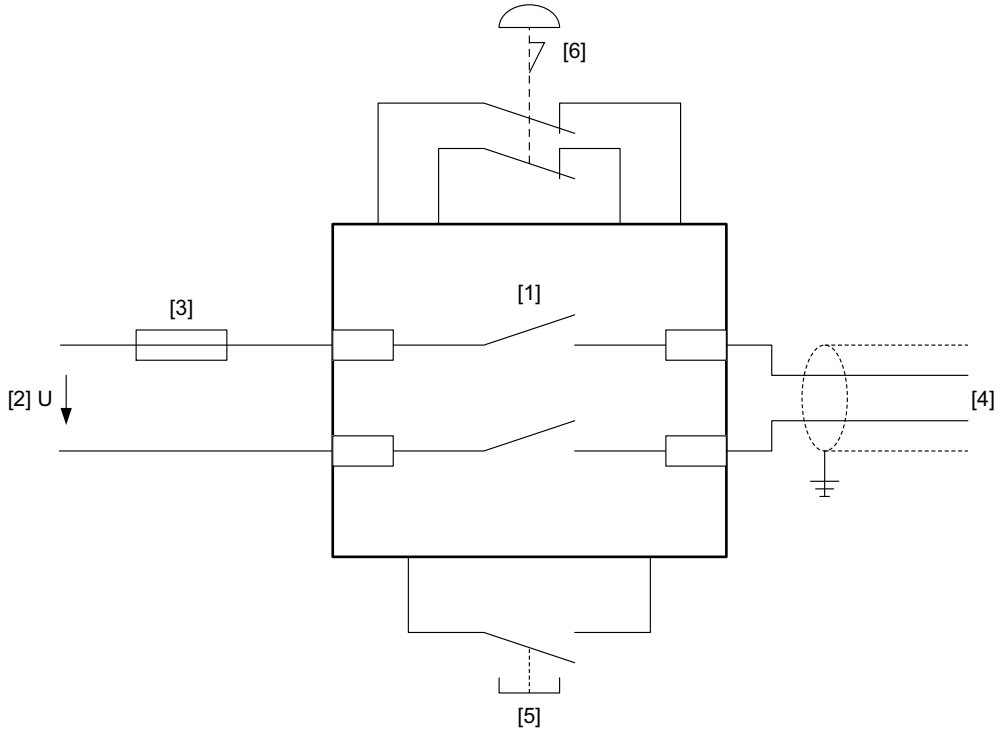
11.2.3 Requirements on the external safety controller



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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 publication.

Other instructions 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 PLd/SIL of the application.

Minimum requirements	SIL2 or PLd SC3 or higher (with force-guided contacts)
Number of output contacts	2 independent
Rated switching voltage	DC 30 V
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" (→ 🗎 196) 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 frequency inverter is not enabled. Therefore, the motor is at a standstill.

  – The STO inputs are no longer energized ("Inhibit" displayed on the frequency inverter display).

  – Enable the frequency inverter. Since the STO inputs continue to not be energized, "Inhibit" continues to be displayed on the frequency inverter display.

- 2. Initial situation:

  The frequency inverter is enabled. The motor rotates.

  – Disconnect the STO inputs from the power supply.

  – Check whether "Inhibit" is displayed on the frequency inverter display, the motor is stopped, and the operation runs in accordance with sections "Safe disconnection function (STO)" (→ 🗎 193) and "STO status and diagnostics" (→ 🗎 195).

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" (→ 🗎 109).

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11.3 Connection variants

11.3.1 General information

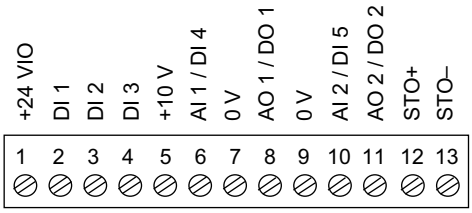
Generally, all the connection variants listed in this documentation are permitted for safety-relevant applications as long as the basic safety concept is fulfilled. This means you have to make sure that the DC 24 V safety inputs are operated by an external safety relay or a safety controller, thus preventing 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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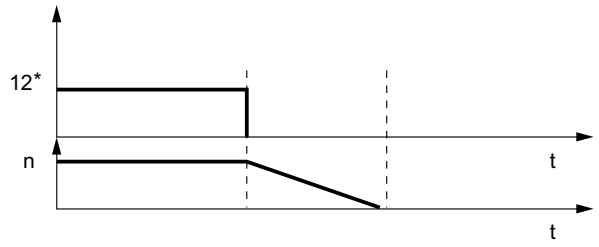
11.3.2 Disconnection of a single drive

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)



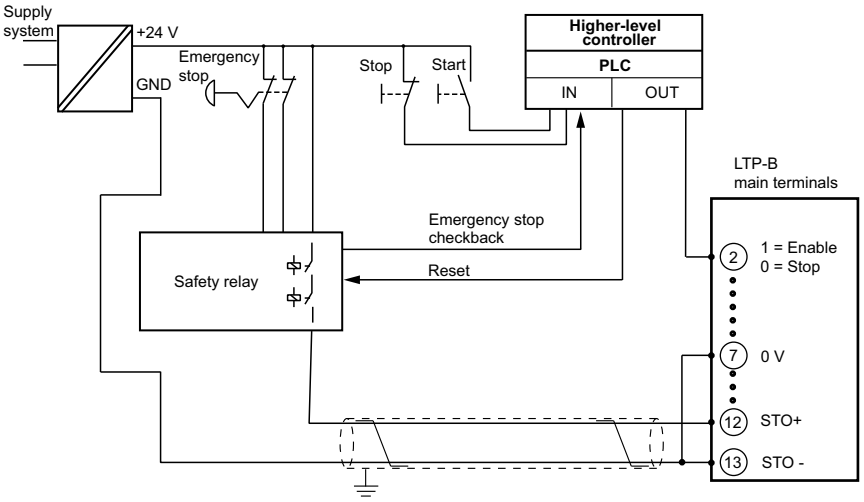
18014406471159051

* Safety input (terminal 12)
n Speed

INFORMATION

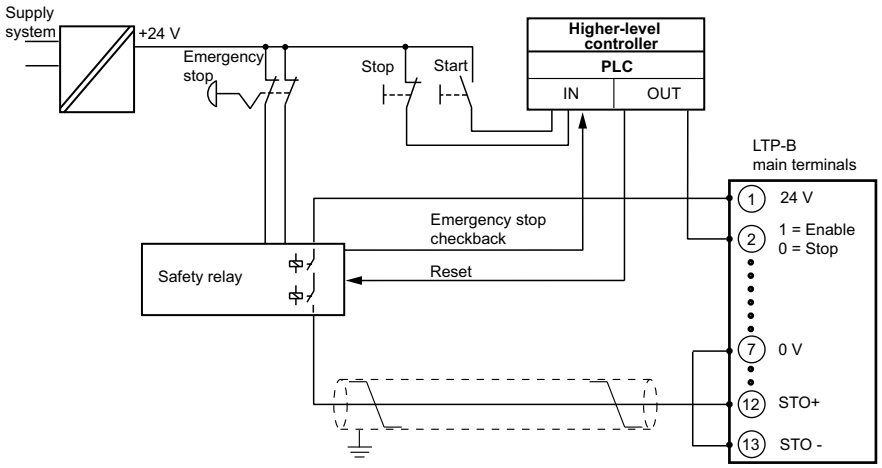
The displayed STO disconnections can be used up to PL d according to EN ISO 13849-1 observing chapter "Requirements on safety relays" (→ 🗎 200).

Digital control with safety relay with external 24 V supply



36028805542448523

Digital control with safety relay with internal 24 V supply



36028805542458635

INFORMATION

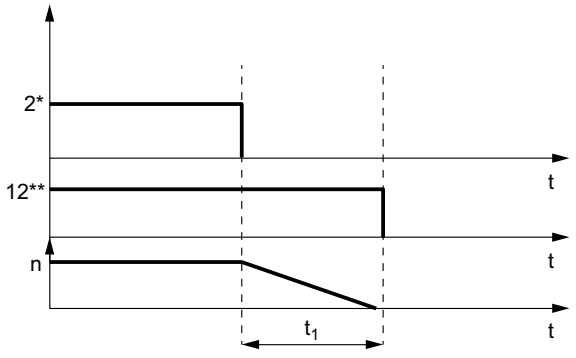
With single-channel disconnection, you have to make certain fault assumptions and provide for corresponding fault exclusions. Observe chapter "Requirements on safety relays" (→ 🗎 200).

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" (→ 🗎 200).

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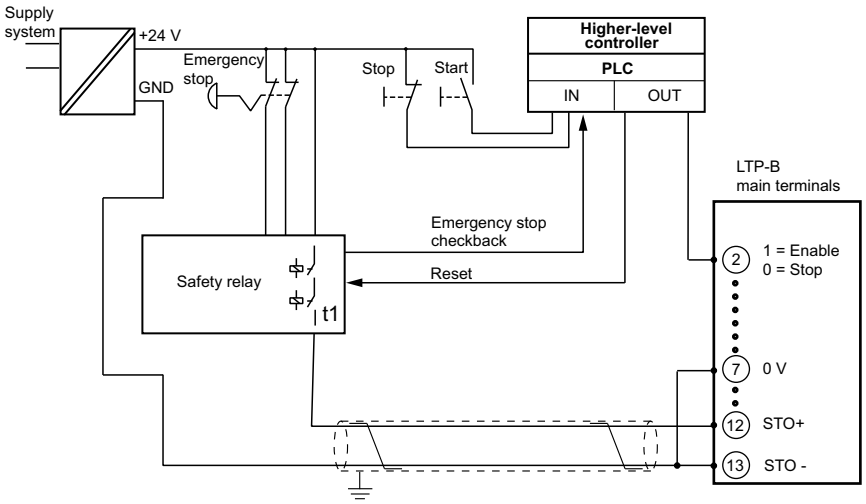
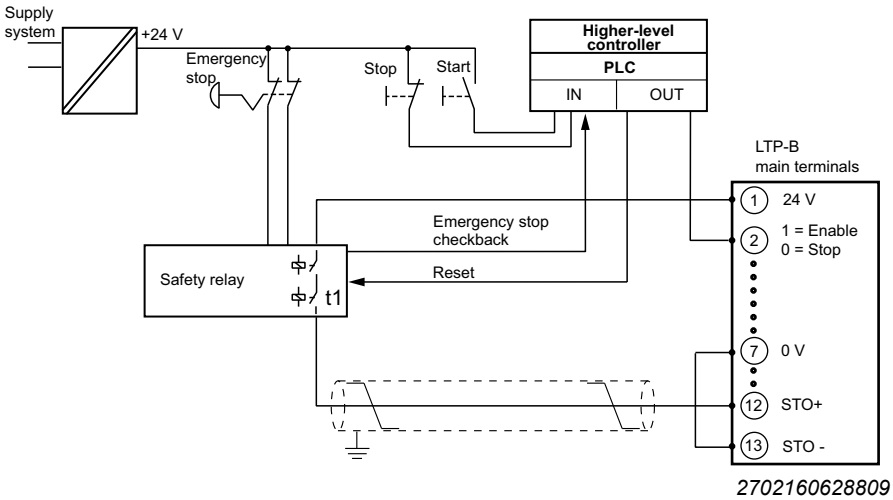
Digital control with safety relay with external 24 V supply



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" (→ 🖹 200).

11.4 Safety characteristics

Characteristic values in accordance with:	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		
Service life / mission time	20 years, then the components must be replaced with new components.		
Proof test interval	20 years	-	20 years
Safe state	Safe Torque Off (STO)		
Safety functions	STO, SS1[2] in accordance with 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
Permissible cable cross section			One core per terminal: 0.05 – 2.5 mm^2 (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 (for example, self-testing digital outputs of safety controllers).

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12 Declaration of conformity

EU Declaration of Conformity

Translation of the original text **901790212/EN**

SEW-EURODRIVE GmbH & Co. KG
Ernst-Blickle-Straße 42, D-76646 Bruchsal
declares under sole responsibility that the following products

Frequency inverters of the product series	**MOVITRAC® LTP-B**
are in conformity with	
Machinery Directive	**2006/42/EC** **(L 157, 09.06.2006, 24-86)**

This includes the fulfillment of the protection targets for "electrical power supply" in accordance with annex I No. 1.5.1 according to the Low Voltage Directive 73/23/EEC -- Note: 2014/35/EU is currently valid (as of 20 Apr 2016).

EMC Directive	**2014/30/EU** **(L 96, 29.03.2014, 79-106)**	**4)**
RoHS Directive	**2011/65/EC** **(L 174, 01.07.2011, 88-110)**	
Applied harmonized standards:	**EN 61800-5-1:2007** **EN 61800-3:2004/A1:2012** **EN 61800-5-2:2007** **EN 50581:2012**	

4) According to the EMC Directive, the listed products are not independently operable products. EMC assessment is only possible after these products have been integrated in an overall system. For the assessment, the product was installed in a typical plant configuration.

Bruchsal	**07.07.2016**	Johann Soder	
Place	Date	Managing Director Technology	a) b)

a) Authorized representative for issuing this declaration on behalf of the manufacturer
b) Authorized representative for compiling the technical documents

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13 Address list

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Sales	Reykjavik	Varma & Vélaverk ehf. Knarrarvogi 4 104 Reykjavík	Tel. +354 585 1070 Fax +354 585)1071 http://www.varmaverk.is vov@vov.is
India			
Registered Office Assembly Sales Service	Vadodara	SEW-EURODRIVE India Private Limited Plot No. 4, GIDC POR Ramangamdi • Vadodara - 391 243 Gujarat	Tel. +91 265 3045200 Fax +91 265 3045300 http://www.seweurodriveindia.com salesvadodara@seweurodriveindia.com
Assembly Sales Service	Chennai	SEW-EURODRIVE India Private Limited Plot No. K3/1, Sipcot Industrial Park Phase II Mambakkam Village Sriperumbudur - 602105 Kancheepuram Dist, Tamil Nadu	Tel. +91 44 37188888 Fax +91 44 37188811 saleschennai@seweurodriveindia.com
	Pune	SEW-EURODRIVE India Private Limited Plant: Plot No. D236/1, Chakan Industrial Area Phase- II, Warale, Tal- Khed, Pune-410501, Maharashtra	Tel. +91 21 35 628700 Fax +91 21 35 628715 salespune@seweurodriveindia.com
Indonesia			
Sales	Medan	PT. Serumpun Indah Lestari Jl.Pulau Solor no. 8, Kawasan Industri Medan II Medan 20252	Tel. +62 61 687 1221 Fax +62 61 6871429 / +62 61 6871458 / +62 61 30008041 sil@serumpunindah.com serumpunindah@yahoo.com http://www.serumpunindah.com
	Jakarta	PT. Cahaya Sukses Abadi Komplek Rukan Puri Mutiara Blok A no 99, Sunter Jakarta 14350	Tel. +62 21 65310599 Fax +62 21 65310600 csajkt@cbn.net.id
	Jakarta	PT. Agrindo Putra Lestari JL.Pantai Indah Selatan, Komplek Sentra Industri Terpadu, Pantai indah Kapuk Tahap III, Blok E No. 27 Jakarta 14470	Tel. +62 21 2921-8899 Fax +62 21 2921-8988 aplindo@indosat.net.id http://www.aplindo.com

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Indonesia			
	Surabaya	PT. TRIAGRI JAYA ABADI Jl. Sukosemolo No. 63, Galaxi Bumi Permai G6 No. 11 Surabaya 60111	Tel. +62 31 5990128 Fax +62 31 5962666 sales@triagri.co.id http://www.triagri.co.id
	Surabaya	CV. Multi Mas Jl. Raden Saleh 43A Kav. 18 Surabaya 60174	Tel. +62 31 5458589 Fax +62 31 5317220 sianhwa@sby.centrin.net.id http://www.cvmultimas.com
Ireland			
Sales Service	Dublin	Alperton Engineering Ltd. 48 Moyle Road Dublin Industrial Estate Glasnevin, Dublin 11	Tel. +353 1 830-6277 Fax +353 1 830-6458 http://www.alperton.ie info@alperton.ie
Israel			
Sales	Tel Aviv	Liraz Handasa Ltd. Ahofer Str 34B / 228 58858 Holon	Tel. +972 3 5599511 Fax +972 3 5599512 http://www.liraz-handasa.co.il office@liraz-handasa.co.il
Italy			
Assembly Sales Service	Milan	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via Bernini,14 20020 Solaro (Milano)	Tel. +39 02 96 980229 Fax +39 02 96 980 999 http://www.sew-eurodrive.it milano@sew-eurodrive.it
Ivory Coast			
Sales	Abidjan	SEW-EURODRIVE SARL Ivory Coast Rue des Pêcheurs, Zone 3 26 BP 916 Abidjan 26	Tel. +225 21 21 81 05 Fax +225 21 25 30 47 info@sew-eurodrive.ci http://www.sew-eurodrive.ci
Japan			
Assembly Sales Service	Iwata	SEW-EURODRIVE JAPAN CO., LTD 250-1, Shimoman-no, Iwata Shizuoka 438-0818	Tel. +81 538 373811 Fax +81 538 373814 http://www.sew-eurodrive.co.jp sewjapan@sew-eurodrive.co.jp hamamatsu@sew-eurodrive.co.jp
Kazakhstan			
Sales	Almaty	SEW-EURODRIVE LLP 291-291A, Tole bi street 050031, Almaty	Tel. +7 (727) 350 5156 Fax +7 (727) 350 5156 http://www.sew-eurodrive.kz sew@sew-eurodrive.kz
	Tashkent	SEW-EURODRIVE LLP Representative office in Uzbekistan 96A, Sharaf Rashidov street, Tashkent, 100084	Tel. +998 71 2359411 Fax +998 71 2359412 http://www.sew-eurodrive.uz sew@sew-eurodrive.uz
	Ulaanbaatar	IM Trading LLC Narny zam street 62 Sukhbaatar district, Ulaanbaatar 14230	Tel. +976-77109997 Fax +976-77109997 imt@imt.mn
Kenya			
Sales	Nairobi	SEW-EURODRIVE Pty Ltd Transnational Plaza, 5th Floor Mama Ngina Street P.O. Box 8998-00100 Nairobi	Tel. +254 791 398840 http://www.sew-eurodrive.co.tz info@sew.co.tz
Latvia			
Sales	Riga	SIA Alas-Kuul Katlakalna 11C 1073 Riga	Tel. +371 6 7139253 Fax +371 6 7139386 http://www.alas-kuul.lv info@alas-kuul.com

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Lebanon			
Sales (Lebanon)	Beirut	Gabriel Acar & Fils sarl B. P. 80484 Bourj Hammoud, Beirut	Tel. +961 1 510 532 Fax +961 1 494 971 ssacar@inco.com.lb
Sales (Jordan, Kuwait , Saudi Arabia, Syria)	Beirut	Middle East Drives S.A.L. (offshore) Sin El Fil. B. P. 55-378 Beirut	Tel. +961 1 494 786 Fax +961 1 494 971 http://www.medrives.com info@medrives.com
Lithuania			
Sales	Alytus	UAB Irseva Statybininku 106C 63431 Alytus	Tel. +370 315 79204 Fax +370 315 56175 http://www.irseva.lt irmantas@irseva.lt
Luxembourg			
representation: Belgium			
Macedonia			
Sales	Skopje	Boznos DOOEL Dime Anicin 2A/7A 1000 Skopje	Tel. +389 23256553 Fax +389 23256554 http://www.boznos.mk
Malaysia			
Assembly Sales Service	Johor	SEW-EURODRIVE SDN BHD No. 95, Jalan Seroja 39, Taman Johor Jaya 81000 Johor Bahru, Johor West Malaysia	Tel. +60 7 3549409 Fax +60 7 3541404 sales@sew-eurodrive.com.my
Mexiko			
Assembly Sales Service	Quéretaro	SEW-EURODRIVE MEXICO S.A. de C.V. SEM-981118-M93 Tequisquiapan No. 102 Parque Industrial Quéretaro C.P. 76220 Querétaro, México	Tel. +52 442 1030-300 Fax +52 442 1030-301 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx
Sales Service	Puebla	SEW-EURODRIVE MEXICO S.A. de C.V. Calzada Zavaleta No. 3922 Piso 2 Local 6 Col. Santa Cruz Buenavista C.P. 72154 Puebla, México	Tel. +52 (222) 221 248 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx
Mongolia			
Technical Office	Ulaanbaatar	IM Trading LLC Narny zam street 62 Union building, Suite A-403-1 Sukhbaatar district, Ulaanbaatar 14230	Tel. +976-77109997 Tel. +976-99070395 Fax +976-77109997 http://imt.mn/ imt@imt.mn
Morocco			
Sales Service	Bouskoura	SEW-EURODRIVE Morocco Parc Industriel CFCIM, Lot 55 and 59 Bouskoura	Tel. +212 522 88 85 00 Fax +212 522 88 84 50 http://www.sew-eurodrive.ma sew@sew-eurodrive.ma
Namibia			
Sales	Swakopmund	DB Mining & Industrial Services Einstein Street Strauss Industrial Park Unit1 Swakopmund	Tel. +264 64 462 738 Fax +264 64 462 734 anton@dbminingnam.com
Netherlands			
Assembly Sales Service	Rotterdam	SEW-EURODRIVE B.V. Industrieweg 175 3044 AS Rotterdam Postbus 10085 3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 Service: 0800-SEWHELP http://www.sew-eurodrive.nl info@sew-eurodrive.nl

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

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

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South Korea			
	Busan	SEW-EURODRIVE KOREA CO., LTD. 28, Noksansandan 262-ro 50beon-gil, Gangseo-gu, Busan, Zip 618-820	Tel. +82 51 832-0204 Fax +82 51 832-0230
Spain			
Assembly Sales Service	Bilbao	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 48170 Zamudio (Vizcaya)	Tel. +34 94 43184-70 Fax +34 94 43184-71 http://www.sew-eurodrive.es sew.spain@sew-eurodrive.es
Sri Lanka			
Sales	Colombo	SM International (Pte) Ltd 254, Galle Raod Colombo 4, Sri Lanka	Tel. +94 1 2584887 Fax +94 1 2582981
Swaziland			
Sales	Manzini	C G Trading Co. (Pty) Ltd PO Box 2960 Manzini M200	Tel. +268 2 518 6343 Fax +268 2 518 5033 engineering@cgtrading.co.sz
Sweden			
Assembly Sales Service	Jönköping	SEW-EURODRIVE AB Gnejsvägen 6-8 553 03 Jönköping Box 3100 S-550 03 Jönköping	Tel. +46 36 34 42 00 Fax +46 36 34 42 80 http://www.sew-eurodrive.se jonkoping@sew.se
Switzerland			
Assembly Sales Service	Basel	Alfred Imhof A.G. Jurastrasse 10 4142 Münchenstein bei Basel	Tel. +41 61 417 1717 Fax +41 61 417 1700 http://www.imhof-sew.ch info@imhof-sew.ch
Taiwan			
Sales	Taipei	Ting Shou Trading Co., Ltd. 6F-3, No. 267, Sec. 2 Tung Huw S. Road Taipei	Tel. +886 2 27383535 Fax +886 2 27368268 Telex 27 245 sewtwn@ms63.hinet.net http://www.tingshou.com.tw
	Nan Tou	Ting Shou Trading Co., Ltd. No. 55 Kung Yeh N. Road Industrial District Nan Tou 540	Tel. +886 49 255353 Fax +886 49 257878 sewtwn@ms63.hinet.net http://www.tingshou.com.tw
Tanzania			
Sales	Daressalam	SEW-EURODRIVE PTY LIMITED TANZANIA Plot 52, Regent Estate PO Box 106274 Dar Es Salaam	Tel. +255 0 22 277 5780 Fax +255 0 22 277 5788 http://www.sew-eurodrive.co.tz info@sew.co.tz
Thailand			
Assembly Sales Service	Chonburi	SEW-EURODRIVE (Thailand) Ltd. 700/456, Moo.7, Donhuaroh Muang Chonburi 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.com
Tunisia			
Sales	Tunis	T. M.S. Technic Marketing Service Zone Industrielle Mghira 2 Lot No. 39 2082 Fouchana	Tel. +216 79 40 88 77 Fax +216 79 40 88 66 http://www.tms.com.tn tms@tms.com.tn
Turkey			
Assembly Sales Service	Kocaeli-Gebze	SEW-EURODRİVE Hareket Sistemleri San. Ve TIC. Ltd. Sti Gebze Organize Sanayi Böl. 400 Sok No. 401 41480 Gebze Kocaeli	Tel. +90 262 9991000 04 Fax +90 262 9991009 http://www.sew-eurodrive.com.tr sew@sew-eurodrive.com.tr

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Ukraine			
Assembly Sales Service	Dnipropetrovsk	ООО «СЕВ-Евродрайв» ул. Рабочая, 23-В, офис 409 49008 Днепропетровск	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	IGLogistics@seweurodrive.com
	Additional addresses for service provided on request!		
Uzbekistan			
Technical Office	Tashkent	SEW-EURODRIVE LLP Representative office in Uzbekistan 96A, Sharaf Rashidov street, Tashkent, 100084	Tel. +998 71 2359411 Fax +998 71 2359412 http://www.sew-eurodrive.uz sew@sew-eurodrive.uz
Vietnam			
Sales	Ho Chi Minh City	Nam Trung Co., Ltd Huế - South Vietnam / Construction Materials 250 Binh Duong Avenue, Thu Dau Mot Town, Binh Duong Province HCM office: 91 Tran Minh Quyen Street District 10, Ho Chi Minh City	Tel. +84 8 8301026 Fax +84 8 8392223 khanh-nguyen@namtrung.com.vn http://www.namtrung.com.vn
	Hanoi	MICO LTD Quảng Trị - North Vietnam / All sectors except Construction Materials 8th Floor, Ocean Park Building, 01 Dao Duy Anh St, Ha Noi, Viet Nam	Tel. +84 4 39386666 Fax +84 4 3938 6888 nam_ph@micogroup.com.vn http://www.micogroup.com.vn

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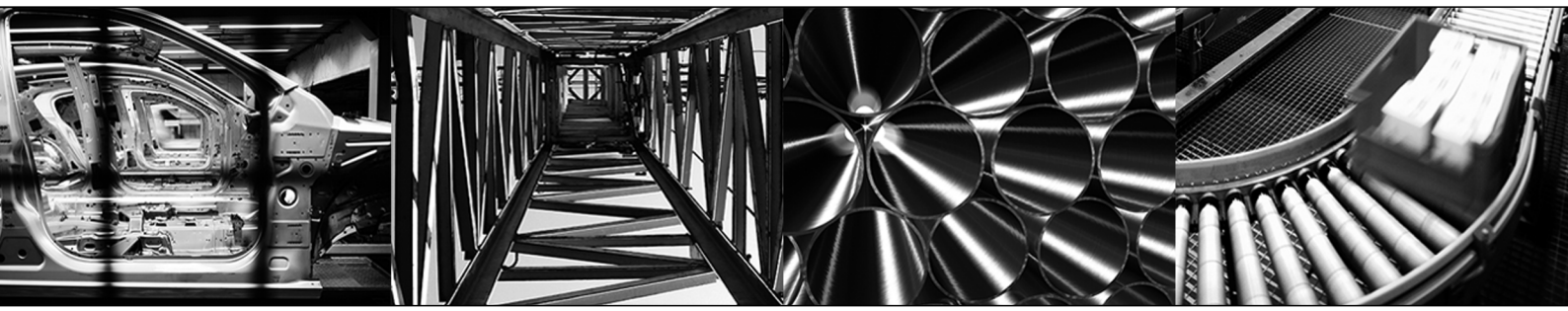

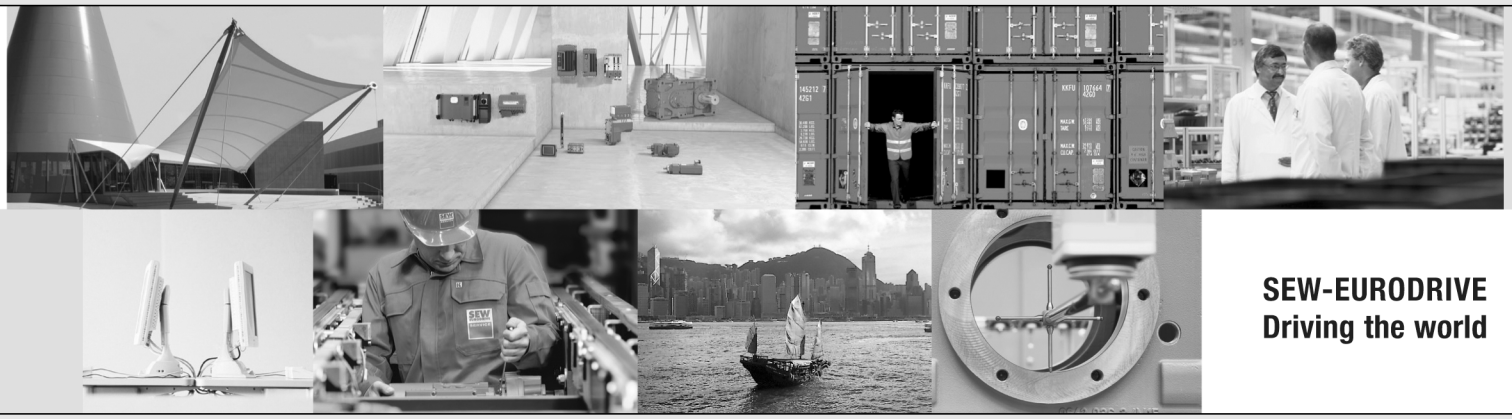

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