SEW EURODRIVE

Operating Instructions

MOVITRAC® LTP-B

Edition 01/2015

21270996/EN

Contents

21270996/EN – 01/2015

21270996/EN – 01/2015

21270996/EN – 01/2015

21270996/EN – 01/2015

1 General information

1.1 About this documentation

This documentation is an integral part of the product. The documentation is intended for all employees who perform assembly, installation, startup, and service work on the 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 device 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.

21270996/EN – 01/2015

1.3 Rights to claim under limited warranty

A requirement of fault-free operation and fulfillment of any rights to claim under limited warranty is that you adhere to the information in the documentation. Read the documentation before you start working with the product.

1.4 Content of the documentation

The German version of the MOVITRAC® LTP-B operating instructions is the original version.

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

1.5 Exclusion of liability

You must comply with the information contained in this documentation to ensure safe operation and 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, any liability for defects is excluded.

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

21270996/EN – 01/2015

2 Safety notes

2.1 Preliminary information

The following basic safety notes must be read carefully to prevent injury to persons and damage to property. The user must ensure that the basic safety notes are read and observed. Make sure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the operating instructions carefully and understood them. If you are unclear about any of the information in this documentation, or if you require further information, please contact SEW-EURODRIVE.

The following safety notes are primarily concerned with the use of the unit described in these operating instructions. If you use other components from SEW-EURODRIVE, also refer to the safety notes for these particular components in the corresponding documentation.

Please also observe the supplementary safety notes in the individual chapters of this documentation.

2.2 General information

⚠ WARNING

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

Severe or fatal injuries.

- All work related to transportation, storage, installation, assembly, connection, startup, maintenance, and repair may only be carried out by qualified personnel, in strict observance of
  - The relevant detailed documentation
  - The warning and safety signs on the unit
  - All other relevant project planning documents, startup instructions and wiring diagrams
  - The specific regulations and requirements for the system
  - The national/regional regulations governing safety and the prevention of accidents.
- Never install damaged products.
- Submit a complaint to the shipping company immediately in the event of damage.

Removing covers without authorization, improper use as well as incorrect installation or operation may result in severe injuries to persons or damage to machinery.

Refer to the following chapters for more information.

21270996/EN – 01/2015

2.3 Target group

Mechanical work of any kind may be carried out only by trained specialists. Specialists in the context of this documentation are persons who are familiar with the design, mechanical installation, troubleshooting, and maintenance of the product and have the following qualifications:

- Training in mechanical engineering (for example, as a machinist or mechatronics technician) and the successful completion of final examinations.
- Knowledge of this documentation.

Electrical work of any kind may be carried out only by skilled persons. In the context of this documentation, skilled persons are persons who are familiar with the electrical installation, startup, troubleshooting, and maintenance of the product and who have the following qualifications:

- Training in electrical engineering (for example, as an electronics technician or mechatronics technician) and the successful completion of final examinations.
- Knowledge of this documentation.

In addition to that, they must be familiar with the relevant safety regulations and laws, especially with the requirements of the performance levels in accordance with DIN EN ISO 13849-1 and all other standards, directives and laws specified in this documentation. The above-mentioned persons must have the express authorization of the company to operate, program, parameterize, identify, and ground units, systems, and circuits in accordance with safety technology standards.

All work in the areas of transportation, storage, operation, and waste disposal must be performed by suitably trained personnel.

2.4 Designated use

Frequency inverters are components for controlling asynchronous AC motors. Frequency inverters are intended for installation in electrical systems or machines. Never connect capacitive loads. Operation with capacitive loads results in overvoltages and may destroy the unit.

The following standards apply, if the frequency inverters are marketed in the EU/EFTA:

- In the case of installation in machines, startup of frequency inverters (meaning the start of designated use) is prohibited until it is determined that the machine meets the requirements stipulated in Directive 2006/42/EC (Machinery Directive); observe EN 60204.
- Startup (meaning the start of designated use) is only permitted under observance of EMC Directive 2004/108/EC.
- The frequency inverters comply with the requirements of the Low Voltage Directive 2006/95/EC. The harmonized standards of the EN 61800-5-1/DIN VDE T105 series in connection with EN 60439-1/VDE 0660 part 500 and EN 60146/VDE 0558 are applied to these frequency inverters.

Observe the technical data and the connection requirements specified on the nameplate and the operating instructions.

2.4.1 Safety functions

MOVITRAC® LTP-B frequency inverters may not perform any safety functions without a higher-level safety system.

21270996/EN – 01/2015

Use higher-level safety systems to ensure protection of equipment and personnel.

2.5 Other applicable documentation

Observe the corresponding documentation for all connected devices.

2.6 Transportation and storage

Inspect the shipment for transport damage as soon as you receive the delivery. Inform the shipping company immediately of any damage. If necessary, put startup on hold.

Note the following points regarding transport:

- Before transportation, cover the connections with the supplied protection caps.
- Place the unit only on the cooling fins or on a side without connectors during transportation.
- Ensure that the unit is not subjected to mechanical impact during transportation.

If necessary, use suitable, sufficiently rated handling equipment. Prior to startup, remove the transport protection.

Keep the inverter in its packaging until it is needed.

In addition, observe the notes on climatic conditions in chapter "Technical data" (→ 🗎 169).

2.7 Installation/assembly

Ensure that the unit is installed and cooled in accordance with the regulations in this documentation.

Protect the unit from excessive strain. Especially during transportation and handling, do not allow the components to be deformed or insulation spaces altered. Electrical components must not be mechanically impaired or irreparably damaged.

The following applications are prohibited unless explicitly permitted:

- Use in potentially explosive atmospheres
- Use in environments exposed to harmful oils, acids, gases, vapors, dust, radiation, and so on
- Use in applications that are subject to mechanical vibration and shock loads in excess of the requirements in EN 61800-5-1

Observe the notes in chapter "Mechanical installation" (→ 🗎 32).

2.7.1 Housing installation guidelines for IP20 units

The IP20 units are provided for installation in a control cabinet. Here, the control cabinet's IP degree of protection must be at least IP54. Furthermore, degree of pollution 2 must be maintained in the control cabinet.

2.7.2 Housing installation guidelines for IP55 units

The IP55 units are provided solely for installation indoors.

21270996/EN – 01/2015

2.8 Electrical connection

Observe the relevant national accident prevention regulations when working on a live drive controller.

Perform the electrical installation in accordance with the relevant regulations (for example, cable cross sections, fusing, protective earth connections, and so on). The documentation contains additional notes.

Preventive measures and protection devices must comply with the relevant regulations (for example, EN 60204-1 or EN 61800-5-1).

Required preventive measures for mobile use:

Type of energy transfer	Protective measure
Direct power supply	Ground connection

2.9 Safe disconnection

The unit meets all requirements for the safe disconnection of power and electronics connections in accordance with EN 61800-5-1. To ensure safe disconnection, all connected circuits must also comply with the requirements for safe disconnection.

2.10 Startup/operation

⚠ CAUTION

The surfaces of the unit and any connected elements (for example, braking resistors) may reach high temperatures during operation.

Danger of burns

- Let the unit and external options cool down before you start working on them.

Do not disable the monitoring and protection devices, even during the test run.

When in doubt, switch off the unit whenever changes occur compared with normal operation (for example, increased temperatures, noise, oscillation). Determine the cause of the fault and, if necessary, contact SEW-EURODRIVE.

Where required, systems in which such units are installed must be equipped with additional monitoring and protection devices in accordance with the respective applicable safety regulations (for example, the law governing technical equipment, accident prevention regulations, and so on).

Additional preventive measures may be necessary for applications with an increased hazard potential. You must check the effectiveness of protection devices each time you change the configuration.

During operation, connections that are not in use must be covered with the protection caps supplied.

Do not touch live components or power connections immediately after disconnecting the unit from the voltage supply because some capacitors may still be charged. Adhere to a minimum switch-off time of ten minutes. Observe the corresponding labels on the unit.

When the unit is switched on, dangerous voltages are present at all power connections as well as at connected cables and motor terminals. This applies even when the unit is not running and the motor is at a standstill.

21270996/EN – 01/2015

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

Mechanical blocking or internal safety functions within the unit can cause the motor to stop. Eliminating the cause of the problem or performing a reset may help to restart the drive automatically. If, for safety reasons, this is not permitted for the drive-controlled machine, disconnect the unit from the supply system before you start troubleshooting.

2.11 Inspection/maintenance

⚠ WARNING

Danger of electric shock due to exposed, live parts in the unit.

Severe or fatal injuries

- Never open the unit.
- Only SEW-EURODRIVE is authorized to carry out repairs.

The inverter should be included in the scheduled maintenance program so that the design can ensure a suitable operating environment. Maintenance should include the following:

- The ambient temperature should be at or below the value specified in the section "Ambient conditions" (→ 🗎 169).
- The heat sink fan should be able to rotate freely and should be free of dust.
- The housing in which the inverter is installed must be free of dust and condensation. Furthermore, you must check whether the fan and fan filter can ensure proper air flow.

You should also check all electrical connections to ensure that all screw terminals are tightly secured and the supply cables do not exhibit any signs of heat damage.

21270996/EN – 01/2015

3 General specification

3.1 Input voltage ranges

Depending on the model and nominal power, the frequency inverters are designed for direct connection to the following voltage sources:

MOVITRAC® LTP-B			
Nominal voltage	Size	Connection type	Rated frequency
200 – 240 V ± 10%	2	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

* The single-phase frequency inverter can also be connected to two phases of a three-phase power supply system of 200 – 240 V.

3.2 Nameplate

The following figure shows a nameplate:

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21270996/EN – 01/2015

3.3 Type designation

Example: MCLTP-B 0015-2B1-4-00 (60 Hz)		
Product name	MCLTP	MOVITRAC® LTP-B
Version	B	Version status of the unit series
Recommended motor power	0015	0015 = 1.5 kW
Supply 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 = 4Q operation with brake chopper
Design	00	• 00 = Standard IP20 housing • 10 = IP55/NEMA-12K housing
Country-specific variant	(60 Hz)	60 Hz = 60 Hz variant

3.4 Overload capacity

MOVITRAC® LTP-B provides a continuous output current of 100%.

Frequency inverters

Overload capacity based on nominal frequency inverter current	60 seconds	2 seconds
MOVITRAC® LTP-B	150%	175%

Motors

Overload capacity based on nominal motor current	60 seconds	2 seconds
Asynchronous motor (factory setting)	150%	175%
Synchronous motors (CMP and third-party motors)	200%	250%[1)]

1) Only 200% for size 3; 5.5 kW.

Overload capacity based on nominal motor current	60 seconds
MGF..2-DSM with LTP-B, 1.5 kW MGF..4-DSM with LTP-B, 2.2 kW MGF..4/XT-DSM[1)] with LTP-B, 4.0 kW	200%

1) In preparation

3.5 Protection function

- Output short circuit, phase-phase, phase-ground
- Output overcurrent
- Overload protection
  - The frequency inverter responds to an overload as described in chapter "Overload capacity" (→ 🗎 15).
- Overvoltage fault
  - Set to 123% of the maximum rated supply voltage of the frequency inverter
- Undervoltage fault
- Overtemperature fault
- Undertemperature fault
  - The frequency inverter is shut down at a temperature below -10°C.
- Line phase failure
  - An operational frequency inverter shuts down when one phase of a three-phase system fails for longer than 15 seconds.
- Thermal motor overload protection in accordance with NEC (National Electrical Code, US)

21270996/EN – 01/2015

4 Safe Torque Off (STO)

Safe Torque Off is abbreviated to STO for the remainder of this section.

4.1 Integrated safety technology

The MOVITRAC® LTP-B safety technology described below was developed and tested in accordance with the following safety requirements:

Underlying standards	Safety category
EN 61800-5-2:2007	SIL
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 units that have the TÜV logo imprinted on the nameplate. Copies of the TÜV certificate can be obtained from SEW-EURODRIVE.

4.1.1 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.

4.1.2 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.

21270996/EN – 01/2015

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" (→ 🗎 49),
- 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.

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 stop) 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 h	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" (→ 🗎 169).

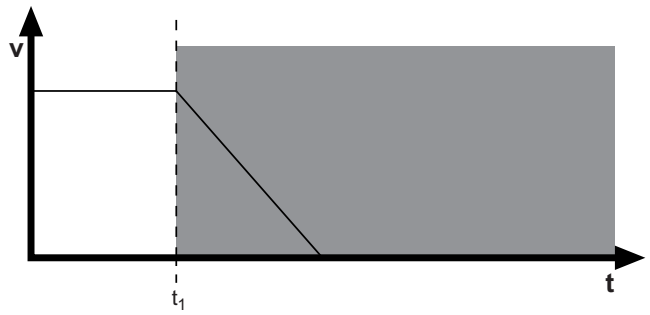
21270996/EN – 01/2015

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.

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" (→ 🗎 104).

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.

21270996/EN – 01/2015

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 the time • when a fault is detected in the STO circuit Until the time • when the fault is displayed on the frequency inverter display or the digital output is displayed Status: Frequency inverter fault

4.1.3 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.

21270996/EN – 01/2015

4.2 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.

4.2.1 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.

4.2.2 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" (→ 🗎 55) 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.
  - Individual conductors can be routed inside an electrical installation space.
  - 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.

21270996/EN – 01/2015

- Only use grounded voltage sources with a safe disconnection (PELV) in accordance with VDE0100 and EN 60204-1. In the case of a single fault, the voltage between the outputs or between any output and grounded parts must not exceed DC 60 V.
- The safety-relevant DC 24 V supply voltage must 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 inverter supply. 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 associated with the frequency inverter.
- When designing the safety circuits, observe the values specified for the safety components.
- 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.

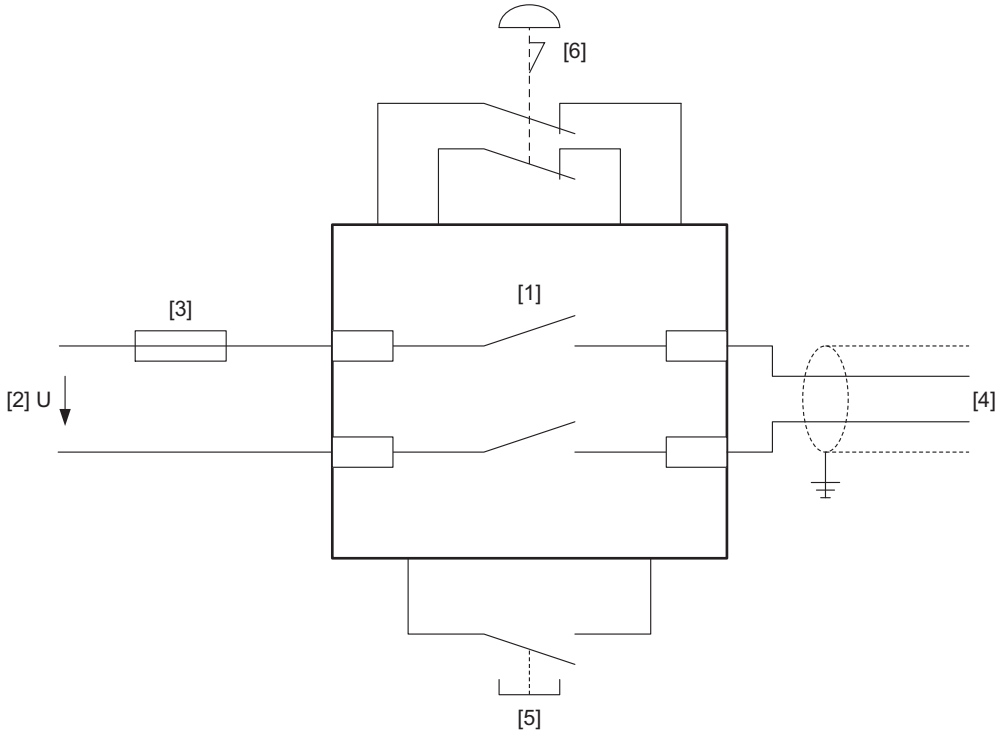
  The fault assumption "short circuit between any two conductors" can be excluded in accordance with EN ISO 13849-2: 2008 under the following conditions:

  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 cables 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, the ground or a protective earth (PE) connection" can be excluded under the following condition:
  - Short circuits between a conductor and any exposed conductive part within an installation space.

21270996/EN – 01/2015

4.2.3 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).

4.2.4 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 as described in this publication apply.

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	30 V DC
Switching current	100 mA

4.2.5 Requirements on startup

- To validate the implemented safety functions, they must be documented and checked after a successful startup (validation).

  Observe the limitations for safety functions in chapter "Limitations" (→ 🗎 20). Non-safety-related parts and components that affect the validation result (for example, the motor brake) must be disabled, if necessary.
- When using MOVITRAC® LTP-B in safety-relevant applications, it is essential that you conduct and log startup checks for the disconnecting device and correct wiring.

4.2.6 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.

21270996/EN – 01/2015

- 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*.

- First scenario:

  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.

- Second scenario:

  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)" (→ 🗎 18) and "STO status and diagnostics" (→ 🗎 19).

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" (→ 🗎 103).

21270996/EN – 01/2015

4.3 Connection variants

4.3.1 General information

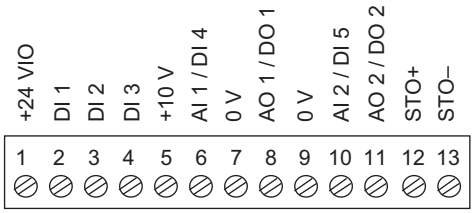
Generally, all the connection variants listed in this documentation are permitted for safety-relevant applications as long as the basic safety concept is fulfilled. This means you have to make sure that the DC 24 V safety inputs are operated by an external safety relay or a safety controller, thus preventing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



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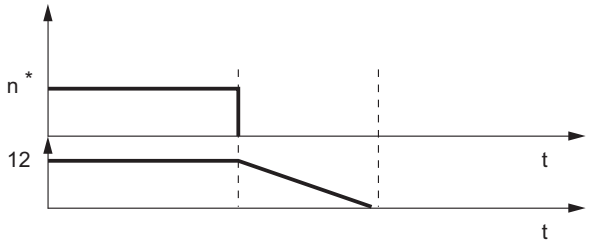
4.3.2 Disconnection of a single drive

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 there is no brake.

STO – Safe Torque Off (EN 61800-5-2)



9007207216418059

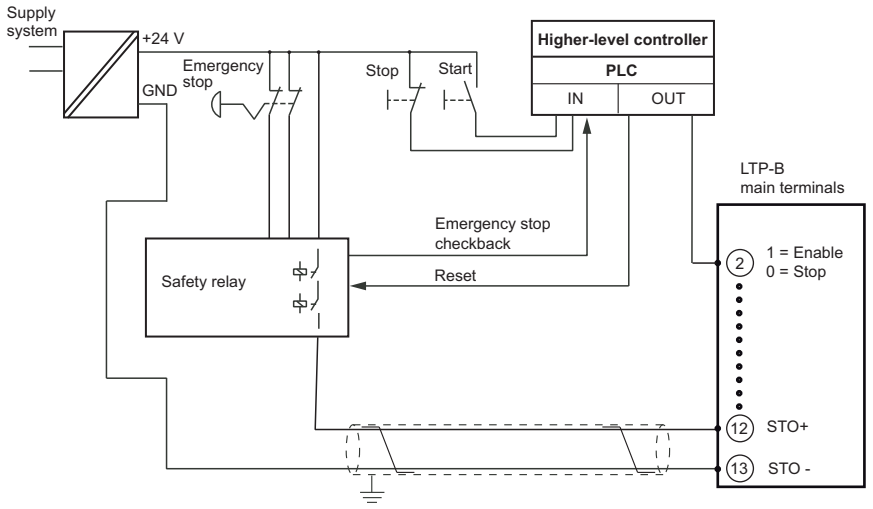
* Safety input (terminal 12)
n Speed

21270996/EN – 01/2015

INFORMATION

The STO disconnections shown here can be used up to PL d in accordance with EN ISO 13849-1 while observing chapter "Requirements for safety relays" (→ 🗎 24).

Digital control with safety relay with external 24 V supply



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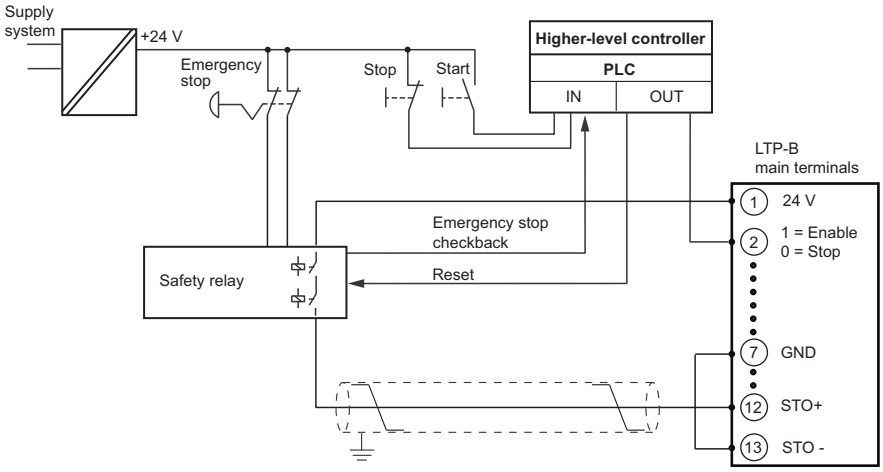
Digital control with safety relay with internal 24 V supply



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INFORMATION

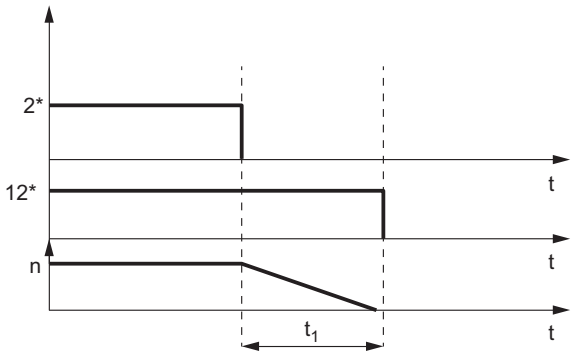
With a single-channel disconnection, you have to make certain fault assumptions and make provisions for the corresponding fault exclusions. See chapter "Use of safety relays".

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

The procedure is as follows:

- Terminal 2 is disconnected (for example, in the case of an emergency stop).
- 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)



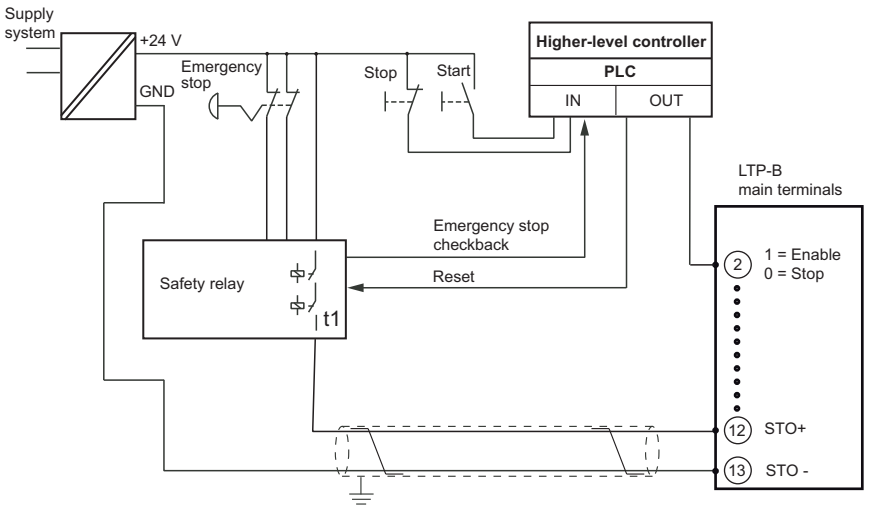
9007207780912011

* Digital input 1 (terminal 2)
** Safety input (terminal 12)
n Speed

INFORMATION

The SS1(c) disconnections displayed here can be used up to PL d in accordance with EN ISO 13849-1 while observing chapter "Requirements for safety relays" (→ 🗎 24).

Digital control with safety relay with external 24 V supply



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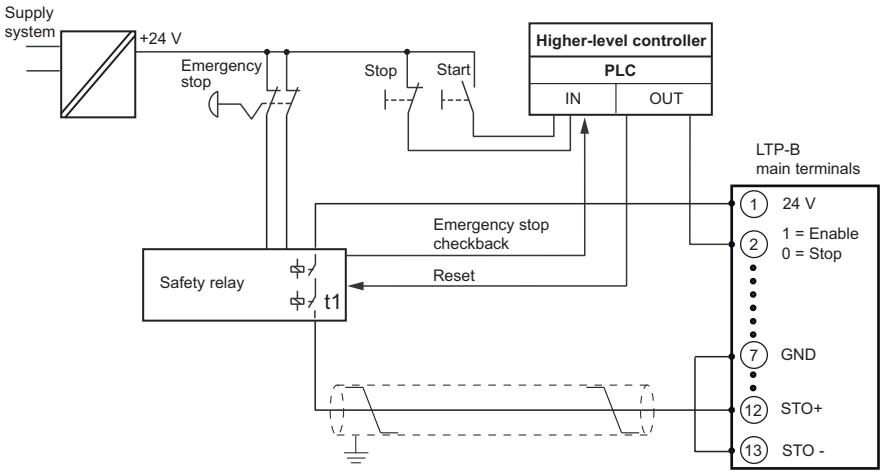
Digital control with safety relay with internal 24 V supply



18014407033350923

INFORMATION

With a single-channel disconnection, you have to make certain fault assumptions and make provisions for the corresponding fault exclusions. See chapter "Use of safety relays".

4.4 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

4.5 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).

21270996/EN – 01/2015

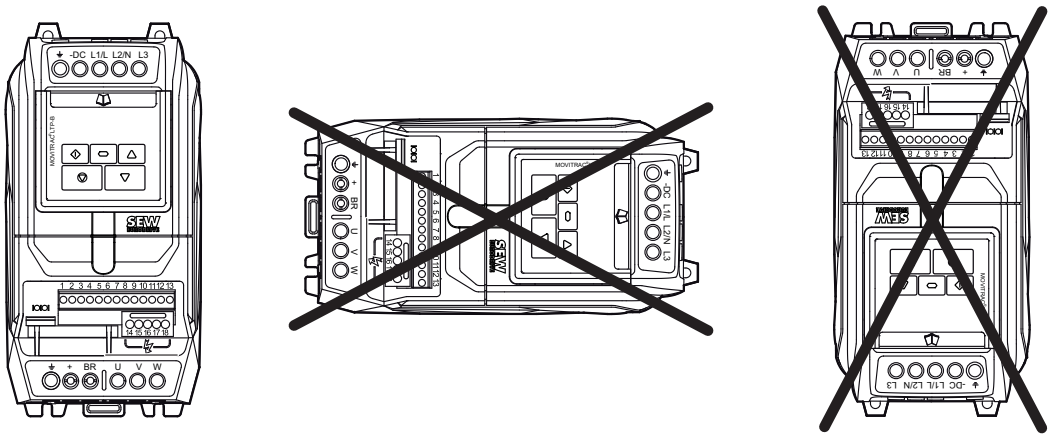
5 Installation

The next chapter describes the installation.

5.1 General information

- Before installation, carefully check the frequency inverter for damage.
- Store the frequency inverter in its packaging until you need it. The storage location must be clean and dry with an ambient temperature between -40°C and +60°C.
- Install the frequency 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 frequency 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 frequency inverter from direct sunlight. Use a cover when using the frequency inverter outdoors.
- The frequency inverters can be installed side by side. Doing so ensures sufficient ventilation space between the individual units. If the frequency inverter is installed above another frequency inverter or another device that dissipates heat, there must be a vertical minimum clearance of 150 mm. To facilitate self-cooling, the control cabinet must be cooled through forced ventilation or sized accordingly. See chapter "IP20 housing: Installation and installation space" (→ 🗎 36).
- The maximum permitted ambient temperature during operation is +50°C for IP20 frequency inverters and +40°C for IP55 frequency inverters. The minimum permitted ambient temperature during operation is -10°C.

  Observe the relevant information in chapter "Ambient conditions" (→ 🗎 169).
- DIN rail mounting is only possible for size 2 frequency inverters (IP20).
- Install the frequency inverter only as depicted in the following figure:



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21270996/EN – 01/2015

5.2 Mechanical installation

5.2.1 Housing variants and dimensions

Sizes

MOVITRAC® LTP-B is available in sizes 2 – 7.

Housing variants

MOVITRAC® LTP-B is available in two housing variants:

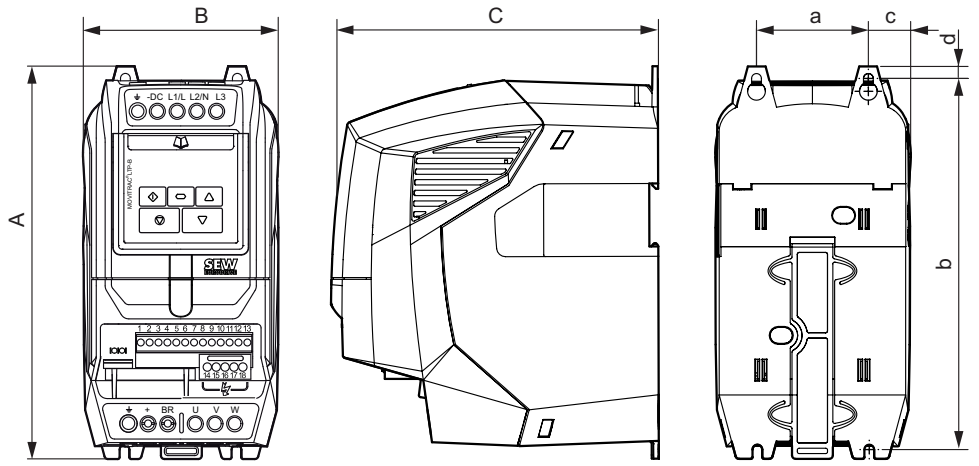
- IP20/NEMA 1 housing for use in control cabinets
- IP55/NEMA 12K housing

The IP55 and NEMA 12K housing is protected against humidity and dust. This allows for operating the frequency inverter indoors under difficult conditions. The electronics and functions of the frequency inverters are identical. The only difference is in the dimensions of the housing and its mass.

21270996/EN – 01/2015

Dimensions of the IP20 housing

Sizes 2 and 3

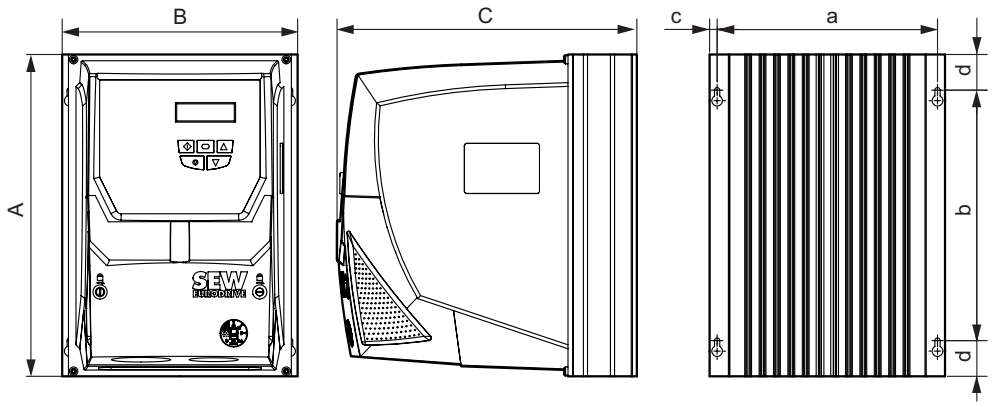


Dimension		Size 2	Size 3
Height (A)	mm	221	261
	in	8.70	10.28
Width (B)	mm	110	131
	in	4.33	5.16
Depth (C)	mm	185	205
	in	7.28	8.07
Weight	kg	1.8	3.5
	lb	3.97	7.72
a	mm	63.0	80.0
	in	2.48	3.15
b	mm	209.0	247
	in	8.23	9.72
c	mm	23	25.5
	in	0.91	1.01
d	mm	7.00	7.75
	in	0.28	0.30
Recommended screw size		4 × M4	

21270996/EN – 01/2015

Dimensions of the IP55/NEMA 12K housing (LTP xxx–10)

Sizes 2 and 3



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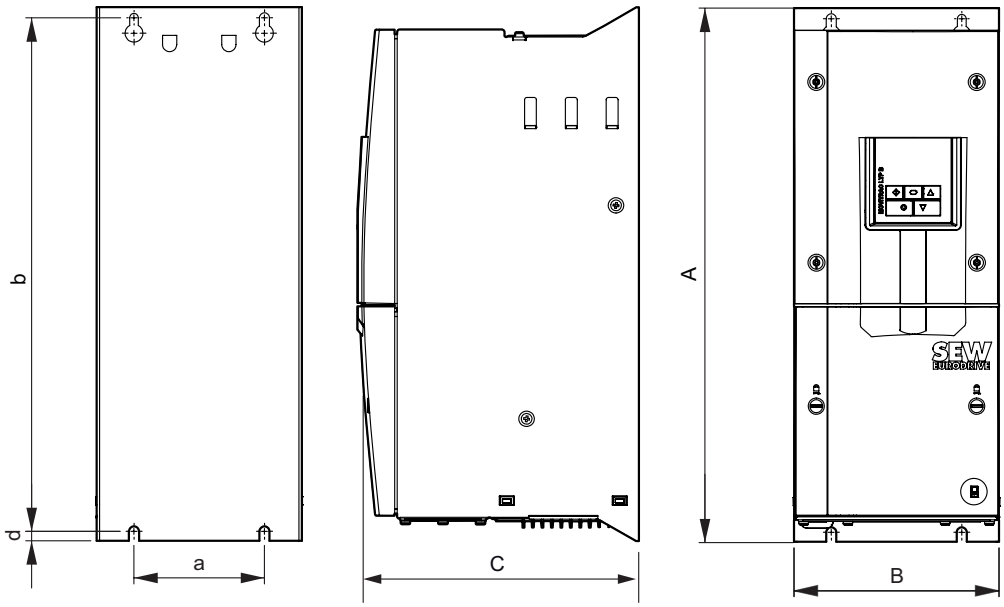
Dimension		Size 2	Size 3
Height (A)	mm	257	310
	in	10.12	12.20
Width (B)	mm	188	211
	in	7.40	8.31
Depth (C)	mm	239	251
	in	9.41	2.88
Weight	kg	4.8	7.3
	lb	10.58	16.09
a	mm	178	200
	in	7.09	7.87
b	mm	200	252
	in	7.87	9.92
c	mm	5	5.5
	in	0.20	0.22
d	mm	28.5	29
	in	1.12	1.14
Recommended screw size		4 × M4	

21270996/EN – 01/2015

Sizes 4 – 7

Frequency inverter sizes 4 – 7 are each delivered with a base plate either with and without bores for the cable bushing.



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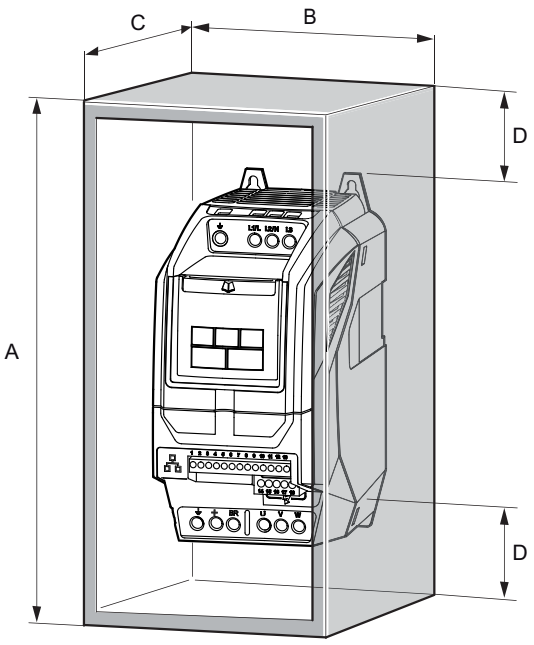
Dimension		Size 4	Size 5	Size 6	Size 7
Height (A)	mm	450	540	865	1280
	in	17.32	21.26	34.06	50.39
Width (B)	mm	171	235	330	330
	in	6.73	9.25	12.99	12.99
Depth (C)	mm	235	268	335	365
	in	9.25	10.55	13.19	14.37
Weight	kg	11.5	22.5	50	80
	lb	25.35	49.60	110.23	176.37
a	mm	110	175	200	200
	in	4.33	6.89	7.87	7.87
b	mm	423	520	840	1255
	in	16.65	20.47	33.07	49.41
c	mm	61	60	130	130
	in	2.40	2.36	5.12	5.12
d	mm	8	8	10	10
	in	0.32	0.32	0.39	0.39
Recommended screw size		4 × M8		4 × M10	

5.2.2 IP20 housing: Installation and installation space

For applications that require a higher IP degree of protection than IP20, the frequency inverter 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 air cooling.
- When using a control cabinet with ventilation openings, the openings must be provided above and below the frequency inverter to allow for unobstructed circulation of air. The air must be supplied below the frequency inverter and dissipated above it.
- If the frequency inverter is operated in external environments with particles of dirt (such as dust), ventilation openings either have to be equipped with a suitable particle filter or forced air 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 IP20 frequency inverter can be assembled directly next to one another without clearance.

Dimensions of metal cabinet without ventilation openings



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Power rating		Sealed control cabinet							
		A		B		C		D	
		mm	in	mm	in	mm	in	mm	in
Size 2	**230 V**: 0.75 kW, 1.5 kW **400 V**: 0.75 kW, 1.5 kW, 2.2 kW	400	15.75	300	11.81	250	9.84	60	2.36
Size 2	**230 V**: 2.2 kW	600	23.62	450	17.72	300	11.81	100	3.94
Size 3	All power ranges	800	31.50	600	23.62	350	13.78	150	5.91

21270996/EN – 01/2015

Dimensions of control cabinet with ventilation openings

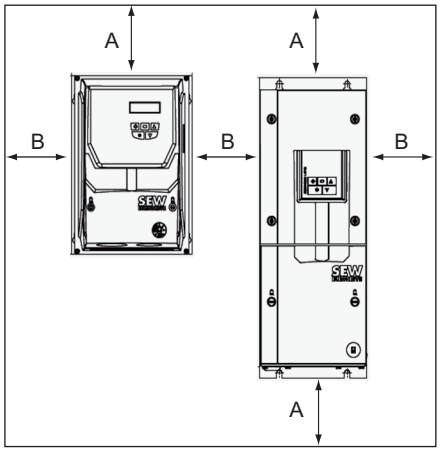
Power rating		Control cabinet with ventilation openings							
		A		B		C		D	
		mm	in	mm	in	mm	in	mm	in
Size 2	**230 V**: 0.75 kW, 1.5 kW **400 V**: 0.75 kW, 1.5 kW, 2.2 kW	400	15.75	300	11.81	250	9.84	60	2.36
Size 2	**230 V**: 2.2 kW	600	23.62	400	15.75	300	11.81	100	3.94
Size 3	All power ranges	800	31.50	600	23.62	350	13.78	150	5.91

Dimensions of control cabinet with forced cooling

Power rating		Control cabinet with forced air cooling								
		A		B		C		D		Air flow rate
		mm	in	mm	in	mm	in	mm	in	
Size 2	**230 V**: 0.75 kW, 1.5 kW **400 V**: 0.75 kW, 1.5 kW, 2.2 kW	400	15.75	300	11.81	250	9.84	60	2.36	> 45 m^3/h
Size 2	**230 V**: 2.2 kW	400	15.75	300	11.81	250	9.84	100	3.94	> 45 m^3/h
Size 3	All power ranges	600	23.62	400	15.75	250	9.84	150	5.91	> 80 m^3/h

5.2.3 IP55 housing: Installation and control cabinet dimensions

In control cabinets or in the field, the following minimum distances must be observed.



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Size	A		B	
	mm	in	mm	in
2 – 7	200	7.87	10	0.39

21270996/EN – 01/2015

INFORMATION

If the IP55 frequency inverter is installed in a control cabinet, it must be adequately ventilated.

5.3 Electrical installation

Observe the safety notes in chapter 2 during installation.

⚠ WARNING

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

Severe or fatal injuries.

- Wait ten minutes after disconnecting the frequency inverter from the power supply as well as disconnecting the line voltage and the DC 24 V voltage. Then, establish that the unit has been de-energized. Only then, start to work on the unit.

⚠ WARNING

Danger of fatal injury due to falling hoist.

Severe or fatal injuries.

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

- The frequency inverter may only be installed by electrical specialists in compliance with the relevant 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 frequency inverter has degree of protection IP20. For a higher IP degree of protection, a suitable enclosure or the IP55/NEMA 12K variant must be used.
- Make sure that the units are properly grounded. Observe the wiring diagram in chapter "Connecting the frequency inverter and motor" (→ 🗎 45).

5.3.1 Before installation

- Make sure that the supply voltage, frequency, and number of phases (single-phase or three-phase) correspond to the nominal values of the frequency inverter on delivery.
- A disconnecting switch or similar disconnecting element must be installed between the voltage supply and the frequency inverter.
- Never connect the mains supply to output terminals U, V or W of the frequency inverter.
- Do not install automatic contactors between the frequency inverter and the motor. Adhere to a minimum clearance of 100 mm at points where control cables and electric power lines are installed close to one another, and an angle of 90° for crossing cables.

21270996/EN – 01/2015

- The cables are only protected by slow-blow high-power fuses or a motor protection switch. For more information, see section "Permitted voltage supply systems" (→ 🗎 41).
- Make sure that the shieldings and sheaths of power cables are designed in accordance with the wiring diagram in section "Connecting the frequency inverter and motor" (→ 🗎 45).
- Make sure that all terminals have been tightened with the proper tightening torque (see chapter "Technical data" (→ 🗎 169)).

General

Unlike direct operation in the supply system, frequency 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.

Line contactors

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

Make sure to observe a minimum time interval of 120 seconds between two cycles.

Mains fuses

Fuse types:

- Line protection types in utilization categories gL, gG:
  - Nominal fuse voltage ≥ nominal line voltage
  - The nominal fuse current must be designed for 100% of the nominal frequency inverter current, depending on the use of the frequency inverter.
- Miniature circuit breaker with characteristic B:
  - Nominal circuit breaker voltage ≥ nominal line voltage
  - The nominal currents of the miniature circuit breakers must be 10% higher than the nominal frequency 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 3-phase frequency inverters.

- A 3-phase frequency inverter creates a DC component in the leakage current and may greatly reduce the sensitivity of a type-A residual current device. A type-A residual current device is therefore not permitted as a protection device.

  Use only a type-B residual current device.
- If the use of a residual current device is not stipulated in the standards, SEW-EURODRIVE recommends not using a residual current device.

Operation on an IT system

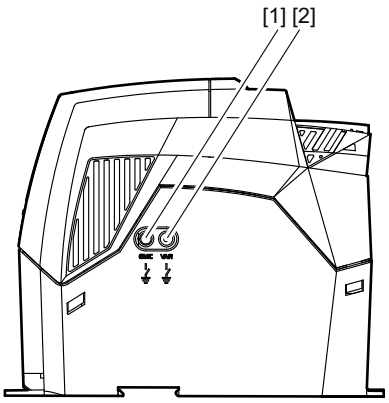
IP20 units can run on an IT system as described below. For all other units, contact SEW-EURODRIVE. Here, you have to disconnect the components for overvoltage suppression and disable the filter. Remove the EMC and VAR screws from the side of the unit.

⚠ WARNING

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

Severe or fatal injuries.

- Disconnect the frequency inverter from the power supply at least ten minutes before removing the EMC screw.



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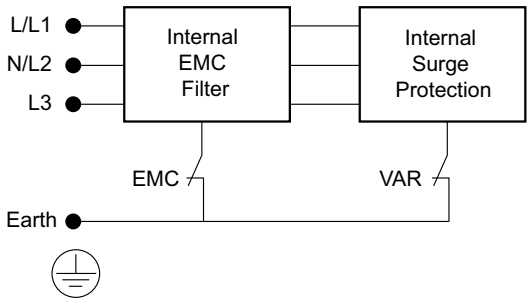
[1] EMC screw
[2] VAR screw



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

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

IP20 frequency inverters with an 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 an EMC filter. The EMC filter may trigger faults during operation with residual current devices. To reduce the leakage current, disable the EMC filter. Remove the EMC screw from the side of the unit. See the figure in chapter "Operation on an IT system" (→ 🗎 40).

21270996/EN – 01/2015

Permitted voltage supply systems

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

  The frequency inverter is intended for operation on TN and TT systems with a directly grounded star point.

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

  Operation on systems with a non-grounded star point (for example, IT systems) is permitted only for frequency inverters with IP20 degree of protection. See chapter "Operation on an IT system" (→ 🗎 40).

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

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

Help card

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

In the IP55 housing, the help card is affixed behind the removable front cover.

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

21270996/EN – 01/2015

5.3.2 Installation

Connect the frequency inverter as shown in the wiring diagrams below. Ensure proper wiring in the motor terminal box. A distinction is made between the following two basic connections: star connection and delta connection. Make sure that the motor is connected with the voltage source in such a way that it is supplied with the correct operating voltage.

For more information, refer to the figure in section "Wiring in the motor terminal box" (→ 🗎 44).

It is recommended that you use a 4-core PVC-insulated and shielded cable as the power cable. Route this cable in accordance with the relevant national regulations of the industry sector as well as the rules and standards. Conductor end sleeves are required in order to connect the power cables to the frequency inverter.

The grounding terminal of each frequency inverter must be connected individually and **directly** to the ground busbar (mass) of the installation site (via a filter, if available).

See section "Connecting the frequency inverter and motor" (→ 🗎 45).

Do not loop the ground connections of the MOVITRAC® LT inverter from one inverter to the other. Furthermore, do not 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.

To comply with UL regulations, all earth connections must be designed with UL-listed crimping ring cable lugs.

INFORMATION

Make sure that the earth connections are executed properly. The inverter may generate leakage currents in excess of 3.5 mA. The grounding cable must be adequately sized in order to route the maximum supply fault current, which is 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.

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

Removing the terminal cover

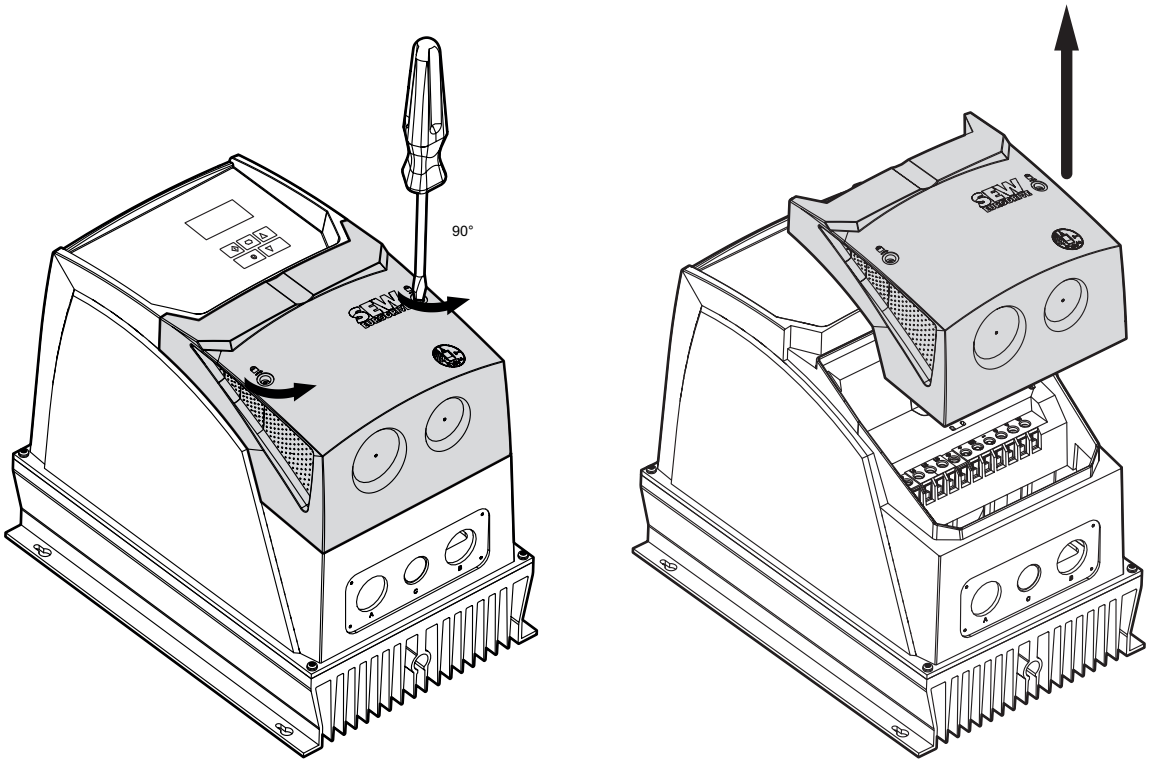
To access the terminals, remove the front cover of the frequency inverter. To open the terminal cover, use only a screwdriver for recessed-head screws or slotted screws.

The terminals can be accessed when the two or four screws on the front of the product are loosened as shown below.

The front cover is attached by proceeding in reverse order.

21270996/EN – 01/2015

Sizes 2 and 3



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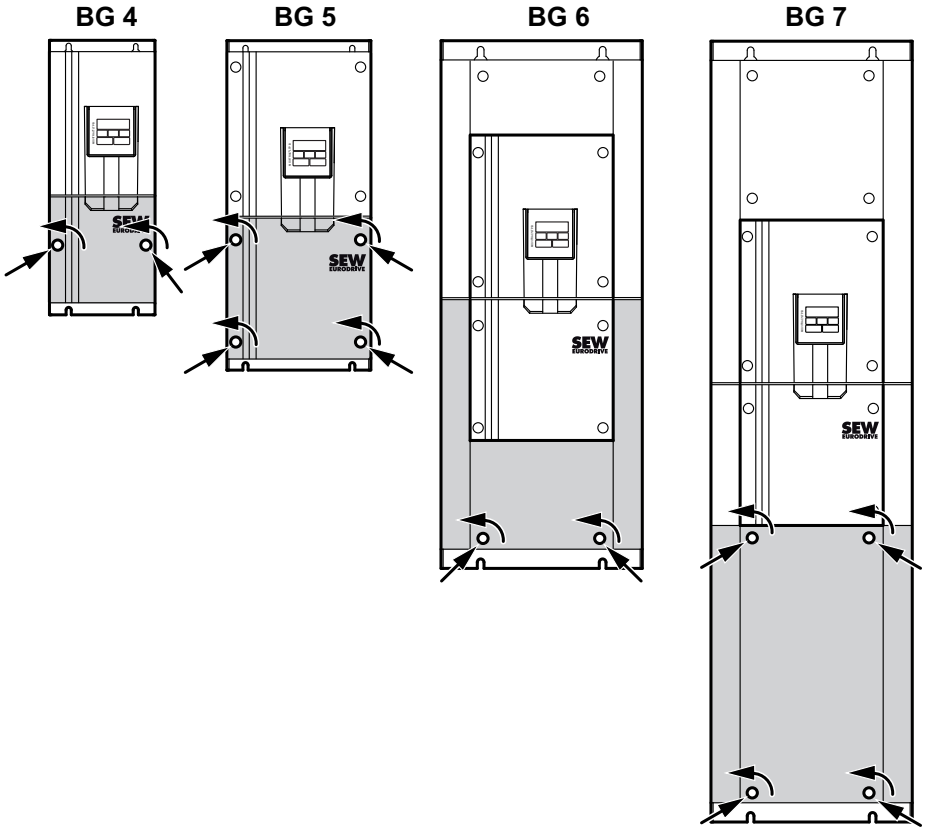
Sizes 4 to 7



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21270996/EN – 01/2015

Connecting and installing the braking resistor

⚠ WARNING

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

Severe or fatal injuries.

- Disconnect the frequency inverter from the power supply at least ten minutes before removing the supply cable.

⚠ CAUTION

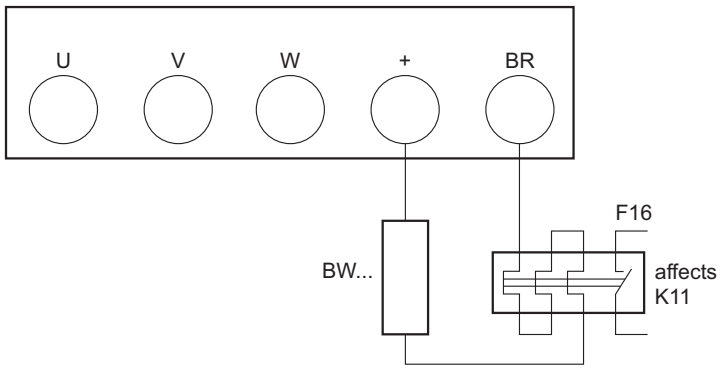
Danger of burns The surfaces of the braking resistors get very hot when the braking resistors are loaded with P_N.

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 frequency inverter terminals "BR" and "+". In new units, these terminals are provided with detachable covers. Detach the covers at first use.

- Shorten the cables to the required length.
- Use two tightly twisted cables or a 2-core shielded power cable. The cross section corresponds to the rated power of the frequency inverter.
- Protect the braking resistor with a bimetallic relay and set the tripping current I_F of the corresponding braking resistor.
- Flatpack resistors have internal thermal overload protection (a non-replaceable fuse). Install the flatpack resistors together with the appropriate touch guard.
- For braking resistors in the BW...-...-T series, you can (as an alternative to the bimetallic relay) connect the integrated temperature sensor using a 2-core, shielded cable.



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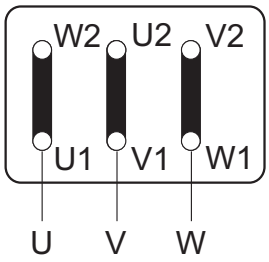
Connection in the motor terminal box

Motors are either connected in star, delta, double star or NEMA star. The motor nameplate provides information about the voltage range for the respective connection type, which must correspond to the operating voltage of the frequency inverter.

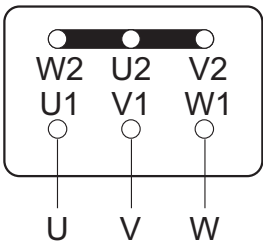
21270996/EN – 01/2015

R13



2933392011

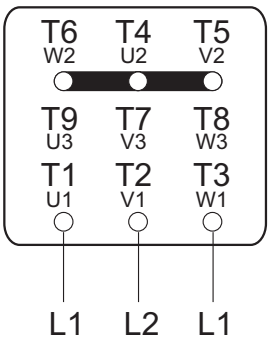
Low voltage Δ



2933393675

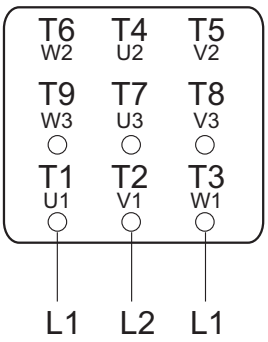
High voltage ⅄

R76



2933395339

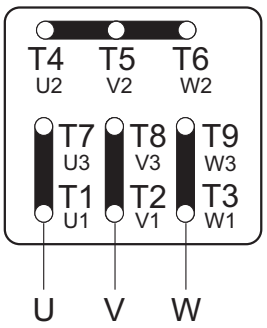
Low voltage ⅄ ⅄



2933397003

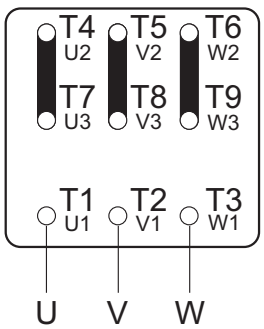
High voltage ⅄

DR/DT/DV



2933398667

Low voltage ⅄ ⅄



2933400331

High voltage ⅄

Connecting the frequency inverter and motor

⚠ WARNING

Danger of electric shock. Improper wiring may cause danger due to high voltages.

Severe or fatal injuries.

- Adhere to the connection sequence illustrated below.

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

- All hoisting applications
- Applications that require a quick brake reaction time

INFORMATION

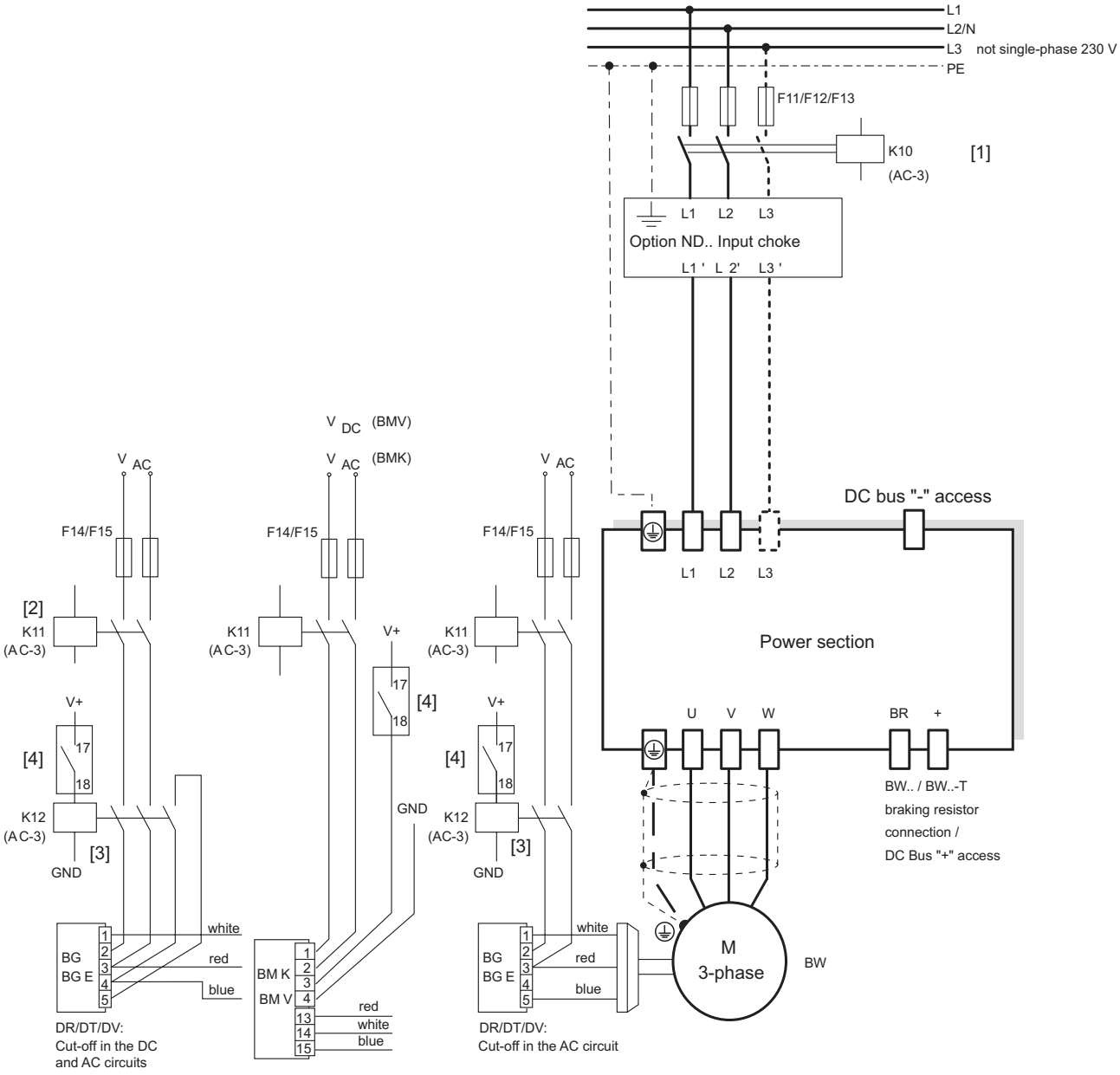
In new units, the terminals DC-, DC+, and BR are initially provided with detachable covers. If necessary, detach these covers.

All IP55 frequency inverters have a power supply entry and a motor cable entry on the underside of the frequency inverter.

Connect the brake rectifier using a separate supply system lead.

Supply via the motor voltage is not permitted.

21270996/EN – 01/2015



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[1] Mains contactor between supply system and frequency inverter
[2] Mains supply to brake rectifier, switched simultaneously by K10
[3] Control contactor/relay, energized by the internal relay contact [4] of the frequency inverter and therefore supplies the brake rectifier
[4] Isolated relay contact of the frequency 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

Motor thermal protection (TF/TH)

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

If thermal protection is triggered, the frequency inverter displays a fault.

The temperature sensor is connected to terminal 1 (+24 V) and terminal 10 (analog input 2). In parameter *P1-15*, you must select an input configuration with the function "External fault" at analog input 2 (for example, *P1-15* = 6) so that the temperature sensor can be evaluated. In addition, you must set the "External fault" at analog input 2 in parameter *P2-33* to "PTC-th". The trigger threshold is 2.5 kΩ. Information about the motor thermistor is available in chapter "P1-15 Digital inputs function selection" (→ 🗎 166) and in the description of the parameter "P2-33 Analog input 2 format" (→ 🗎 132).

INFORMATION

Configure the above parameters before you connect the TF temperature sensor. An internal resistor protects the TF temperature sensor from overvoltage after you configure the parameters.

Multi-motor drive / group drive

The total of the motor currents must not exceed the nominal current of the frequency inverter. The maximum permitted cable length for the group is limited to the values of the single connection. See chapter "Technical data" (→ 🗎 169).

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

Multi-motor operation is only possible with AC asynchronous motors, not with synchronous motors.

For groups comprising more than three motors, SEW-EURODRIVE recommends using an output choke "HD LT xxx", unshielded cables, and a maximum permitted output frequency of 4 kHz.

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.

21270996/EN – 01/2015

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 electromagnetically and brake using spring force. A brake rectifier supplies the brake with DC voltage.

INFORMATION

The brake rectifier must have a separate supply system lead when the frequency inverter is running. Supply via the motor voltage is not permitted.

5.3.3 Overview of signal terminals

Main terminals

⚠ CAUTION

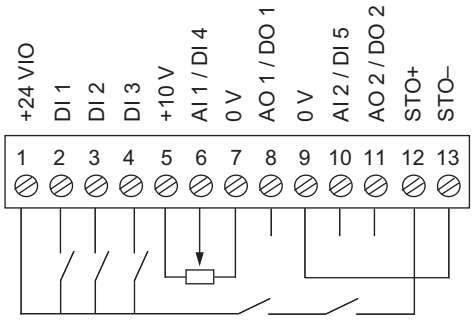
Applying voltages of more than 30 V to the signal terminals may damage the controller.

Possible damage to property.

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

The terminal assignment can be set with parameter *P1-15*. For more information, see chapter "P1-15 Digital inputs function selection" (→ 🗎 166).

IP20 and IP55



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The signal terminal block is equipped with the following signal connections:

Terminal no.	Signal	Connection	Description
1	+24 VIO	+24 V: Reference voltage	Reference voltage for activating DI1 – DI3 (max. 100 mA)
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	

Terminal no.	Signal	Connection	Description
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 "Logic 1" input voltage range: DC 8 – 30 V
7	0 V	0 V: Reference potential	0 V: Reference potential
8	AO 1 / DO 1	Analog output 1 (10 bit) Digital output 1	Analog: 0 – 10 V, 10 – 0 V, 0 – 20 mA, 20 – 0 mA, 4 – 20 mA, 20 – 4 mA Digital: 0 / 24 V maximum output current: 20 mA
9	0 V	0 V: Reference potential	0 V: Reference potential
10	AI 2 / DI 5	Analog input 2 (12 bit) Digital input 5 / thermistor contact	Analog: 0 – 10 V, 10 – 0 V, PTC-th, 0 – 20 mA, 4 – 20 mA, 20 – 4 mA "Logic 1" input voltage range: DC 8 – 30 V
11	AO 2 / DO 2	Analog output 2 (10 bit) Digital output 2	Analog: 0 – 10 V, 10 – 0 V, 0 – 20 mA, 20 – 0 mA, 4 – 20 mA, 20 – 4 mA Digital: 0 / 24 V maximum output current: 20 mA
12	STO+	Output stage enable	DC +24 V input, current consumption: max. 100 mA STO safety contact, high = DC 18 – 30 V
13	STO-		GND reference potential for DC +24 V input STO safety contact

All digital inputs are activated 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.

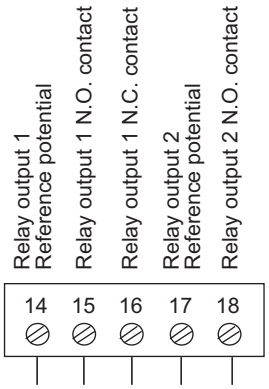
INFORMATION

Terminals 7 and 9 can be used as GND reference potential if the frequency inverter is controlled by a PLC. Connect STO+ to +24 V and STO- to 0 V to enable the power output stage. Otherwise, the frequency inverter will display "Inhibit". If STO is to act as a safety function, observe the information and connections in this publication.

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

21270996/EN – 01/2015

Overview of relay terminals



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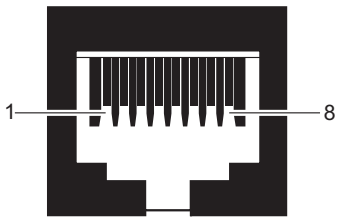
Terminal no.	Signal	Relay function selection	Description
14	Relay output 1 reference	*P2-15*	Relay contact (AC 250 V / DC 30 V, max. 5 A)
15	Relay output 1 NO contact		
16	Relay output 1 NC contact		
17	Relay output 2 reference	*P2-16*	
18	Relay output 2 NO contact		

5.3.4 Communication socket RJ45

Socket at unit



13515899787

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

5.3.5 UL-compliant installation

Note the following points for a UL-compliant installation:

Ambient temperatures

The frequency 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

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

Tightening torques for power terminals

The permitted tightening torques for the frequency inverter power terminals are listed in chapter "Technical data" (→ 🗎 169).

Tightening torques for control terminals

The permitted tightening torque for the control terminals is 0.8 Nm (7 lb_f-in).

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 frequency inverters are suitable for operation in voltage supply systems with an earthed star point (TN and TT systems) that supply a maximum line current and a maximum line voltage in accordance with the tables below. The fuses listed in the tables below are the maximum permitted back-up fuse for each frequency inverter. Use fuses only.

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

1 × 200 – 240 V units

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		

21270996/EN – 01/2015

3 × 200 – 240 V units

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		

21270996/EN – 01/2015

3 × 380 – 480 V units

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		

21270996/EN – 01/2015

3 × 500 – 600 V units

3 × 500 – 600 V	Fuse or MCB (type B)	Max. supply short-circuit current	Max. line voltage
0008	6 A	100 kA rms (AC)	600 V
0015	6 A		
0022	10 A		
0040	10 A		
0055	15 A		
0075	20 A		
0110	30 A		
0150	35 A		
0185	45 A		
0220	60 A		
0300	70 A		
0370	80 A		
0450	100 A		
0550	125 A		
0750	150 A		
0900	175 A		
1100	200 A		

Thermal motor protection

The frequency inverter is provided with thermal motor overload protection in accordance with 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 thermal protection (TF/TH)" (→ 🗎 48)
- Using internal thermal motor overload protection by enabling parameter *P4-17*

5.3.6 Electromagnetic compatibility (EMC)

Frequency inverters with an EMC filter are designed for use in machines and drive systems. They meet the EMC product standard EN 61800-3 for drives with variable speed. For an EMC-compliant installation of the drive system, observe the specifications of Directive 2004/108/EC (EMC) of the European Council.

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.

21270996/EN – 01/2015

Interference emission

With regard to the interference emission, the frequency inverter with an EMC filter meets the limit values defined in the standards EN 61800-3 and EN 55014. The frequency inverters can be used for both industrial and domestic (light industrial) applications.

To ensure the best possible electromagnetic compatibility, install the frequency inverters as described in chapter "Installation" (→ 🗎 31). Ensure good ground connections for the frequency inverters. To comply with interference emissions, use shielded motor cables.

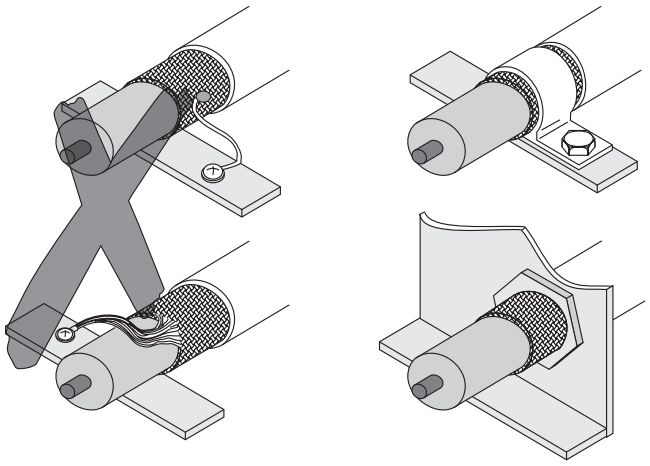
The conditions for use in drive applications are defined in the table below.

<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>

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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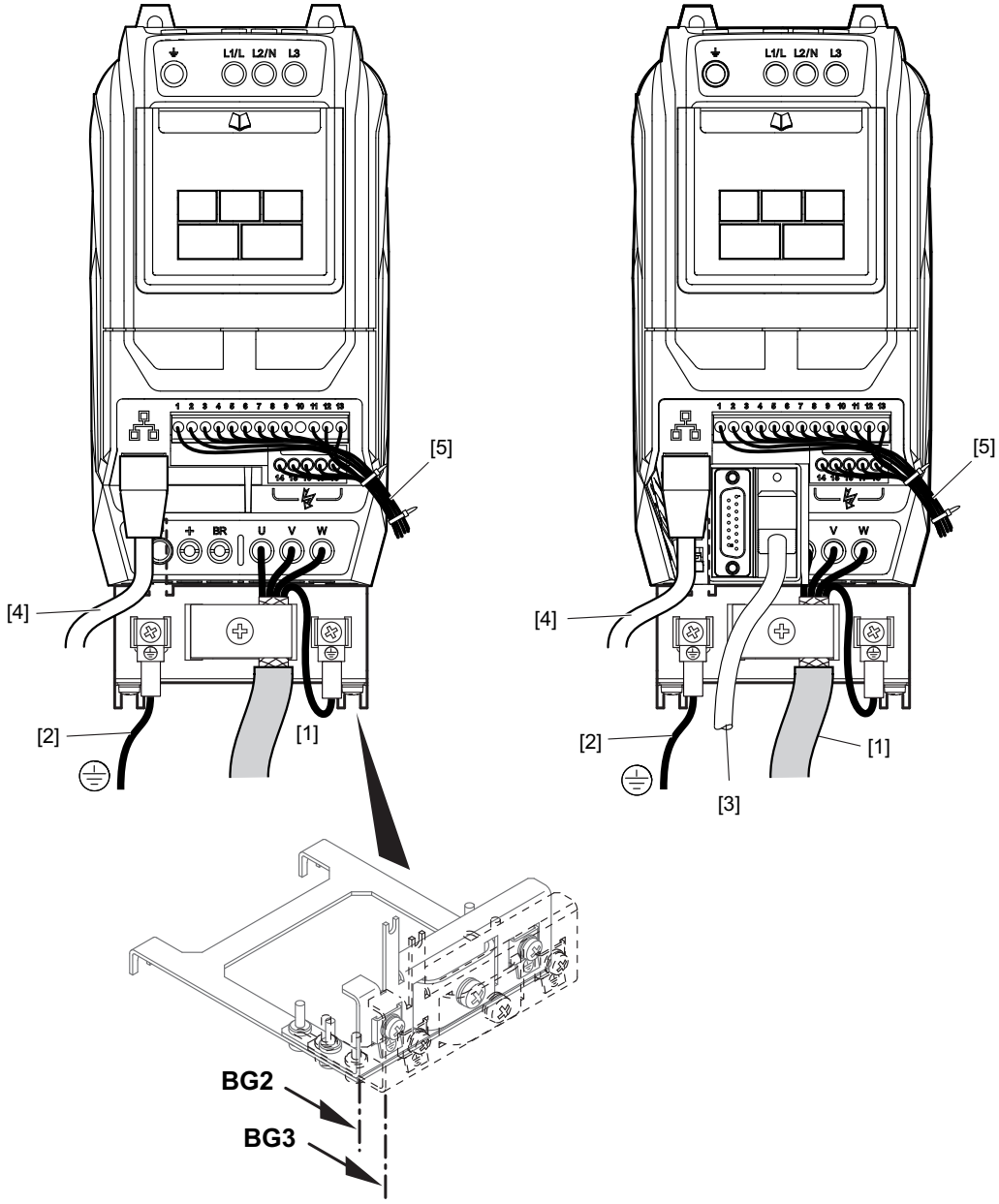
21270996/EN – 01/2015

Recommendation for connecting the motor shield with an IP20 frequency inverter

Sizes 2 and 3



12903068427

[1] Motor cable
[2] Additional PE connection
[3] Encoder cable
[4] Communication cable RJ45
[5] Control cables

In the IP20 design, you can use the shield plate for sizes 2 and 3 (optional). To make the adjustment, proceed as follows:

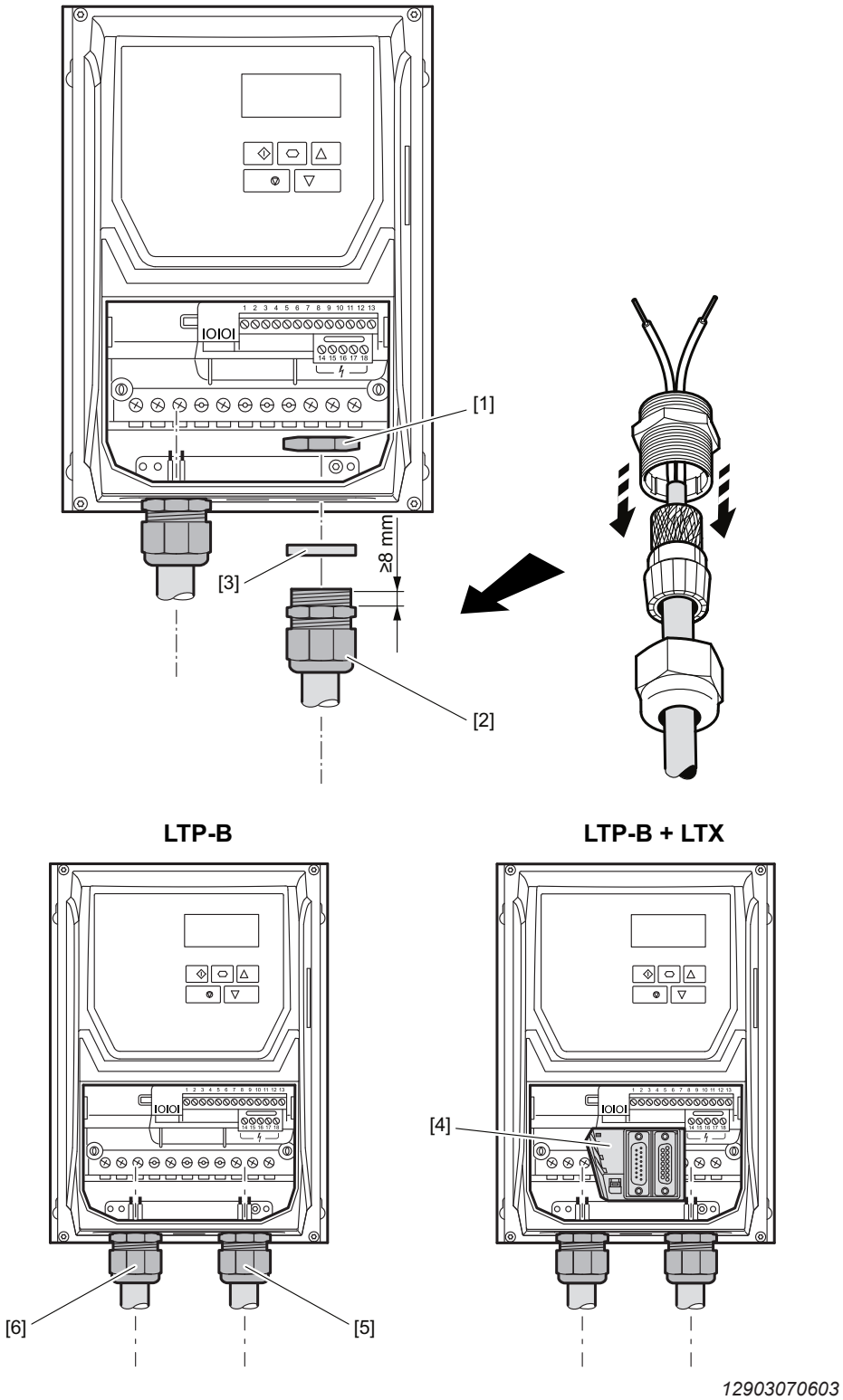
1. Loosen the 4 screws in the slotted holes.
2. Move the sheet metal for the required size as far as it can go.
3. Tighten the screws again.

Make sure that the sheet metal is properly connected to the PE connection.

Recommendation for connecting the motor shield with an IP55 frequency inverter

We recommend that you use metal cable glands to connect the motor shield to the unit. For sizes 2 and 3, the threadneck length must be at least 8 mm.

Sizes 2 and 3

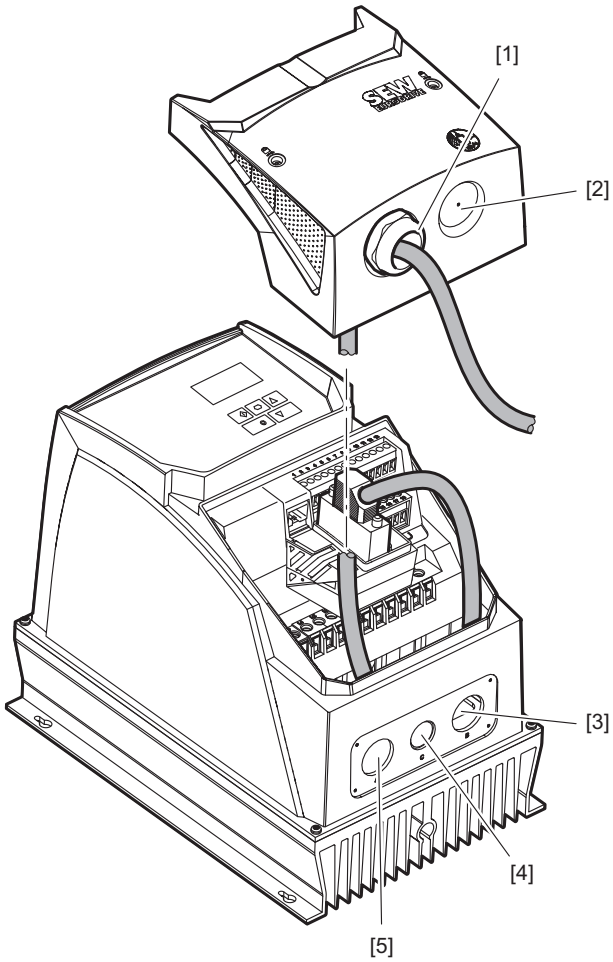


12903070603

[1] Counter nut made of metal
[2] Metal cable gland
[3] Enclosed rubber gasket
[4] LTX module
[5] Motor cable
[6] Supply system lead

21270996/EN – 01/2015

Recommendation for routing the encoder, control, and communication cables



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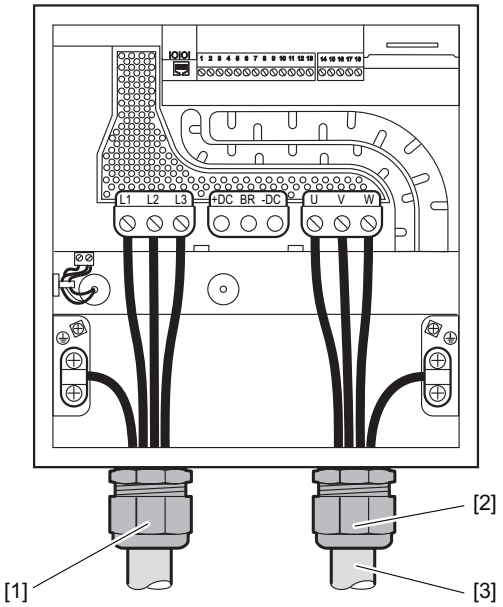
[1] Encoder cable, if LTX module present
[2] Signal terminal/communication
[3] Motor cable
[4] Signal terminal/communication
[5] Supply system lead

21270996/EN – 01/2015

Sizes 4 and 5

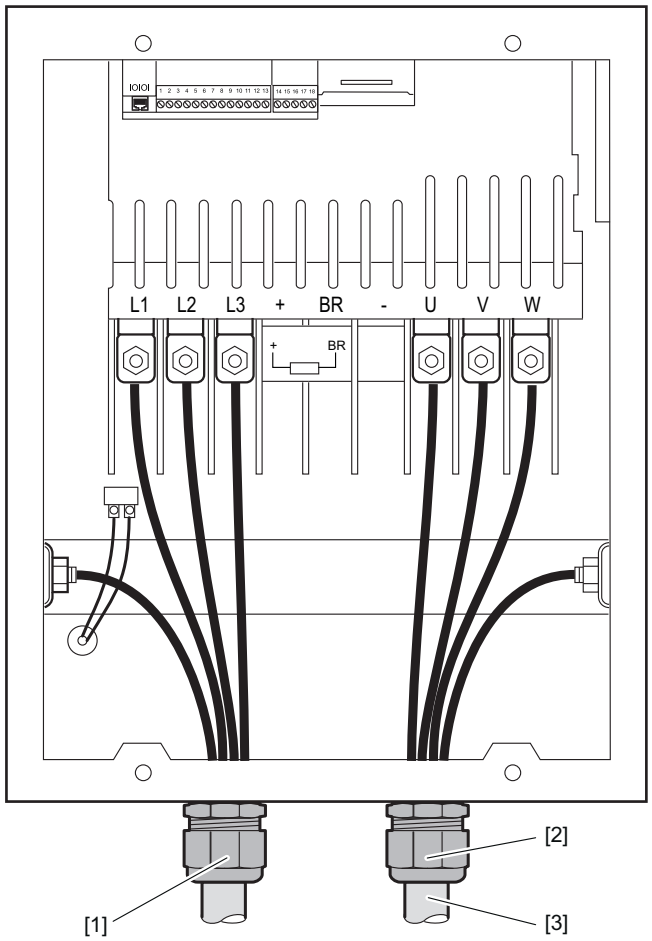


14172961163

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

21270996/EN – 01/2015

Sizes 6 and 7



14172963851

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

21270996/EN – 01/2015

5.3.7 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 cause particles to remain in the product.

Possible damage to property.

- Be careful when drilling the hole to prevent particles from remaining in the product.

→ Remove any remaining particles.

Some size guidelines are provided below:

Recommended hole sizes and hole types for the cable gland

	Hole size	Anglo-American	Metrical
Sizes 2 and 3	25 mm	PG16	M25

Hole sizes for flexible electrical installation ducts

	Hole size	Trade size	Metrical
Sizes 2 and 3	35 mm	1 in	M25

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

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

Not intended for rigid electrical installation ducts.

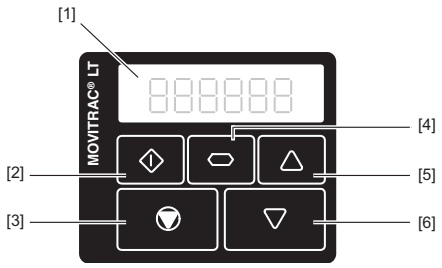
21270996/EN – 01/2015

6 Startup

6.1 User interface

6.1.1 Operator terminal

Each MOVITRAC® LT inverter is equipped with an operator terminal as standard, which allows for operating and setting up the frequency inverter without the use of any further devices.



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

The operator terminal has five keys with the following functions:

Key	Navigate [4]	• Toggle between menus • Save parameter values • Display realtime information
Key	Up [5]	• Increase speed • Increase parameter values
Key	Down [6]	• Decrease speed • Decrease parameter values
Key	Stop [3]	• Stop drive • Acknowledge error
Key	Start [2]	• Enable drive • Change direction of rotation

If the parameters are set to the factory setting, the <Start> and <Stop> keys of the operator terminal are disabled. To release the <Start>/<Stop> keys on the operator terminal for use, set parameter *P-12* for LTE-B or *P1-12* for LTP-B to "1" or "2".

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

- To toggle between the menu for changing parameters and the realtime display (operating speed/operating current), keep the key pressed for longer than one second.
- To toggle between the operating speed and the operating current of the running frequency inverter, press the key briefly (for less than one second).

6.1.2 Reset parameters to default settings

To reset the parameters to their default value, proceed as follows:

1. The frequency inverter must not be enabled and "Inhibit" must be shown on the display.
2. Press the 3 keys  ,  , and  simultaneously for at least 2 s.

   "P-deF" is shown on the display.
3. Press the  key to acknowledge the "P-deF" message.

6.1.3 Factory setting

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

6.1.4 Further key combinations

Function	The unit 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. • "P2-01" is now 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.
Select 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.
Change individual digits within 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.

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

6.1.5 Software LT Shell

The LT Shell software facilitates a simple, fast startup of MOVITRAC® LT inverters. It is available for download from the SEW-EURODRIVE website. After the installation, perform software updates on a regular basis.

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

21270996/EN – 01/2015

which can be used to carry out the following tasks:

- Observe, upload and download parameter
- Save parameter settings
- Firmware updates (manual and automatic)
- Export frequency inverter parameters to Microsoft® Word
- Monitor the state of the inputs/outputs and the motor
- Control the frequency inverter/manual mode
- Scope (in preparation)

6.1.6 MOVITOOLS® MotionStudio software

The software can be connected to the frequency inverter as follows:

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

The following functions are available in MOVITOOLS® MotionStudio:

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

21270996/EN – 01/2015

6.2 Auto tune

The frequency inverter is not based on motor databases. It is able to auto tune almost all motors in order to determine the relevant motor data. You must perform auto tune without interruption. After a reset to factory settings, auto tune starts after the first enable and lasts for up to two minutes, depending on the control mode. Enable the frequency inverter only after you have correctly entered all rated motor data in the relevant parameters. Once you have entered the motor data, you can also use parameter *P4-02* to start auto tune manually. Terminals 12 and 13 for STO must be connected to a voltage supply. It is not necessary to enable the frequency inverter. "Stop" must be shown on the display.

INFORMATION

After the initial startup or a change to the control mode in *P4-01*, perform auto tune when the motor is not running (cold). If necessary, you can also perform auto tune manually at any time by starting parameter *P4-02*.

6.3 Startup for motors

⚠ WARNING

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

Severe or fatal injuries.

- Do not touch the motor shaft.

INFORMATION

For MOVITRAC® LTP-B, 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*.

6.3.1 Startup for asynchronous motors with V/f control

1. Connect the motor to the frequency inverter. When connecting the motor, pay attention to the nominal voltage of the motor.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = rated 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, 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 auto tune as described in chapter "Auto tune" (→ 🗎 66).

6.3.2 Startup for asynchronous motors with VFC speed control

1. Connect the motor to the frequency inverter. When connecting the motor, pay attention to the nominal voltage of the motor.

21270996/EN – 01/2015

2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = rated 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 (advanced 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 auto tune as described in chapter "Auto tune" (→ 🗎 66).
6. If necessary, adjust *P7-10* to optimize the control response.

6.3.3 Startup for asynchronous motors with VFC torque control

1. Connect the motor to the frequency inverter. When connecting the motor, pay attention to the nominal voltage of the motor.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = rated 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 (advanced 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 user units in the "Acceleration" row to two decimal places.
5. Start auto tune as described in chapter "Auto tune" (→ 🗎 66).
6. If necessary, adjust *P7-10* to optimize the control response.

In the example below, analog input 2 is used as a source of reference for torque, while the speed is set in analog input 1:

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

21270996/EN – 01/2015

6.3.4 Startup for synchronous motors with PM speed control

Synchronous motors are Permanent Magnet (PM) motors.

INFORMATION

A test application must be used to test the operation of synchronous motors without an encoder. Stable operation in this operating mode cannot be ensured for all application scenarios. Therefore, the user is personally responsible for using the operating mode.

1. Connect the motor to the frequency inverter. When connecting the motor, pay attention to the nominal voltage of the motor.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = EMF → In the case of synchronous motors, the internal voltage at nominal speed, and not the system voltage, is entered in *P1-07* (motor voltage).
   - *P1-08* = rated current of the motor
   - *P1-09* = rated frequency of the motor
   - *P1-10* = rated speed of the motor
   - *P1-14* = 201 (advanced parameter menu)
   - *P4-01* = 3 (PM 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 auto tune as described in chapter "Auto tune" (→ 🗎 66).
6. If necessary, adjust *P7-10* to optimize the control response.

If unexpected problems occur during motor control, you should test or configure the following:

- To achieve greater torque in the lower speed range, you must increase the two parameters *P7-14* and *P7-15*. Note that the higher current flow may cause the motor to heat up significantly.
- If an "O torque" error message occurs during the initial starting torque, a fault-free startup generally occurs after you reset the frequency inverter.
- It is partly necessary to align the rotor of high-inertia motors before startup. To achieve this, you can easily increase or decrease the pre-magnetization time *P7-12* and the field strength during the pre-magnetization time in *P7-14*.

In rare cases, it may be helpful to compare the parameters determined by auto tune with the motor data parameters and correct them, if necessary. Note that the values may differ in the case of long motor cables.

It is not necessary to repeat the auto tune process.

- *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)

21270996/EN – 01/2015

6.3.5 Startup for LSPM motors

SEW-EURODRIVE motors of the type LSPM are Line Start Permanent Magnet motors.

1. Connect the motor to the frequency inverter. When connecting the motor, pay attention to the nominal voltage of the motor.
2. Enter the motor data indicated on the motor nameplate:
   - *P1-07* = rated 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 (advanced parameter menu)
   - *P4-01* = 0 (VFC speed control).
3. Set the maximum speed *P1-01* and the minimum speed *P1-02* = 300 rpm.
4. Set the acceleration and deceleration ramps using *P1-03* and *P1-04*.
5. Start auto tune as described in chapter "Auto tune" (→ 🗎 66).
6. After "auto tune", set the rotor resistance to 0 Ω (*P7-02* = *0*).
7. Adjust the boost parameters. The following is a default setting:
   - *P7-14* = 10%
   - *P7-15* = 10%
8. If necessary, adjust *P7-10* to optimize the control response.

6.3.6 Startup for preset synchronous motors

The inverter is suitable for permanent magnet motors without encoders, such as LSPM. In the case of CMP motors, both the AK0H encoder and the LTX servo module are required.

6.3.7 Startup for SEW-EURODRIVE preset motors

Startup can be performed if one of the following CMP motors (speed class 4500 rpm) or MGF..-DSM motors (speed class 2000 rpm) is connected to the frequency 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[1)]	gf-4Ht

1) In preparation

21270996/EN – 01/2015

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 "Addendum to the MOVITRAC® LTX 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 required parameters (voltage, current, and so on) are set automatically.

INFORMATION

"Auto tune" is not required for preset motors.

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

If MGF..-DSM is selected, the upper torque limit in *P4-07* is automatically set to 200%. You must use the publication "Addendum to the operating instructions for the MGF..-DSM drive unit on the LTP-B frequency inverter" to adjust this value in accordance with the gear unit ratio.

All necessary motor data is set automatically. To protect the motor, the KTY temperature sensor must be connected to an external monitoring device.

Ensure motor protection by means of an external protection device.

- For a detailed list, refer to chapter "Servo-specific parameters" (→ 🗎 122).

6.4 Startup of control

⚠ WARNING

An enable can be achieved by installing sensors or switches on the terminals. The motor can start up automatically.

Severe or fatal injuries.

- Do not touch the motor shaft.
- Install switches in their open state.
- If you install a potentiometer, set it to 0 beforehand.

21270996/EN – 01/2015

6.4.1 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 in accordance with your requirements in *P1-15*. For possible settings, see chapter "P1-15 Digital inputs function selection" (→ 🗎 166).
- 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 sliding contact is connected to pin 6.
- Connect terminals 12 and 13 of the STO input as described in chapter "Disconnection of single drive" (→ 🗎 26).
- Enable the frequency inverter by establishing a connection between terminals 1 and 2.
- Set the speed using the potentiometer.

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

For operation in keypad mode:

- Set *P1-12* to "1" (uni-directional) or "2" (bi-directional).
- To enable the frequency inverter, connect a wire break or switch between terminals 1 and 2 on the user terminal block.
- Connect terminals 12 and 13 of the STO input as described in chapter "Disconnection of single drive" (→ 🗎 26).
- Press the <Start> key. The frequency inverter is enabled with 0.0 Hz.
- To increase the speed, press the <Up> key. To reduce the speed, press the <Down> key.
- To stop the frequency inverter, press the <Stop/reset> key.
- To revert the drive to the original speed, press the "Start" key again. If bi-directional mode is activated (*P1-12* = 2), the direction is reversed by pressing the <Start> key again.

INFORMATION

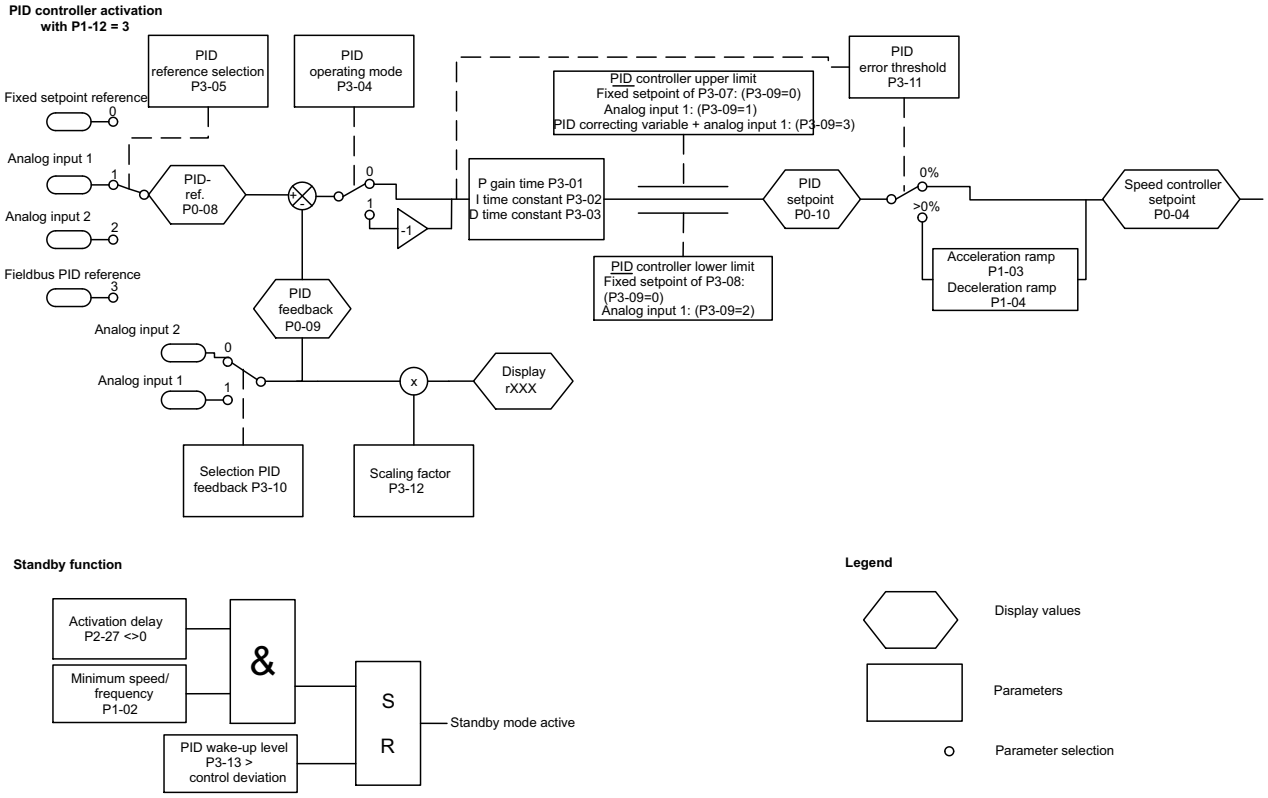
You can preset the required setpoint speed by pressing the <Stop/reset> key at standstill. Pressing the <Start> key then accelerates the drive along the configured ramp until it has reached the required speed.

21270996/EN – 01/2015

6.4.3 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.



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General information on use

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

You can set the setpoint 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 setting *P3-05* = 0 activates the fixed setpoint reference entered in *P3-06* . As soon as parameters *P9-34* and *P9-35* are described with a value other than "OFF", three additional fixed setpoint references (*P3-14* to *P3-16*) are activated and selected in accordance with the table below:

Selecting the terminals via *P9-34*	Selecting the terminals 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*

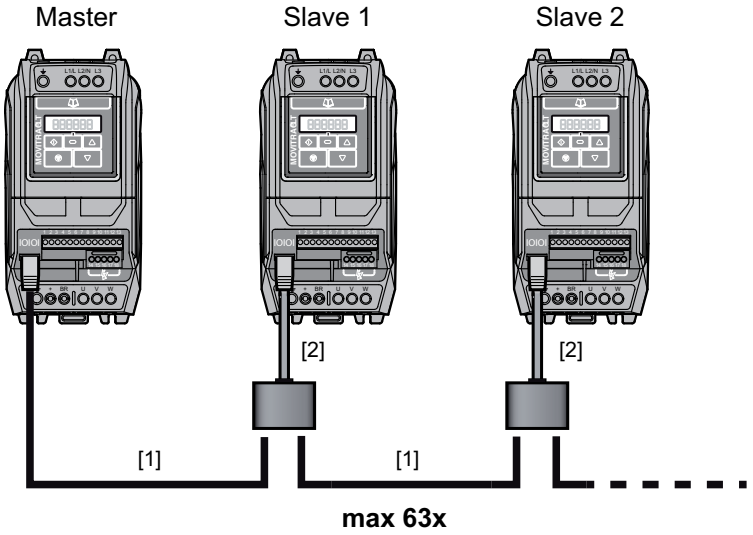
Fieldbus PID reference

Here, the following parameters must be set in the frequency inverter:

P1-12 = 5 (for example, control signal source SBus)

P1-14	=	201 (advanced parameter menu)
P1-15	=	0 (free function selection of digital inputs)
P3-05	=	3 (PID reference via fieldbus)
P5-09 – 11	=	4 (select process output data word for PID reference)
P9-01	=	Select digital input for frequency inverter enable
P9-10	=	PID (speed source for frequency inverter)

6.4.4 Master/slave mode (*P1-12* = 4)



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

The frequency inverter has a built-in master/slave function. A special protocol facilitates master/slave communication. The frequency inverter then communicates via the RS485 engineering interface. In a communication network, RJ45 connectors can be used to connect up to 63 frequency inverters to one another. One frequency inverter is configured as a master while all other frequency inverters are configured as slaves. Each network may have only one master frequency inverter. This master frequency inverter transmits its operating state (such as enabled, disabled) and its setpoint frequency every 30 ms. The slave frequency inverter then tracks the operating state of the master frequency inverter.

Configuring the master frequency inverter

The master frequency inverter in each network must have the communication address "1". Set the following:

- *P1-12* ≠ 4
- *P1-14* = 201 (advanced parameter menu)
- *P5-01* frequency inverter address (communication) to "1"

Configuring the slave frequency inverter

- Each connected slave must have a unique slave communication address that is set in *P5-01*. You can assign slave addresses from 2 to 63. Set the following:

- *P1-12* to "4"
- *P1-14* = 201 (advanced parameter menu)
- The type of speed scaling in *P2-28*
- The scaling factor in *P2-29*

INFORMATION

Cable set B can be used to set up the master/slave network. It is not necessary to use a terminating resistor.

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

See chapter "Fieldbus operation" (→ 🗎 89).

6.4.6 MultiMotion mode (P1-12 = 8)

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

21270996/EN – 01/2015

6.5 Hoisting function

The MOVITRAC® LTP-B is equipped with a hoist function. When the hoist function is active, all relevant parameters and functions are activated and locked, if necessary. To ensure proper functioning, you must start up the motor correctly, as described in chapter "Startup instructions" (→ 🗎 76).

In addition, observe the following points:

- The frequency inverter must be used for the motor brake control. Connect a brake rectifier between inverter relay 2 (terminals 17 and 18) and the brake (see chapter "Electrical installation" (→ 🗎 38)).
- Use an adequately sized braking resistor.
- SEW-EURODRIVE recommends that you do not use the motor in a very low speed range or keep the load at zero speed without applying the brake.
- If you need sufficient torque, run the motor within its nominal range.

To ensure safe operation, the following parameters are preset when the hoist function is active or ignored when the firmware is changed:

- *P1-06*: The energy saving function is disabled.
- *P2-09 / P2-10*: Skip frequencies are ignored.
- *P2-26*: The flying start function is disabled.
- *P2-27*: Standby mode is disabled.
- *P2-36*: The start mode is edge-controlled (Edgr-r).
- *P2-38*: A line voltage failure causes the motor to coast to a halt.
- *P4-06 / P4-07*: The upper torque limits are set to the maximum values.
- *P4-08*: The lower torque limits are set to "0".
- *P4-09*: The upper limit for the regenerative operation torque is set to the maximum value permitted.

The following hoist parameters are already set for motors in the same power range. However, they can be adjusted at any time in order to optimize the system:

- *P2-07*: Preset speed 7 becomes the brake release speed.
- *P2-08*: Preset speed 8 becomes the brake application speed.
- *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 brake release
- *P4-16*: Torque threshold for timeout

The following parameters are permanently locked:

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

21270996/EN – 01/2015

6.5.1 General information

- CW corresponds to an upward direction.
- CCW corresponds to a downward direction.
- To reverse the direction of rotation, stop the motor. To do this, activate the brake. Disable the drive before you reverse the direction of rotation.

6.5.2 Startup for hoist function

Startup recommendations are provided below.

Motor data:

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

Parameter activation:

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

Motor control:

- *P4-01* = 0 (VFC speed control)
- *P4-05* = cos phi

In VFC operation, it is necessary to perform auto tune. Therefore, the motor must be as cold as possible.

Hoist parameter:

P4-12 = 1 (hoist function activated)

Thermal braking resistor protection:

If a sensor is not used to protect the braking resistor, you can set the following parameters (optional) to protect the braking resistor temperature from reaching an excessive level. However, only a sensor can provided guaranteed protection.

- *P6-19*: Braking resistance value
- *P6-20*: Braking resistance power

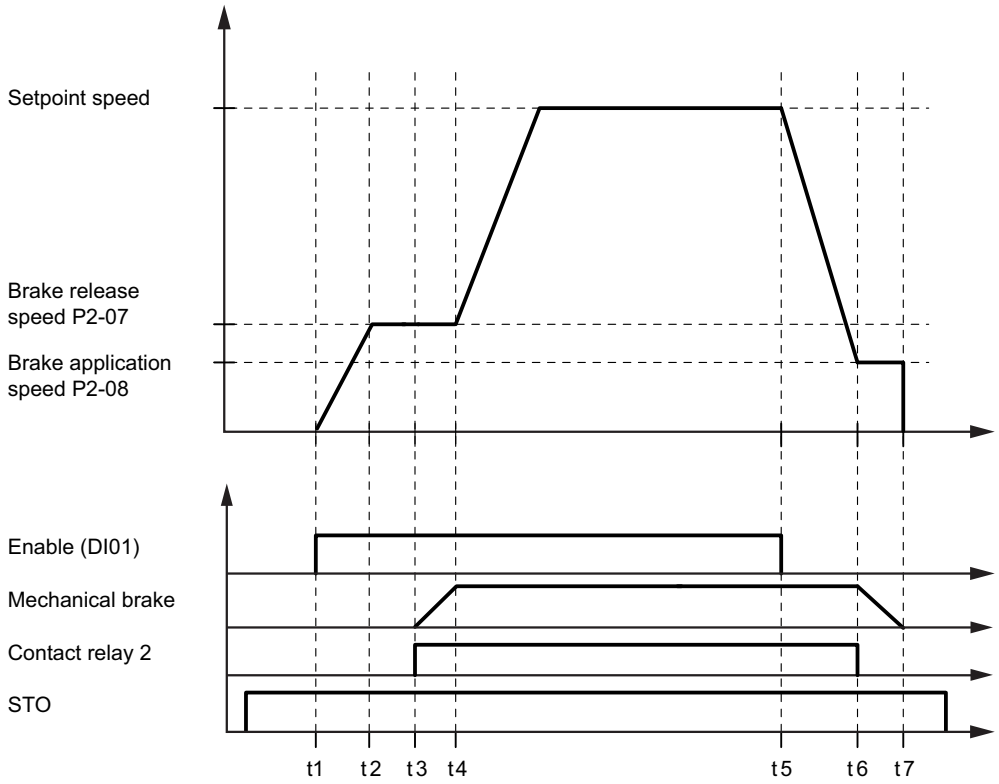
INFORMATION

If hoist mode is activated, the frequency inverter must be enabled. If it is enabled at the same time as or earlier than the STO, the frequency inverter remains in "STOP" mode.

21270996/EN – 01/2015

6.5.3 Hoisting mode

The following diagram shows the hoist operation.



t_1 Frequency inverter enabled

t_1 - t_2 The motor accelerates up to brake release speed (preset speed 7).

t_2 The brake release speed is reached.

t_2 - t_3 Torque threshold *P4-15* verified. The frequency 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 the brake release time *P4-13*

t_4 Brake is open. The drive accelerates up to the setpoint speed.

t_4 - t_5 Normal operation

t_5 Frequency inverter inhibit

t_5 - t_6 Drive slows down to brake application speed (preset speed 8)

t_6 Relay closes

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

t_7 Brake is closed and drive stopped.

21270996/EN – 01/2015

6.5.4 Troubleshooting and optimizing the hoist function

SP-Err / ENC02:

If this error message is displayed, increase the speed error window in *P6-07*.

If problems occur (for example, sagging during hoist operation), check and/or adjust the following parameters:

P1-03 / 04	=	Reduce ramp times and travel through the slow speed ranges as quickly as possible.
P7-10	=	Adjust the stiffness; higher values increase the stiffness of the application.
P4-15	=	Increase the torque threshold for the brake release.
P7-14 / 15	=	If sagging occurs during the hoist operation, we recommend that you increase the boost parameters.
P7-07	=	0. If problems occur during slow lowering speeds, set this parameter to 1.

6.6 Fire mode

When you activate the fire mode input, the frequency inverter drives the motor with the preset values. In this mode, the frequency inverter ignores all faults and shutdowns and operates the motor until it is destroyed or until there is a loss of voltage supply.

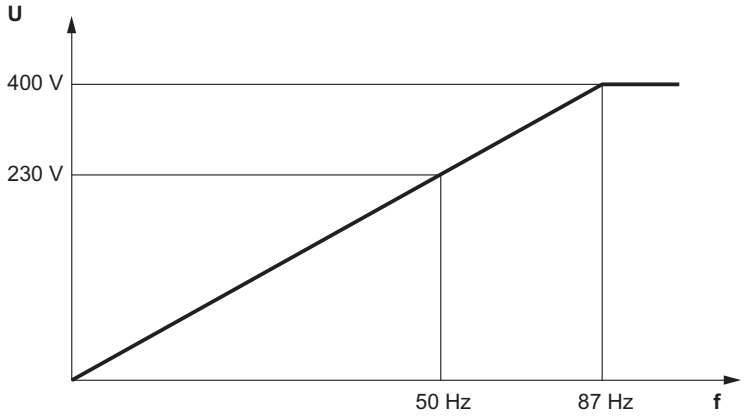
Set fire mode as follows:

- Start up the motor.
- To access further parameters, set parameter *P1-14* to "201".
- To configure the digital inputs, set parameter *P1-15* to "0".
- Configure the inputs depending on the requirements in parameter group *P9-xx*. For terminal control, set parameter *P9-09* to "9 = terminal control".
- Set parameter *P9-33 Fire 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 used in fire mode. You can specify a positive or negative speed setpoint.

21270996/EN – 01/2015

6.7 Operation at 87 Hz characteristic

The V/f ratio remains the same in 87 Hz mode. However, higher speeds and power ratings are generated, thus resulting in a higher current flow.



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Set the "87 Hz characteristic" mode as described below:

- Set parameter *P1-07* to star voltage.
- Set parameter *P1-08* to delta current.
- Set parameter *P1-09* to "87 Hz".
- Set parameter *P1-10* to √3 × nominal speed.

INFORMATION

Set the *P1-01* maximum speed in accordance with your requirements. In 87 Hz mode, the frequency inverter must provide a √ 3 times higher current. If necessary, you must choose a larger frequency inverter size.

6.8 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.

To obtain the same functionality as for the predecessor inverter MOVITRAC® LTP-A, perform startup as described below.

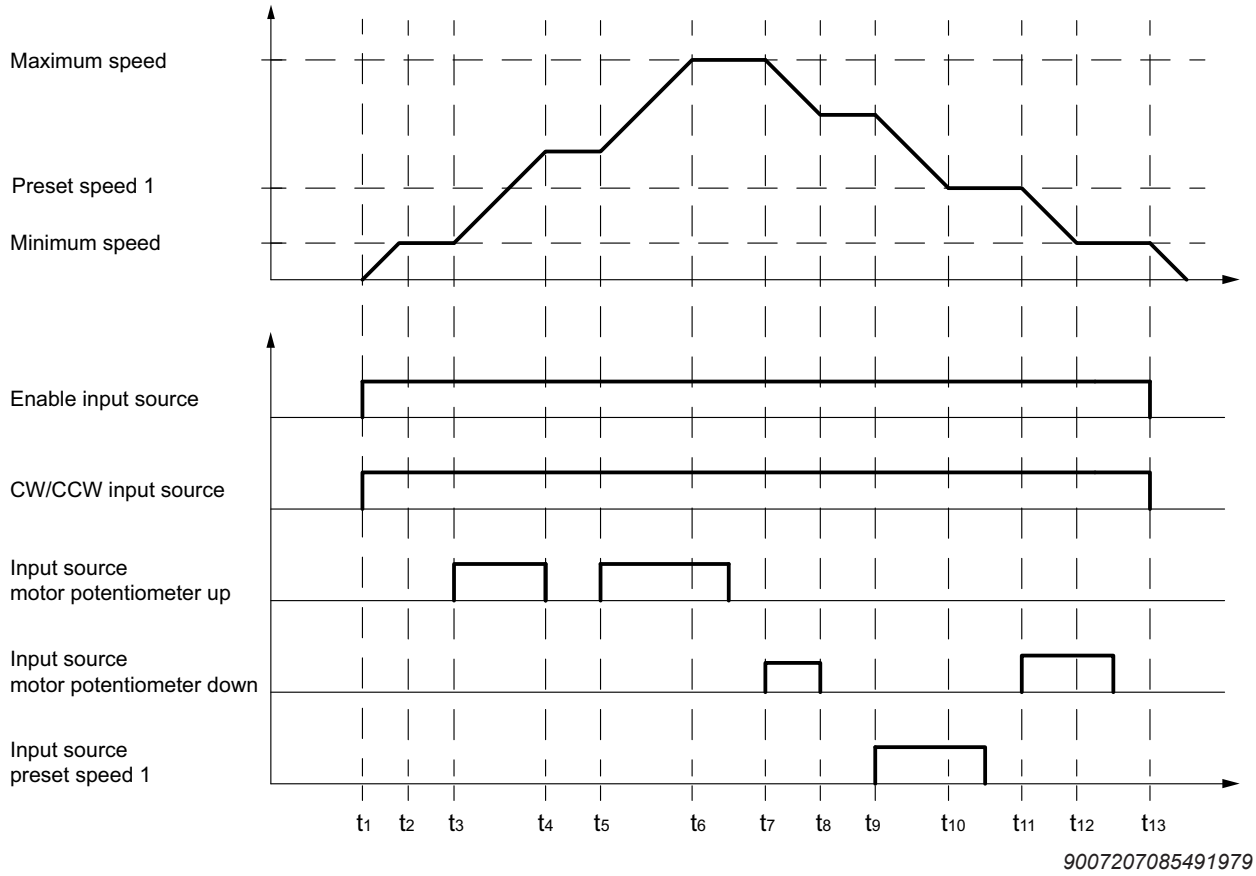
INFORMATION

If the terminal assignment is different, inputs can also be configured individually.

21270996/EN – 01/2015

6.8.1 Motor potentiometer operation

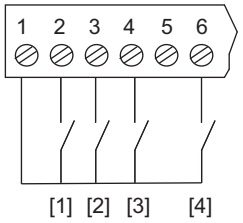
The following diagram shows the basic function of the motor potentiometer. The description in chapter "Parameter settings" (→ 🗎 81) is based on the frequently used crane function and works in accordance with the terminal assignment in chapter "Terminal assignment" (→ 🗎 81).



t_1 Frequency inverter enabled
t_1 - t_2 The motor accelerates up to the set minimum speed (*P1-02*).
t_2 - t_3 Motor maintains the 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 a signal is no longer present 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 a signal is no longer present at *P9-28*, the actual speed is maintained.
t_9 Preset speed is activated.
t_9 - t_{11} As long as the signal is present at the preset speed, the motor speed is decreased along deceleration ramp *P1-04* until it reaches the preset 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*).

21270996/EN – 01/2015

6.8.2 Terminal assignment



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[1] DI1 Enable / decrease speed

[2] DI2 Increase speed

[3] DI3 Preset speed 1

[4] DI4 Change in direction (CW/CCW rotation)

6.8.3 Parameter settings

Start up the motor as described in chapter "Startup" (→ 🗎 66).

To use the motor potentiometer, make the following settings:

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

Input configuration:

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

User settings:

- *P1-02* = Minimum speed
- *P1-03* = Acceleration ramp time
- *P1-04* = Deceleration ramp time
- *P2-01* = Preset speed 1

21270996/EN – 01/2015

6.9 Examples of analog input scaling and analog input offset

The analog input format, scaling, and offset are interlinked.

Frequency inverter setting:

P1-01 = 50 Hz

Example: Analog input scaling

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

n_1 = 0 Hz, n_2 = 40 Hz

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

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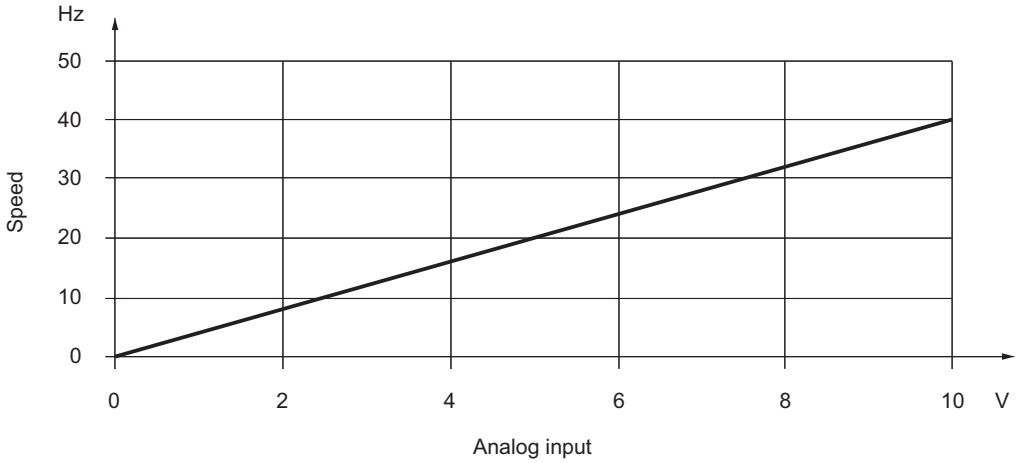
P2-31 = 80%



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Example: Analog input offset

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

$n_1 = n_{Offset}$ = 20 Hz, n_2 = 30 Hz

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

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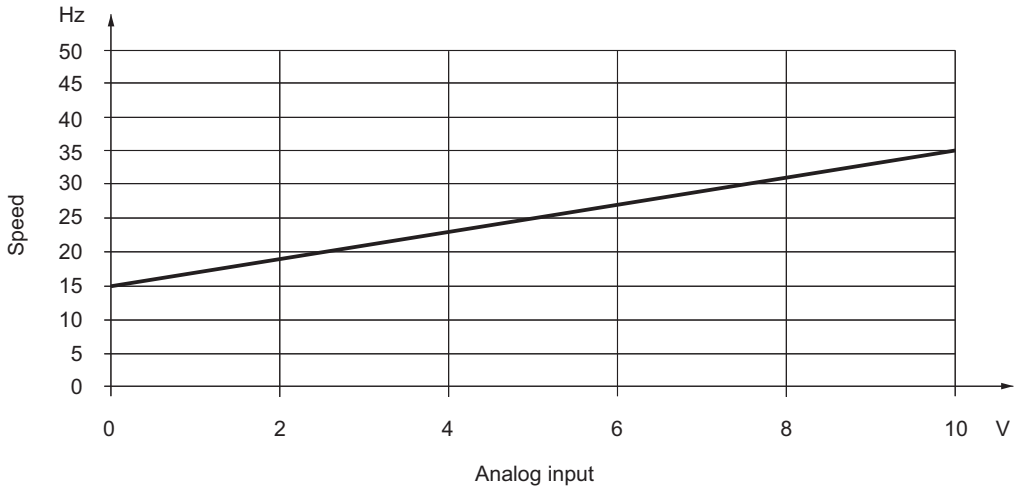
21270996/EN – 01/2015

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



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

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6.10 Fans and pumps

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

- Voltage increase/boost *(P1-11)*
- V/f characteristic curve adjustment (*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 ("Parameter group 3: PID controller (level 2)" (→ 🗎 134))
- Fire mode ("Fire mode" (→ 🗎 78))

21270996/EN – 01/2015

7 Operation

The following information is displayed so that you can read the operating state of the frequency inverter at all times:

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

7.1 Status of the frequency inverter

7.1.1 Static state of the frequency inverter

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

Abbreviation	Description
StoP	The frequency inverter's performance level is switched off. This message is displayed when the frequency inverter is at a standstill and no error is present. The frequency inverter is ready for normal operation. The frequency 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 frequency inverter can resume operation.
Stndby	The frequency inverter is in standby mode. When *P2-27* > 0 s, this message appears when the frequency inverter has stopped and the setpoint is also "0".
Inhibit	This 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

7.1.2 Operating state of the frequency inverter

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

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

Abbreviation	Description
H xxx	Output frequency of the frequency inverter in Hz. This message is displayed while the frequency inverter is running.
A xxx	Output current of the frequency inverter in Ampere. This message is displayed while the frequency inverter is running.
P xxx	Current output power of the frequency inverter in kW. This message is displayed while the frequency inverter is running.
Auto-t	The motor parameters are measured automatically to configure the motor parameters. Auto tune runs automatically during the first enable after operation with factory-set parameters. No hardware enable is required for running auto tune.

21270996/EN – 01/2015

Abbreviation	Description
Ho-run	Reference travel is started. Wait until the frequency inverter has reached the reference position. "Stop" is shown on the display after a successful reference travel.
xxxx	Output speed of the frequency inverter (in rpm). This message appears while the frequency inverter is running if the rated speed of the motor was entered in parameter *P1-10*.
C xxx	This is the "Speed" scaling factor (*P2-21 / P2-22*).
. . . . . . (flashing dots)	The output current of the frequency inverter exceeds the current value entered in *P1-08*. The frequency inverter monitors the extent and during of the overload. The frequency inverter indicates fault "I.t-trP" depending on the extent of the overload.

7.1.3 Fault reset

You can reset an error by pressing the <Stop/reset> key or by opening and closing digital input 1. For more information, refer to chapter "Error codes" (→ 🗎 104).

7.2 Power reduction

You need to reduce the maximum continuous output current of the frequency inverter if:

- Operating at an ambient temperature greater than 40°C / 104°F
- Operating at an installation altitude greater than 1000 m / 3281 ft
- Operating with an effective switching frequency greater than the minimum value

Apply the following power reduction factors if operating outside these conditions.

7.2.1 Power reduction for the ambient temperature

Housing type	Max. ambient temperature without a power reduction	Reduced by	Max. permitted temperature
IP20, sizes 2 – 3	50°C / 122°F	2.5% per °C (1.8°F)	60°C
IP55, sizes 2 – 3	40°C/104°F	2.5% per °C (1.8°F)	50°C
IP55, sizes 4 − 7	40°C/104°F	1.5% per °C (1.8°F)	50°C

7.2.2 Power reduction for the installation altitude

Housing type	Max. height without a power reduction	Reduced by	Max. permitted height (UL-approved)	Max. permitted height (non-UL-approved)
IP20, sizes 2 – 3	1000 m (3281 ft)	1% per 100 m (328 ft)	2000 m (6562 ft)	4000 m (13123 ft)
IP55, sizes 2 – 3	1000 m (3281 ft)	1% per 100 m (328 ft)	2000 m (6562 ft)	4000 m (13123 ft)

21270996/EN – 01/2015

Housing type	Max. height without a power reduction	Reduced by	Max. permitted height (UL-approved)	Max. permitted height (non-UL-approved)
IP55, sizes 4 – 7	1000 m (3281 ft)	1% per 100 m (328 ft)	2000 m (6562 ft)	4000 m (13123 ft)

21270996/EN – 01/2015

7.2.3 Available effective PWM switching frequencies and default settings

230 V units

230 V, 1-phase			
kW	**HP**	**Standard**	**Max.**
0.75	1	8 kHz	16 kHz
1.5	2	8 kHz	16 kHz
2.2	3	8 kHz	16 kHz

230 V, 3-phase			
kW	**HP**	**Standard**	**Max.**
0.75	1	8 kHz	16 kHz
1.5	2	8 kHz	16 kHz
2.2	3	8 kHz	16 kHz
3	4	8 kHz	16 kHz
4	5	8 kHz	16 kHz
5.5	7.5	8 kHz	8 kHz
7.5	10	4 kHz	12 kHz
11	15	4 kHz	12 kHz
15	20	4 kHz	12 kHz
18.5	25	4 kHz	12 kHz
22	30	4 kHz	8 kHz
30	40	2 kHz	8 kHz
37	50	2 kHz	6 kHz
45	60	2 kHz	4 kHz
55	75	2 kHz	8 kHz
75	100	2 kHz	6 kHz

400 V units

400 V, 3-phase			
kW	**HP**	**Standard**	**Max.**
0.75	1	4 kHz	16 kHz
1.5	2	4 kHz	16 kHz
2.2	3	4 kHz	16 kHz
3	4	4 kHz	16 kHz
4	5	4 kHz	16 kHz
5.5	7.5	4 kHz	12 kHz
7.5	10	4 kHz	12 kHz
11	15	4 kHz	8 kHz
15	20	4 kHz	12 kHz
18.5	25	4 kHz	12 kHz
22	30	4 kHz	12 kHz
30	40	4 kHz	12 kHz
37	50	4 kHz	12 kHz
45	60	2 kHz	8 kHz
55	75	2 kHz	8 kHz
75	100	2 kHz	6 kHz
90	150	2 kHz	4 kHz
110	175	2 kHz	8 kHz
132	200	2 kHz	6 kHz
160	250	2 kHz	4 kHz

21270996/EN – 01/2015

575 V units

575 V, 3-phase			
kW	**HP**	**Standard**	**Max.**
0.75	1	8 kHz	12 kHz
1.5	2	8 kHz	12 kHz
2.2	3	8 kHz	12 kHz
4	5	8 kHz	12 kHz
5.5	7.5	8 kHz	12 kHz
7.5	10	8 kHz	12 kHz
11	15	8 kHz	12 kHz
15	20	8 kHz	12 kHz
18.5	25	8 kHz	12 kHz
22	30	8 kHz	12 kHz
30	40	8 kHz	12 kHz
37	50	8 kHz	12 kHz
45	60	8 kHz	12 kHz
55	75	4 kHz	8 kHz
75	100	4 kHz	8 kHz
90	125	4 kHz	6 kHz
110	150	4 kHz	6 kHz

21270996/EN – 01/2015

8 Fieldbus mode

8.1 General information

8.1.1 Available controllers, gateways and cable sets

Fieldbus gateways

The fieldbus gateways convert standard fieldbuses to the SBus of SEW-EURODRIVE. This means that up to eight frequency inverters with three process data each can be triggered using one gateway.

The controller (PLC or PC) and the frequency inverter exchange process data, such as control words or speed, using the fieldbus.

In general, you can also connect and operate other SEW-EURODRIVE units (such as MOVIDRIVE® drive inverters) to the gateway using the SBus.

Available gateways

For the fieldbus interface, gateways are available for the following bus systems:

Bus	Separate housing
PROFIBUS	DFP21B / UOH11B
EtherCAT®	DFE24 / UOH11B
DeviceNet™	DFD11 / UOH11B
PROFINET	DFE32 / UOH11B
EtherNet/IP™	DFE33B / UOH11B
INTERBUS	UFI11A

Available controllers

Type	Fieldbus interfaces
DHE21B / 41B in UOH11B	• Ethernet TCP/IP • UDP
DHF21B / 41B in UOH21B	• Ethernet TCP/IP • UDP • PROFIBUS DP-V1 • DeviceNet
DHR21B / 41B in UOH21B	• Ethernet TCP/IP • UDP • PROFINET • EtherNet/IP™ • Modbus TCP/IP

Available cable sets

Cable sets with matching components are available for connecting controllers, gateways, and LT inverters. For more information, see the "MOVITRAC® LTP-B" catalog.

21270996/EN – 01/2015

8.1.2 Structure of process data words of frequency inverters with a factory setting

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

The structure of process data words is identical for both SBus/Modbus RTU/CANopen as well as inserted communication cards.

Higher byte	Lower byte
15 – 8	7 – 0

Description		Bit		Settings
PO1	Control word	0	Output stage inhibit.[1] In 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	Scaling: 0x4000 = 100% of the maximum speed as set in *P1-01*. Values above 0x4000 or below 0xC000 are limited to 0x4000/0xC000.		
PO3	No function (configurable)			
PO4	No function (available only with Modbus RTU/CANopen)			

1) Output stage inhibit means that the motor coasts to a halt

Process data words (16-bit) from frequency inverter to gateway (PI):

Description		Bit		Settings	Byte
PI1	Status word	0	Output stage enabled	0: Inhibited 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	Error/warning	0: No error 1: Error	
		6	Limit switch CW active[1]	0: Inhibited 1: Enabled	
		7	Limit switch CCW active[1]	0: Inhibited 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
		8 – 15	Frequency inverter status if bit 5 = 1 See chapter "Error codes" (→ 🗎 104).		
PI2	Actual speed	Scaling: 0x4000 = 100% of the maximum speed as set in *P1-01*.			
PI3	Actual current	Scaling: 0x4000 = 100% of the inverter current.			
PI4	No function (available only with Modbus RTU/CANopen).				

1) Limit switch assignment can be set in P1-15; see addendum to the operating instructions "MOVITRAC® LTX servo module for MOVITRAC® LTP-B".

21270996/EN – 01/2015

8.1.3 Communication example

The following information is sent to the frequency inverter if

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

Description		Value	Description
PO1	Control word	0x0000	Stop along the second deceleration ramp (*P2-25*).
		0x0001	coasting
		0x0002	Stop along the process ramp (*P1-04*).
		0x0003 - 0x0005	Reserved
		0x0006	Accelerate along a ramp (*P1-03*) and run at setpoint speed (PO2).
PO2	Setpoint speed	0x4000	= 16384 = maximum speed, for example, 50 Hz (*P1-01*) CW
		0x2000	= 8192 = 50% of the maximum speed, for example, 25 Hz CW
		0xC000	= -16384 = maximum speed, for example, 50 Hz (*P1-01*) CCW
		0x0000	= 0 = min. speed, set in *P1-02*

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

Description		Value	Description
PI1	Status word	0x0407	Status = running; output stage enabled; Frequency inverter ready; PO data enabled
PI2	Actual speed	Should correspond to PO2 (setpoint speed)	
PI3	Actual current	Depends on speed and load	

8.1.4 Parameter settings for the frequency inverter

- Start up the frequency inverter as described in chapter "Simple startup" (→ 🖹 66).
- Set the following parameters depending on the bus system used:

Parameter	SBus	CANopen	Modbus RTU[1)]
P1-12 (control signal source)	5	6	7
P1-14 (advanced 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 into 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)]	Additional setting options[5)]	Additional 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".

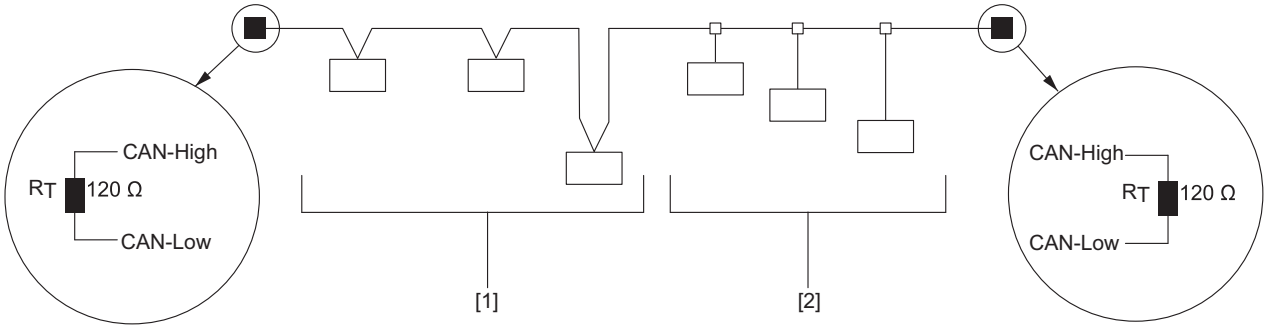
21270996/EN – 01/2015

8.1.5 Connecting the signal terminals to the frequency 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" (→ 🗎 49). When the DI3 signal level changes, the system toggles between the speed setpoint source fieldbus (low) and fixed setpoint 1 (high).

8.1.6 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.



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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)

8.2 Connecting a gateway or controller (SBus MOVILINK®)

8.2.1 Specification

The MOVILINK® profile via CAN/SBus is an application profile from SEW-EURODRIVE specifically adjusted to frequency inverters from SEW-EURODRIVE. For detailed information on the structure of the protocol, refer to the "MOVIDRIVE® MDX60B/61B communication and fieldbus unit profile" manual.

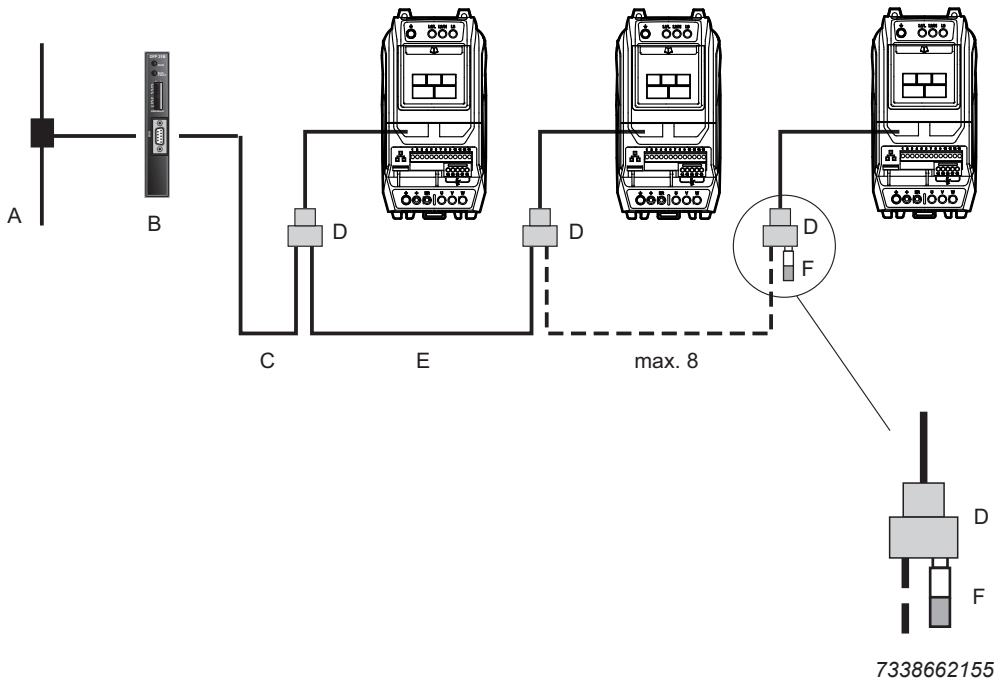
To use SBus, configure the frequency inverter as described in chapter "Parameter settings for the frequency inverter" (→ 🗎 91). The status and control words are fixed; all other process data words can be configured as required in parameter group *P5-xx*.

For detailed information on the structure of process data words, refer to chapter "Structure of process data words of frequency inverters with factory setting" (→ 🗎 90). You find a detailed list of all parameters including the necessary indexes as well as the scaling in chapter "Parameter register" (→ 🗎 113).

21270996/EN – 01/2015

8.2.2 Electrical installation

Connecting a gateway and MOVI-PLC®



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[A] Bus connection
[B] Gateway (for example, DFx/UOH)
[C] Connection cable
[D] Splitter
[E] Connection cable
[F] Y connector with terminating resistor

INFORMATION

A backup mode for maintaining communication in the event of a power failure is not possible.

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

Instead of a terminating connector from cable set A, you can use the Y adapter from engineering cable set C. This set also includes a terminating resistor. Detailed information on cable sets is available in the "MOVITRAC® LTP-B" catalog.

Wiring from the controller to communication socket RJ45 (→ 🗎 51) of the frequency inverter:

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

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

8.2.3 Startup at gateway

- Connect the gateway as described in chapter "Electrical installation" (→ 🗎 93).
- Reset all settings of the gateway to the factory setting.
- If necessary, set all connected frequency inverters to SBus MOVILINK® mode as described in chapter "Parameter settings for the frequency inverter" (→ 🗎 91). 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 frequency inverters at the SBus has not been wired properly or has not started up 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, for the DFE3x Ethernet gateway).
- For the frequency inverter, you can use the corresponding parameters in parameter group 0 to check which process data is transferred.

8.2.4 Startup at a CCU

Before starting up the frequency inverter with "Drive Startup" in MotionStudio, you have to set the following parameters directly on the frequency 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, *P1-16* must display the proper motor type. If not, select the proper motor type using the <Up> and <Down> keys.
- Assign a unique frequency inverter drive 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.

21270996/EN – 01/2015

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

If the frequency inverter, with or without the LTX encoder module, is operated with MOVI-PLC® or CCU, the following parameters must be set on the frequency inverter:

- Set *P1-14* to "1" to obtain 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, *P1-16* will display the proper motor type. If not, select the respective motor type using the "Up" and "Down" keys.
- Assign a unique frequency inverter drive address in *P1-19*.
- Set the SBus baud rate (*P1-20*) to "1000 kBaud".
- Start up the drive using the MOVITOOLS® MotionStudio software.

8.3 Modbus RTU

The frequency inverters support communication via Modbus RTU. Holding registers (03) are used for reading, while single holding registers (06) are used for writing. To use Modbus RTU, configure the frequency inverter as described in chapter "Parameter settings for the frequency inverter" (→ 🗎 91).

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

8.3.1 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 two-core
User Interface	RJ45

8.3.2 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 115 200 Bd/s 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" (→ 🗎 51).

21270996/EN – 01/2015

8.3.3 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	-	0, 3	Read
6	PI1 status word (fixed)		0, 3	Read
7	PI2 (default setting in *P5-12* = *1*; actual speed)		0, 3	Read
8	PI3 (default setting in *P5-13* = *2*; actual current)		0, 3	Read
9	PI4 (default setting in *P5-14* = *4*; power)		0, 3	Read
…	For more registers, refer to chapter "Parameter register" (→ 🗎 113).			

You find the complete allocation of parameter registers as well as the scaling of data in the memory allocation plan in chapter "Parameter register" (→ 🗎 113).

INFORMATION

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

8.3.4 Data flow example

In the following example, the controller reads in the following parameters (PLC address basis = 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 of 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

21270996/EN – 01/2015

Rx – receive 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 nominal frequency 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 frequency inverter (PLC address basis = 1):

Process output 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 of 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 described = 2 PO2)
Information	0700 (setpoint speed)
2 × CRC bytes	CRC_high, CRC_low

8.4 CANopen

The frequency inverters support communication via CANopen. To use CANopen, configure the frequency inverter as described in chapter "Parameter settings for the frequency inverter" (→ 🗎 91).

A general overview of how to establish a communication connection via CANopen is provided below with some information about process data communication. The CANopen configuration is not described below.

For detailed information on the CANopen profile, refer to the "MOVIDRIVE® MDX60B/61B communication and fieldbus unit profile" manual.

8.4.1 Specification

CANopen communication is implemented in accordance with the specification DS301 version 4.02 of CAN in automation (see www.can-cia.de). A specific unit profile, such as DS 402, is not implemented.

8.4.2 Electrical installation

See chapter "Structure of a CANopen/SBus network" (→ 🗎 92).

8.4.3 COB IDs and functions in the frequency 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 a dynamically configurable COB ID
Emergency	080h + device address	Emergency message with a 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 exchange of parameter data with the CANopen master
SDO (Rx)[2]	600h + device address	
Error control	700h + device address	Guarding and heartbeat functions are supported. COB ID can be set to another value.

1) The frequency inverter supports up to two 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 frequency inverter SDO channel supports "expedited" transmission only. The SDO mechanisms are described in detail in the CANopen specification DS301.

INFORMATION

Transmitting speed, current, position 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 unit profile" manual.

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

8.4.4 Supported transmission modes

The various transmission types can be selected for every process data project (PDO) in 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 is transmitted to the frequency inverter as soon as the next synchronization message is received.
254, 255	Asynchronous	The received data is transmitted to the frequency inverter without delay.

The following transmission types are supported for Tx PDOs:

Tx PDO transmission type		
Transmission type	**Mode**	**Description**
0	Acyclic synchronous	Tx PDO is transmitted only if the process data has changed and a SYNC object has been 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 transmitted only when the corresponding Rx PDO has been received.
255	Asynchronous	Tx PDOs are always transmitted as soon as the PDO data has changed.

21270996/EN – 01/2015

8.4.5 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	Frequency inverter temperature	

INFORMATION

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

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

8.4.6 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 message
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 message
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	-	-	-	-	-	-	-	Placeholder
2	0x000	NMT service	-	-	-	-	-	-	Bus status	Unit address
3	0x201	Rx PDO1 + device address 1	-	-	Ramp specification		Setpoint speed		Control word	
4	0x080	SYNC message	-	-	-	-	-	-	-	-
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 → frequency inverter (index: 1A00h)

Response frequency 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

8.4.7 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 (for example, 1.00)
100Ah	0	Manufacturer software version	RO	String	N	x.xx (for example, 1.12)

21270996/EN – 01/2015

CANopen-specific objects						
Index	**Sub-index**	**Function**	**Access**	**Type**	**PDO map**	**Default value**
100Ch	0	Guard time [1ms]	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 [100us]	RW	Unsigned 16	N	0
1017h	0	Producer heart beat time [1ms]	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)[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 [100us]	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 [100us]	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
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 nine digits in the serial number.

8.4.8 Table of manufacturer-specific objects

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

Manufacturer-specific objects						
Index	**Sub-index**	**Function**	**Access**	**Type**	**PDO map**	**Comment**
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 = rated inverter 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 to 2C6EF correspond to SBus parameter indexes 11000d – 11375d; some of them are read-only.

8.4.9 Emergency code objects

See chapter "Error codes" (→ 🗎 104).

21270996/EN – 01/2015

9 Service and error codes

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.

9.1 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 the motor and inverter must match. The delta connection always yields the lower voltage of a multi-voltage motor.
Overload or overcurrent – motor does not rotate	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 to the specified values.
The inverter does not start at extremely cold ambient conditions.	The inverter may 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*.

9.2 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 error will be deleted from the error history.

- **NOTE**

  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 MOVITRAC® LTP-B inverter is switched off.

21270996/EN – 01/2015

9.3 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 lies within the range defined in *P2-30* and *P2-33*. • 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 that: • The motor is connected correctly and without error. • The windings have 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 that: • The motor is connected correctly and without error. • The power rating of the motor corresponds to the power rating of the connected inverter.
AtF-03	42	81	0x51	0x102A	The measured motor inductance is too low.	The measured motor inductance is too low. Check that the motor is connected correctly and without error.
AtF-04	43	81	0x51	0x102B	The measured motor inductance is too high.	The measured motor inductance is too high. Check that: • The motor is connected correctly and without error. • The power rating of the motor corresponds to the power rating of the connected inverter.
AtF-05	44	81	0x51	0x102C	Inductance measurement timeout	The measured motor parameters are not convergent. Check that: • The motor is connected correctly and without error. • The power rating of the motor corresponds to the power rating of the connected inverter.
dAtA-E	19	98	0x62	0x1013	Internal memory error (DSP)	Contact SEW-EURODRIVE Service.
dAtA-F	17	98	0x62	0x1011	Internal memory error (IO)	Contact SEW-EURODRIVE Service.
E-triP	11	26	0x1A	0x100B	External fault at digital input 5	NC contact was opened. • Check the motor thermistor (if connected).
Enc-01	30	14	0x0E	0x101E	Communication error between encoder card and inverter	
ENC02/ SP-Err	31	14	0x0E	0x101F	Speed error (*P6-07*)	The difference between the actual speed and the setpoint speed is greater than the percentage value set in *P6-07*. This error is active only in vector control mode or in control mode with encoder feedback. Increase the value in *P6-07*.
Enc-03	32	14	0x0E	0x1020	Incorrect PPR count parameterized	Check the parameter settings in *P6-06* and *P1-10*.
Enc-04	33	14	0x0E	0x1021	Encoder channel A error	
Enc-05	34	14	0x0E	0x1022	Encoder channel B error	
Enc-06	35	14	0x0E	0x1023	Encoder channel A or B error	
Enc-07	36	14	0x0E	0x1024	RS485 data channel error, Hiperface® data channel error	
Enc-08	37	14	0x0E	0x1025	Hiperface® I/O communication channel error	

21270996/EN – 01/2015

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-09	38	14	0x0E	0x1026	Hiperface® type not supported	An incorrect motor/inverter combination was used with the Smart Servo Package. Check that: • The speed class of the CMP motor is 4500 rpm. • The nominal motor voltage corresponds to the nominal inverter voltage. • An Hiperface® encoder is used.
Enc-10	39	14	0x0E	0x1027	Trigger: KTY	KTY was triggered or is not connected.
Er-LED					Display error	Contact SEW-EURODRIVE Service.
EtI-24					External 24 V supply	The line voltage supply is not connected. The inverter is supplied externally with 24 V.
F-Ptc	21	31	0x1F	0x1015	PTC trigger	The connected PTC thermistor caused the inverter to be switched off.
FAN-F	22	50	0x32	0x1016	Internal fan error	Contact 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 the reference cam. • Check the limit switch connection. • Check the reference travel type setting and all necessary parameters.
Inhibit					STO safety circuit open	Check that terminals 12 and 13 are connected properly.
Lag-Er	28	42	0x2A	0x101C	Lag error	Check: • The encoder connection • The wiring of the encoder, motor and line phases • to ensure that the mechanical components can move freely and are not blocked. Extend the ramps. Set the P component to a higher value. Parameterize the speed controller again. Increase the lag error tolerance.
I.t-trp	04	8	0x08	0x1004	Inverter/motor overload (I2t error)	Make sure that: • The motor nameplate parameter is entered correctly in *P1-07*, *P1-08*, and *P1-09* • The motor power factor in *P4-05* is correct in vector mode operation (*P4-01* = 0 or 1) • Auto tuning was successful Check that: • The decimal places are flashing (inverter overloaded) and increase the acceleration ramp (*P1-03*) or decrease the motor load • The cable length meets the requirements • The load can move freely and that there are no blockages or other mechanical faults (mechanically check the load)

21270996/EN – 01/2015

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-I	03	1	0x01	0x2303	Short-term overcurrent at inverter output Heavy motor overload	**Fault during the stop procedure:** Check whether the brake was applied too soon. **Fault while enabling the drive:** Check that: • The motor nameplate parameter is entered correctly in *P1-07*, *P1-08*, and *P1-09* • The motor power factor in *P4-05* is correct in vector mode operation (*P4-01* = 0 or 1) • Auto tuning was successful • The load can move freely and that there are no blockages or other mechanical faults (mechanically check the load) • The motor and motor connection cable have a short circuit between phases or a ground fault at one phase • The brake is connected correctly, controlled, and then released correctly if the motor has a holding brake Reduce the voltage gain setting in *P1-11*. Increase the run-up time in *P1-03*. Disconnect the motor from the inverter. Enable the inverter again. If this fault occurs again, fully replace the inverter and check the complete system beforehand. **Fault during operation:** Check: • For a sudden overload or malfunction • The cable connection between the 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 frequency inverter.
hO-I	15	1	0x01	0x230F	Hardware overcurrent fault at inverter output (automatic IGBT protection in the event of an overload)	
O-hEAt	23	124	0x7C	0x4117	Ambient temperature too high	Check that the ambient conditions change within the preset specification for the inverter.
O-t	8	11	0x0B		Heat sink over temperature	The heat sink temperature can be displayed in *P0-21*. An historical log is stored in parameter *P0-38* at 30 s intervals before the unit switches off with an error message. This error message is displayed for a heat sink temperature ≥ 90°C. Check: • The ambient temperature of the inverter • The inverter cooling and housing dimensions • Whether the cooling fan within the inverter is working properly Reduce the setting for the effective clock frequency in parameter *P2-24* or the motor/inverter load.
O-torq	24	52	0x34	0x1018	Maximum torque limit timeout	Check the motor load. If necessary, increase the value in *P6-17*.
O-Volt	06	7	0x07	0x3206	DC link overvoltage	This fault occurs if a high inertia load or pull-through load is connected, which transfers the excess regenerative energy back to the inverter. If this fault occurs when stopping or during deceleration, increase the deceleration ramp time *P1-04* or connect a suitable braking resistor to the frequency inverter. In vector mode operation, reduce the proportional gain in *P4-03*. In PID control operation, make sure that the ramps are active by reducing *P3-11*. In addition, check whether the supply voltage changes within the specification. Note: The value of the DC bus voltage can be displayed in *P0-20*. An historical log is stored in parameter *P0-36* at 256 ms intervals before the unit switches off with an error message.

21270996/EN – 01/2015

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		
OI-b	01	4	0x04	0x2301	Brake channel overcurrent Braking resistor overload	Make sure that the connected braking resistor is above the minimum value permitted for the inverter (see technical data). Check the braking resistor and cabling for possible short circuits.
OL-br	02	4	0x04	0x1002	Braking resistor overloaded	The software has detected that the braking resistor is overloaded and therefore switches off the resistor in order to protect it. Make sure that the braking resistor operates within its preset parameters before you change the parameters or system. To reduce the load on the resistor, increase the deceleration time, reduce the load's moment of inertia or add more braking resistors in parallel. Observe the minimum resistance value for the frequency inverter used.
OF-01	60	28	0x1C	0x103C	Error with internal connection to the option module	Contact SEW-EURODRIVE Service.
OF-02	61	28	0x1C	0x103D	Option module error	Contact SEW-EURODRIVE Service.
Out-F	26	82	0x52	0x101A	Inverter output stage error	Contact SEW-EURODRIVE Service.
P-LOSS	14	6	0x06	0x310E	Input phase failure	An input phase was disconnected or interrupted for an inverter designed for operation with a three-phase supply.
P-dEF	10	9	0x09	0x100A	Factory setting made	
PS-trP	05	200	0xC8	0x1005	Output stage error (automatic IGBT protection in the event of an overload)	See error **O-I**.
SC-F03	52	41	0x29	0x1034	Fieldbus module communication error (on the fieldbus side)	Contact SEW-EURODRIVE Service.
SC-F04	53	41	0x29	0x1035	IO option card communication error	Contact SEW-EURODRIVE Service.
SC-F05	54	41	0x29	0x1036	LTX module communication error	Contact 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 the inverter and external devices • The uniquely assigned address for each inverter in the network
Sto-F	29	115	0x73	0x101D	STO circuit error	Unit replacement because the inverter is defective
StoP					The inverter is not enabled.	Activate the enable. In the case of the hoist function, you must ensure that the enable is activated after the STO.
SC-0b5	12	29	1D		Connection between inverter and operator terminal interrupted	Check that there is a connection between the inverter and the operator terminal.
th-Flt	16	31	0x1F	0x1010	Faulty thermistor at heat sink	Contact SEW-EURODRIVE Service.
U-torq	25	52	0x34	0x1019	Minimum torque limit timeout (hoist)	The torque threshold was not exceeded in good time. Increase the time in *P4-16* or increase the torque limit in *P4-15*.
U-t	09	117	0x75	0x4209	Undertemperature	Occurs at an ambient temperature below -10°C. To start the inverter, increase the temperature to above -10°C.

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		
U-Volt	07	198	0xC6	0x3207	DC link undervoltage	Occurs routinely when switching off the inverter. Check the line voltage if this occurs while the inverter is running.

9.4 SEW-EURODRIVE Electronics Service

If you are unable to rectify a fault, contact SEW-EURODRIVE Electronics Service.

Please provide the following information when sending the device in for repair:

- Serial number (→ nameplate)
- Type designation
- Short description of the application (application, control via terminals or serial)
- Connected components (motor, and so on)
- Type of error
- Circumstances
- Your own assumptions as to what has happened
- Any unusual events preceding the problem, and so on

21270996/EN – 01/2015

9.5 Extended storage

If the unit is stored for a long time, connect it to the line voltage for at least five minutes every two years. Otherwise, the unit's service life 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 may damage the capacitors if the unit is connected using the rated 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 in accordance with the following overview.

The following stages are recommended:

AC 230 V units:

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

AC 400 V units:

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

AC 575 V units:

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

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

9.6 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

21270996/EN – 01/2015

10 Parameters

10.1 Overview of parameters

10.1.1 Parameters for realtime monitoring (read only)

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

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

Parameter	SEW index	Modbus register	Description	Display range	Explanation
		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	Digital value	Status of the digital inputs of the basic unit and option DI8*; DI7*; DI6*; DI5; DI4; DI3; DI2; DI1 * Available only with a suitable option module.
P0-04	11213	22	Speed controller setpoint	-100.0 – 100.0%	68 = 6.8 Hz; 100% = base frequency (*P1-09*)
P0-05	11214	41	Torque controller setpoint	0 – 100.0%	2000 = 200.0%; 100% = nominal motor torque
P0-06	11215		Digital speed setpoint in keypad mode	*-P1-01 – P1-01* in Hz	Speed display in Hz or rpm
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 on motor
P0-12	11271		Output torque	0 – 200.0%	Torque output in %
P0-13	11272 – 11281		Error log	Latest four 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		Magnetization current (Id)	A rms	Magnetization 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		Stator resistance (Rs)	Ω	Phase-to-phase stator resistance
P0-18	11286		Stator inductance (Ls)	H	Stator inductance
P0-19	11287		Rotor resistance (Rr)	Ω	Rotor resistance
P0-20	11220	23	DC link voltage	DC V	600 = 600 V (internal DC link voltage)
P0-21	11221, 11222	24	Inverter temperature	°C	40 = 40°C (internal temperature of 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 using the motor model)	Hz	Applies only to vector mode
P0-26	11292, 11293	30	kWh counter meter (can be reset)	0.0 – 999.9 kWh	100 = 10.0 kWh (cumulative energy consumption)
		32	kWh counter meter		
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

21270996/EN – 01/2015

Parameter	SEW index	Modbus register	Description	Display range	Explanation
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 of relay output		− ; − ; − ; RL5; RL4; RL3; RL2; RL1 The relay status is also displayed without the relay option, depending on the settings in *P5-15* to *P5-20*.
P0-31	11296, 11297	34	Inverter runtime (hours)	Hours and minutes	Ex: 6 = **6h** 39m 07s
		35	Inverter runtime (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		Heat sink temperature log (30 s)	The last 8 values prior to the fault	The last 8 values prior to the fault
P0-39	11239 – 11246		Ambient temperature log (30 s)	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 at the heat sink
P0-45	11342		Counter for critical faults -b O-I	–	Counter for short-circuit faults at the brake chopper
P0-46	11343		Counter for critical faults O-heat	–	Counter for overtemperature faults in the environment
P0-47	11223		Counter for internal I/O communication errors	0 – 65535	–
P0-48	11344		Counter for internal DSP communication errors	0 – 65535	–
P0-49	11224		Counter for Modbus communication errors	0 – 65535	–
P0-50	11225		Counter for CAN bus communication errors	0 – 65535	–

Parameter	SEW index	Modbus register	Description	Display range	Explanation
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	Incoming process data from the perspective of the controller	3 entries; incoming process data from the perspective of the controller
P0-53			Current phase offset and reference value for U	Internal value	2 entries; first is the reference value, second is the measured value; no decimal place for both values
P0-54			Current phase offset and reference value for V	Internal value	2 entries; first is the reference value, second is the 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 the reference value, second is the 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, rpm	Scaling with 3000 = 50.0 Hz with one decimal place 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in rpm if *P1-10* ≠ 0.
P0-59	11226		Frequency input speed	Hz, rpm	Scaling with 3000 = 50.0 Hz with one decimal place 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in rpm if *P1-10* ≠ 0.
P0-60	11346		Calculated slip speed value	Internal value (only with V/f control) Hz, rpm	Scaling with 3000 = 50.0 Hz with one decimal place 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in rpm if *P1-10* ≠ 0.
P0-61	11227		Value for speed hysteresis/ relay control	Hz, rpm	Scaling with 3000 = 50.0 Hz with one decimal place 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in rpm 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 rpm if *P1-10* ≠ 0.
P0-63	11349		Speed setpoint after the ramp	Hz, rpm	Scaling with 3000 = 50.0 Hz with one decimal place 0.0 Hz ~ 999.0 Hz, 1000 Hz ~ 2000 Hz Can be displayed in rpm 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		Reserve		
P0-67	11228		Fieldbus torque setpoint/ limit value	Internal value	
P0-68	11229		User ramp value		The indicating accuracy on the frequency inverter display depends on the ramp time received via the fieldbus. Sizes 2 and 3 Ramp < 0.1 s: Display with 2 decimal places 0.1 s ≤ ramp < 10 s: Display with 1 decimal place 10 s ≤ ramp ≤ 65 s: Display with 0 decimal places Sizes 4 – 7 0.0 s ≤ ramp < 10 s: Display with 1 decimal place 10 s ≤ ramp ≤ 65 s: Display with 0 decimal places
P0-69	11230		Counter for I2C faults	0 ~ 65535	

21270996/EN – 01/2015

Parameter	SEW index	Modbus register	Description	Display range	Explanation
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)
P0-72	11232	39	Processor temperature Room temperature	C	42 = 42°C
P0-73	11354		Encoder status / error codes For an incremental encoder: 1=EnC-04 Signal A/A error 2=EnC-05 Signal B/B error 3=EnC-06 Signal A+B error For an LTX Hiperface® encoder: 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 a decimal value
P0-74			L1 input	Internal value	
P0-75			L2 input	Internal value	
P0-76			L3 input	Internal value	
P0-77			Position feedback	Internal value	Position feedback
P0-78			Position reference	Internal value	Position reference
P0-79	11355, 11356		Lib 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 places
P0-80	11233, 11357		Code for valid motor data Servo module version		2 entries; first value is 1 if valid servomotor data read via the LTX module. Second value is the SW version of the LTX card.

10.1.2 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 (→ 🗎 119)	*P1-02* – **50.0 Hz** – 5 × *P1-09*
102	11021	P1-02 Minimum speed (→ 🗎 119)	**0** – P1-01 Hz
103	11022	P1-03 Acceleration ramp time (→ 🗎 119)	Sizes 2 and 3: 0.00 – **2.0** – 600 s Sizes 4 - 7: 0.0 – **2.0** – 6000 s
104	11023	P1-04 Deceleration ramp time (→ 🗎 119)	Sizes 2 and 3: coast/0.01 – **2.0** – 600 s Sizes 4 - 7: coast/0.1 – **2.0** – 6000 s
105	11024	P1-05 Stop mode (→ 🗎 119)	**0 / Stop ramp** / 1 / coast to stop

Modbus register	SBus/ CANopen index	Associated parameter	Range / factory setting
106	11025	P1-06 Energy saving function (→ 🗎 120)	**0 / Off** / 1 / On
107	11012	P1-07 Rated motor voltage (→ 🗎 120)	• 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 (→ 🗎 120)	20 – 100% of the inverter current
109	11009	P1-09 Rated motor frequency (→ 🗎 120)	25 – **50/60** – 500 Hz
110	11026	P1-10 Rated motor speed (→ 🗎 121)	**0** – 30 000 rpm
111	11027	P1-11 Voltage increase, boost (→ 🗎 121)	0 – 30% (factory setting depends on the inverter)
112	11028	P1-12 Control signal source (→ 🗎 121)	**0 / Terminal mode**
113	11029	P1-13 Error history (→ 🗎 122)	Last 4 faults
114	11030	P1-14 Extended parameter access (→ 🗎 122)	**0** – 30 000
115	11031	P1-15 Digital input function selection (→ 🗎 122)	0 – **1** – 26
116	11006	P1-16 Motor type (→ 🗎 122)	In-Syn
117	11032	P1-17 Servo module function selection (→ 🗎 123)	0 – **1** – 8
118	11033	P1-18 Motor thermistor selection (→ 🗎 124)	**0 / Inhibited**
119	11105	P1-19 Frequency inverter address (→ 🗎 124)	0 – **1** – 63
120	11106	P1-20 SBus baud rate (→ 🗎 124)	125, 250, **500**, 1 000 kBaud
121	11017	P1-21 Stiffness (→ 🗎 124)	0.50 – **1.00** – 2.00
122	11034	P1-22 Motor load inertia ratio (→ 🗎 124)	0 – **1** – 30
201	11036	P2-01 Preset speed 1 (→ 🗎 125)	-P1-01 – **5.0 Hz** – P1-01
202	11037	P2-01 Preset speed 1 (→ 🗎 125)	-P1-01 – **10.0 Hz** – P1-01
203	11038	P2-03 Preset speed 3 (→ 🗎 125)	-P1-01 – **25.0 Hz** – P1-01
204	11039	P2-04 Preset speed 4 (→ 🗎 125)	-P1-01 – **50.0 Hz** – P1-01
205	11040	P2-05 Preset speed 5 (→ 🗎 125)	-P1-01 – **0.0 Hz** – P1-01
206	11041	P2-06 Preset speed 6 (→ 🗎 125)	-P1-01 – **0.0 Hz** – P1-01
207	11042	P2-07 Preset speed 7 (→ 🗎 125) /Brake release speed	-P1-01 – 0.0 Hz – P1-01
208	11043	P2-08 Preset speed 8 (→ 🗎 125) /Brake application speed	-P1-01 – 0.0 Hz – P1-01
209	11044	P2-09 Skip frequency (→ 🗎 126)	P1-02 – P1-01
210	11045	P2-10 Skip frequency range (→ 🗎 126)	**0.0 Hz** – P1-01
211	11046	P2-11 Analog output 1 function selection (→ 🗎 126)	0 – **8** – 12
212	11047	P2-12 Analog output 1 format (→ 🗎 127)	**0 – 10 V**
213	11048	P2-13 Analog output 2 function selection (→ 🗎 127)	0 – **9** – 12
214	11049	P2-14 Analog output 2 format (→ 🗎 127)	**0 – 10 V**
215	11050	P2-15 User relay output 1 function selection (→ 🗎 128)	0 – **1** – 11
216	11051	P2-16 Upper limit user relay 1 / analog output 1 (→ 🗎 128)	0.0 – **100.0** – 200.0%
217	11052	P2-17 Lower limit user relay 1 / analog output 1 (→ 🗎 128)	**0.0** – P2-16
218	11053	P2-18 User relay output 2 function selection (→ 🗎 128)	0 – **3** – 11
219	11054	P2-19 Upper limit user relay 2 / analog output 2 (→ 🗎 128)	0.0 – **100.0** – 200.0%
220	11055	P2-20 Lower limit user relay 2 / analog output 2 (→ 🗎 128)	**0.0** – P2-19
221	11056	P2-21 Display scaling factor (→ 🗎 128)	-30.000 – **0.000** – 30 000
222	11057	P2-22 Display scaling source (→ 🗎 129)	0 – 2
223	11058	P2-23 Zero speed holding time (→ 🗎 129)	0.0 – **0.2** – 60.0 s
224	11003	P2-24 PWM switching frequency (→ 🗎 129)	2 – 16 kHz (depending on the inverter)
225	11059	P2-25 Second deceleration ramp, rapid stop ramp (→ 🗎 129)	Sizes 2 and 3: coast/0.01 – **2.0** – 600 s Sizes 4 - 7: coast/0.1 – **2.0** – 6000 s
226	11060	P2-26 Flying start enable (→ 🗎 129)	**0 / Disabled**
227	11061	P2-27 Standby mode (→ 🗎 129)	**0.0** – 250 s

21270996/EN – 01/2015

Modbus register	SBus/ CANopen index	Associated parameter	Range / factory setting
228	11062	P2-28 Slave speed scaling (→ 🗎 130)	**0 / Disabled**
229	11063	P2-29 Slave speed scaling factor (→ 🗎 130)	-500 – **100** – 500%
230	11064	P2-30 Analog input 1 format (→ 🗎 130)	**0 – 10 V**
231	11065	P2-31 Analog input 1 scaling (→ 🗎 131)	0 – **100** – 500%
232	11066	P2-32 Analog input 1 offset (→ 🗎 131)	-500 – **0** – 500%
233	11067	P2-33 Analog input 2 format (→ 🗎 132)	**0 – 10 V**
234	11068	P2-34 Analog input 2 scaling (→ 🗎 132)	0 – **100** – 500%
235	11069	P2-35 Analog input 2 offset (→ 🗎 132)	-500 – **0** – 500%
236	11070	P2-36 Start mode selection (→ 🗎 132)	**Auto – 0**
237	11071	P2-37 Keypad restart speed (→ 🗎 133)	0 – 7
238	11072	P2-38 Mains loss stop control (→ 🗎 134)	**0** – 3
239	11073	P2-39 Parameter lock (→ 🗎 134)	**0 / Disabled**
240	11074	P2-40 Extended parameter access code definition (→ 🗎 134)	0 – **101** – 9999
301	11075	P3-01 PID proportional gain (→ 🗎 134)	0 – **1** – 30
302	11076	P3-02 PID integral time constant (→ 🗎 134)	0 – **1** – 30
303	11077	P3-03 PID differential time constant (→ 🗎 134)	**0.00** – 1.00
304	11078	P3-04 PID operating mode (→ 🗎 134)	**0 / Direct operation**
305	11079	P3-05 PID reference selection (→ 🗎 135)	**0 / Fixed setpoint reference**
306	11080	P3-06 PID fixed setpoint reference 1 (→ 🗎 135)	**0.0** – 100.0%
307	11081	P3-07 PID controller upper limit (→ 🗎 135)	P3-08 – **100.0%**
308	11082	P3-08 PID controller lower limit (→ 🗎 135)	**0.0%** – P3-07
309	11083	P3-09 PID correcting variable limit (→ 🗎 135)	**0 / Fixed setpoint limit**
310	11084	P3-10 PID feedback selection (→ 🗎 135)	**0 / Analog input 2**
311	11085	P3-11 PID ramp activation error (→ 🗎 135)	**0.0** – 25.0%
312	11086	P3-12 PID actual value display scaling factor (→ 🗎 136)	**0.000** – 50.000
313	11087	P3-13 PID feedback wake-up level (→ 🗎 136)	**0.0** – 100.0%
314	11088	P3-14 PID fixed setpoint speed 2 (→ 🗎 136)	**0.0** – 100.0%
315	11376	P3-15 PID fixed setpoint speed 3 (→ 🗎 136)	**0.0** – 100.0%
316	11377	P3-16 PID fixed setpoint speed 4 (→ 🗎 136)	**0.0** – 100.0%
401	11089	P4-01 Control mode (→ 🗎 137)	**2 / Speed control – Enhanced V/f**
402	11090	P4-02 "Auto tune" (→ 🗎 138)	**0 / Inhibited**
403	11091	P4-03 Speed controller proportional gain (→ 🗎 138)	0.1 – **50** – 400%
404	11092	P4-04 Speed controller integral time constant (→ 🗎 138)	0.001 – **0.100** – 1.000 s
405	11093	P4-05 Motor power factor (→ 🗎 138)	0.50 – 0.99 (depending on the inverter)
406	11094	P4-06 Torque reference (limit value) source (→ 🗎 139)	**0 / Fixed torque reference value / limit value**
407	11095	P4-07 Max. motor torque limit (→ 🗎 140)	P4-08 – **200** – 500%
408	11096	P4-08 Min. torque limit (→ 🗎 141)	**0.0%** – P4-07
409	11097	P4-09 Max. regenerative torque limit (→ 🗎 141)	P4-08 – **200** – 500%
410	11098	P4-10 V/f characteristic adjustment frequency (→ 🗎 142)	**0.0** – 100.0% of P1-09
411	11099	P4-11 V/f characteristic adjustment voltage (→ 🗎 142)	**0.0** – 100.0% of P1-07
412	11100	P4-12 Motor brake control (→ 🗎 142)	**0 / Disabled**
413	11101	P4-13 Brake release time (→ 🗎 142)	0.0 – 5.0 s
414	11102	P4-14 Brake application time (→ 🗎 142)	0.0 – 5.0 s
415	11103	P4-15 Torque threshold for brake release (→ 🗎 142)	0.0 – 200%
416	11104	P4-16 Hoist torque threshold timeout (→ 🗎 143)	0.0 – 25.0 s
417	11357	P4-17 Thermal motor protection to UL508C (→ 🗎 143)	**0 / Disabled**
501	11105	P5-01 Frequency inverter address (→ 🗎 144)	0 – **1** – 63
502	11106	P5-02 SBus baud rate (→ 🗎 144)	125 − **500** − 1 000 kBd
503	11107	P5-03 Modbus baud rate (→ 🗎 144)	9.6 − **115.2 / 115 200 Bd**
504	11108	P5-04 Modbus data format (→ 🗎 144)	**n-1 / No parity, 1 stop bit**

Modbus register	SBus/ CANopen index	Associated parameter	Range / factory setting
505	11109	P5-05 Response to communication failure (→ 🗎 144)	**2 / Stop ramp (without fault)**
506	11110	P5-06 Communication failure timeout for SBus and Modbus (→ 🗎 144)	0.0 – **1.0** – 5.0 s
507	11111	P5-07 Ramp specified via fieldbus (→ 🗎 145)	**0 / Disabled**
508	11112	P5-08 Synchronization duration (→ 🗎 145)	**0**, 5 – 20 ms
509	11369	P5-09 Fieldbus PO2 definition (→ 🗎 145)	0 − 7
510	11370	P5-10 Fieldbus PO3 definition (→ 🗎 145)	0 − 7
511	11371	P5-11 Fieldbus PO4 definition (→ 🗎 145)	0 − 7
512	11372	P5-12 Fieldbus PI2 definition (→ 🗎 146)	0 − 11
513	11373	P5-13 Fieldbus PI3 definition (→ 🗎 146)	0 − 11
514	11374	P5-14 Fieldbus PI4 definition (→ 🗎 146)	0 − 11
515	11360	P5-15 Expansion relay 3 function selection (→ 🗎 147)	0 − 10
516	11361	P5-16 Relay 3 upper limit (→ 🗎 147)	0.0 – **100.0** – 200.0%
517	11362	P5-17 Relay 3 lower limit (→ 🗎 147)	**0.0** – 200.0%
518	11363	P5-18 Expansion relay 4 function selection (→ 🗎 147)	Like *P5-15*
519	11364	P5-19 Relay 4 upper limit (→ 🗎 147)	0.0 – **100.0** – 200.0%
520	11365	P5-20 Relay 4 lower limit (→ 🗎 147)	**0.0** – 200.0%
601	11115	P6-01 Firmware upgrade enable (→ 🗎 148)	**0 / Disabled**
602	11116	P6-02 Automatic thermal management (→ 🗎 148)	**1 / Enabled**
603	11117	P6-03 Auto-reset delay time (→ 🗎 148)	1 – **20** – 60 s
604	11118	P6-04 User relay hysteresis band (→ 🗎 148)	0.0 – **0.3** – 25.0%
605	11119	P6-05 Encoder feedback enable (→ 🗎 149)	**0 / Disabled**
606	11120	P6-06 Encoder PPR (→ 🗎 149)	**0** – 65 535 PPR
607	11121	P6-07 Speed error trigger threshold (→ 🗎 149)	1.0 – **5.0** – 100%
608	11122	P6-08 Max. frequency for speed setpoint (→ 🗎 149)	0; **5** – 20 kHz
609	11123	P6-09 Droop speed control/load sharing (→ 🗎 150)	**0.0** – 25.0
610	11124	P6-10 Reserved (→ 🗎 150)	
611	11125	P6-11 Speed holding time on enable (preset speed 7) (→ 🗎 150)	**0.0** – 250 s
612	11126	P6-12 Speed holding time on inhibit (preset speed 8) (→ 🗎 150)	**0.0** – 250 s
613	11127	P6-13 Fire mode logic (→ 🗎 151)	**0 / Open trigger: Fire mode**
614	11128	P6-14 Fire mode speed (→ 🗎 151)	-P1-01 – **0** – P1-01 Hz
615	11129	P6-15 Analog output 1 scaling (→ 🗎 151)	0.0 – **100.0** – 500.0%
616	11130	P6-16 Analog output 1 offset (→ 🗎 152)	-500.0 – **100.0** – 500.0%
617	11131	P6-17 Max. torque limit timeout (→ 🗎 152)	0.0 – **0.5** − 25.0 s
618	11132	P6-18 DC braking voltage level (→ 🗎 152)	Auto, **0.0** – 30.0%
619	11133	P6-19 Braking resistor value (→ 🗎 152)	**0**, Min-R – 200 Ω
620	11134	P6-20 Braking resistor power (→ 🗎 153)	**0.0** – 200 kW
621	11135	P6-21 Brake chopper undertemperature duty cycle (→ 🗎 153)	**0.0** – 20.0%
622	11136	P6-22 Reset fan runtime (→ 🗎 153)	**0 / Disabled**
623	11137	P6-23 Reset kWh meter (→ 🗎 153)	**0 / Disabled**
624	11138	P6-24 Parameter default settings (→ 🗎 153)	**0 / Disabled**
625	11139	P6-25 Access code level (→ 🗎 153)	0 – **201** – 9 999
701	11140	P7-01 Motor stator resistance (Rs) (→ 🗎 154)	Motor-dependent
702	11141	P7-02 Motor rotor resistance (Rr) (→ 🗎 154)	Motor-dependent
703	11142	P7-03 Motor stator inductance (Lsd) (→ 🗎 154)	Motor-dependent
704	11143	P7-04 Motor magnetization current (Id rms) (→ 🗎 154)	10% × P1-08 − 80% × P1-08
705	11144	P7-05 Motor leakage loss coefficient (sigma) (→ 🗎 154)	0.025 – **0.10** – 0.25
706	11145	P7-06 Motor stator inductance (Lsq) − only for PM motors (→ 🗎 155)	Motor-dependent

21270996/EN – 01/2015

Modbus register	SBus/ CANopen index	Associated parameter	Range / factory setting
707	11146	P7-07 Enhanced generator control (→ 🗎 155)	**0 / Disabled**
708	11147	P7-08 Parameter adjustment (→ 🗎 155)	**0 / Disabled**
709	11148	P7-09 Overvoltage current limit (→ 🗎 155)	0.0 – **1.0** – 100%
710	11149	P7-10 Motor load inertia ratio/stiffness (→ 🗎 156)	0 – **10** – 600
711	11150	P7-11 Pulse width min. limit (→ 🗎 156)	0 – 500
712	11151	P7-12 Pre-magnetization time (→ 🗎 156)	0 – 2 000 ms
713	11152	P7-13 D-gain vector speed controller (→ 🗎 156)	**0.0** – 400%
714	11153	P7-14 Low-frequency torque boost / pre-magnetization current (→ 🗎 157)	**0.0** – 100%
715	11154	P7-15 Torque boost frequency limit (→ 🗎 157)	**0.0** – 50%
716	11155	P7-16 Motor nameplate speed (→ 🗎 157)	**0.0** – 6 000 rpm
801	11156	P8-01 Simulated encoder scaling (→ 🗎 157)	$\mathbf{2}^0$ – 2^3
802	11157	P8-02 Input pulse scaling value (→ 🗎 157)	2^0 – $\mathbf{2}^{16}$
803	11158	P8-03 Lag error low word (→ 🗎 157)	0 – **65 535**
804	11159	P8-04 Lag error high word (→ 🗎 157)	**0** – 65 535
805	11160	P8-05 Reference travel type (→ 🗎 158)	**0 / Disabled**
806	11161	P8-06 Position controller proportional gain (→ 🗎 158)	0.0 – **1.0** – 400%
807	11162	P8-07 Touch probe trigger mode (→ 🗎 158)	**0 / TP1 P edge TP2 P edge**
808	11163	P8-08 Reserved (→ 🗎 158)	
809	11164	P8-09 Velocity feedforward gain (→ 🗎 158)	0 – **100** – 400%
810	11165	P8-10 Acceleration feedforward gain (→ 🗎 158)	**0** – 400%
811	11166	P8-11 Reference offset low word (→ 🗎 159)	**0** – 65 535
812	11167	P8-12 Reference offset high word (→ 🗎 159)	**0** – 65 535
813	11168	P8-13 Reserved (→ 🗎 159)	
814	11169	P8-14 Reference enable torque (→ 🗎 159)	0 – **100** – 500%
901	11171	P9-01 Enable input source (→ 🗎 161)	SAFE, din-1 – din-8
902	11172	P9-02 Rapid stop input source (→ 🗎 161)	OFF, din-1 – din-8, On
903	11173	P9-03 Input source for clockwise rotation (CW) (→ 🗎 161)	OFF, din-1 – din-8, On
904	11174	P9-04 Input source for counterclockwise rotation (CCW) (→ 🗎 161)	OFF, din-1 – din-8, On
905	11175	P9-05 Latch function enable (→ 🗎 162)	OFF, ON
906	11176	P9-06 Direction of rotation reversal (→ 🗎 162)	OFF, din-1 – din-8, On
907	11177	P9-07 Reset input source (→ 🗎 162)	OFF, din-1 – din-8, On
908	11178	P9-08 External fault input source (→ 🗎 162)	OFF, din-1 – din-8, On
909	11179	P9-09 Terminal control enable source (→ 🗎 162)	OFF, din-1 – din-8, On
910	11180	P9-10 Speed source 1 (→ 🗎 162)	Ain-1, Ain-2, speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse
911	11181	P9-11 Speed source 2 (→ 🗎 162)	Ain-1, Ain-2, speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse
912	11182	P9-12 Speed source 3 (→ 🗎 162)	Ain-1, Ain-2, speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse
913	11183	P9-13 Speed source 4 (→ 🗎 163)	Ain-1, Ain-2, speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse
914	11184	P9-14 Speed source 5 (→ 🗎 163)	Ain-1, Ain-2, speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse
915	11185	P9-15 Speed source 6 (→ 🗎 163)	Ain-1, Ain-2, speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse
916	11186	P9-16 Speed source 7 (→ 🗎 163)	Ain-1, Ain-2, speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse
917	11187	P9-17 Speed source 8 (→ 🗎 163)	Ain-1, Ain-2, speed 1 – 8, d-Pot, PID, Sub-dr, F-bus, user, pulse
918	11188	P9-18 Speed selection input 0 (→ 🗎 164)	OFF, din-1 – din-8, On
919	11189	P9-19 Speed selection input 1 (→ 🗎 164)	OFF, din-1 – din-8, On

Modbus register	SBus/ CANopen index	Associated parameter	Range / factory setting
920	11190	P9-20 Speed selection input 2 (→ 🗎 164)	OFF, din-1 – din-8, On
921	11191	P9-21 Preset speed selection input 0 (→ 🗎 165)	OFF, din-1 – din-8, On
922	11192	P9-22 Preset speed selection input 1 (→ 🗎 165)	OFF, din-1 – din-8, On
923	11193	P9-23 Preset speed selection input 2 (→ 🗎 165)	OFF, din-1 – din-8, On
924	11194	P9-24 Positive jog mode input (→ 🗎 165)	OFF, din-1 – din-8
925	11195	P9-25 Negative jog mode input (→ 🗎 165)	OFF, din-1 – din-8
926	11196	P9-26 Reference travel enable input (→ 🗎 165)	OFF, din-1 – din-8
927	11197	P9-27 Reference cam input (→ 🗎 165)	OFF, din-1 – din-8
928	11198	P9-28 Motor potentiometer up input source (→ 🗎 165)	OFF, din-1 – din-8
929	11199	P9-29 Motor potentiometer down input source (→ 🗎 165)	OFF, din-1 – din-8
930	11200	P9-30 Speed-limit switch CW (→ 🗎 166)	OFF, din-1 – din-8
931	11201	P9-31 Speed-limit switch CCW (→ 🗎 166)	OFF, din-1 – din-8
932	11202	P9-32 Enable second deceleration ramp, rapid stop ramp (→ 🗎 166)	OFF, din-1 – din-8
933	11203	P9-33 Fire mode input selection (→ 🗎 166)	OFF, din-1 – din-5
934	11204	P9-34 PID fixed setpoint reference selection input 0 (→ 🗎 166)	**OFF**, din-1 – din-8
935	11205	P9-35 PID fixed setpoint reference selection input 1 (→ 🗎 166)	**OFF**, din-1 – din-8

21270996/EN – 01/2015

10.2 Explanation of the parameters

10.2.1 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 if the factor settings are used or if 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 if the factor settings are used or if 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 frequency inverter enable signal is removed and the frequency inverter decreases the output frequency to zero.

P1-03 Acceleration ramp time

Setting range:

Sizes 2 and 3: 0.00 – **2.0** – 600 s

Sizes 4 – 7: 0.0 – **2.0 –** 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.*

P1-04 Deceleration ramp time

Setting range:

Sizes 2 and 3: Coast (coast to stop) – 0.01 – **2.0** – 600 s

Sizes 4 – 7: Coast (coast to stop) – 0.1 – **2.0** – 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 shown as "coast" on the display because this value causes coasting.

P1-05 Stop mode

- **0 / Stop ramp:** The speed is decreased to zero along the ramp set in *P1-04* when the frequency 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 frequency inverter will hold zero speed during this time before it is inhibited.
- 1 / Coast to stop: In this case, the frequency inverter output is inhibited as soon as the enable signal is removed. The motor then coasts to a stop in a non-controlled manner.

21270996/EN – 01/2015

P1-06 Energy saving function

- **0 / Off**
- 1 / On

If this function is activated, the frequency 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 frequency 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 frequency 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 can only be used for asynchronous motors.

P1-07 Rated motor voltage

Setting range:

- 230 V frequency inverter: 20 – **230** − 250 V
- 400 V frequency inverter: 20 – **400** – 500 V
- 575 V frequency inverter: 20 – **575** – 600 V

Specifies the nominal voltage of the motor connected to the frequency 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 frequency 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 may make a braking resistor redundant.

P1-08 Rated motor current

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

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

If the frequency inverter output current is > 100% of the nominal motor current, the frequency 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 frequency inverter (in accordance with 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 (American version only)

21270996/EN – 01/2015

P1-10 Rated motor speed

Setting range: **0** – 30 000 rpm

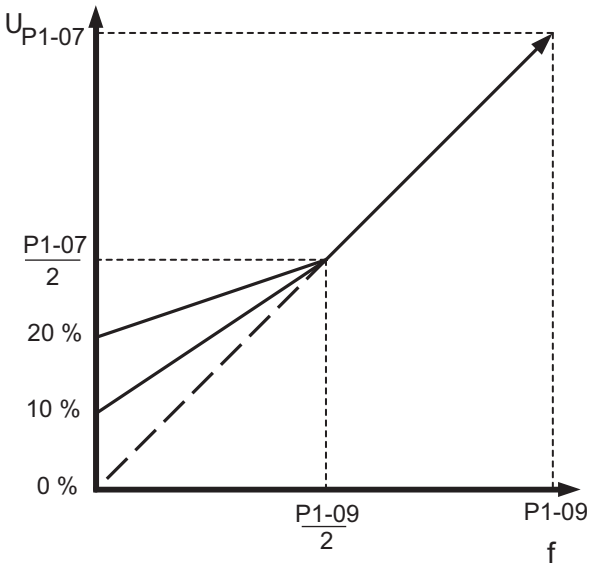
Specifies the rated speed of the motor. When the parameter is set to ≠ 0, all speed-related parameters, such as the minimum and maximum speed, are displayed in "rpm".

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

P1-11 Voltage increase, boost

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

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 frequency inverter is controlled by the:

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

See also chapter "Startup of control" (→ 🗎 70).

- **0 / Terminal mode**
- 1 / Keypad mode, unipolar
- 2 / Keypad mode, bipolar
- 3 / PID controller mode

- 4 / Master/slave mode
- 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 error is displayed with abbreviated text. The most recent error 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 archived only if the frequency inverter is enabled. Undervoltage faults are not archived if the frequency inverter without enable is disconnected from the mains.

P1-14 Extended parameter access

Setting range: **0** – 30 000

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** (basic parameters)
- 1 / *P1-01 – P1-22* (basic + servo parameters)
- 101 / *P0-01 – P5-20* (advanced parameters)
- 201 / *P0-01 – P9-33* (advanced parameter menu → full access)

P1-15 Digital input function selection

Setting range: 0 – **1** – 26

Defines the function of the digital inputs. See chapter "P1-15 Digital inputs function selection" (→ 🗎 166).

10.2.2 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 PM motor control.

21270996/EN – 01/2015

Display value	Motor type	Explanation
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. It contains only the motor data of CMP motors with a speed class of 4500 rpm with an AK0H encoder. Refer to the Smart Servo package.
40M 2b 40M 4b	230 V/400 V CMP40M with brake	
50S 2 50S 4	230 V / 400 V CMP50S	
50S 2b 50S 4b	230 V/400 V CMP50S with brake	
50M 2 50M 4	230 V/400 V CMP50M	
50M 2b 50M 4b	230 V/400 V CMP50M with brake	
50L 2 50L 4	230 V/400 V CMP50L	
50L 2b 50L 4b	230 V/400 V CMP50L with brake	
63S 2 63S 4	230 V/400 V CMP63S	
63S 2b 63S 4b	230 V/400 V CMP63S with brake	
63M 2 63M 4	230 V/400 V CMP63M	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. It contains only the motor data of CMP motors with a speed class of 4500 rpm with an AK0H encoder. Refer to the Smart Servo package.
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 MGF..-DSM is selected, the torque limit in *P4-07* is automatically set to 200%. You must use the publication "Addendum to the operating instructions for the MGF..-DSM drive unit on the LTP-B frequency inverter" to adjust this value in accordance with the gear unit ratio. All necessary motor data is configured automatically.
gf-4	MGF..4-DSM	
gf-4Ht	MGF..4/XT-DSM[1)]	

1) In preparation

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

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

P1-17 Servo module function selection

Setting range: 0 − **1** – 8

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

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 servo module.

P1-19 Frequency inverter address

Setting range: 0 − **1** – 63

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

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*.

P1-21 Stiffness

Setting range: 0.50 – **1.00** – 2.00

Can only be used with the LTX encoder module. Always use *P7-10* in an open control loop.

P1-22 Motor load inertia ratio

Setting range: 0.0 – **1.0** – 30.0

The inertia ratio between the motor and the connected load is entered in this parameter. This value can usually remain set to the default value "1.0". The inertia ratio is used by the control algorithm of the frequency inverter as a precontrol value for CMP/PM motors from *P1-16* in order 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 this value at the default setting "1.0".

21270996/EN – 01/2015

10.2.3 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 Preset speed 1

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

Is also used as jog speed.

P2-01 Preset speed 1

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

P2-03 Preset speed 3

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

P2-04 Preset speed 4

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

P2-05 Preset speed 5

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

Is also used as reference travel speed.

P2-06 Preset speed 6

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

Is also used as reference travel speed.

P2-07 Preset speed 7

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

Used for brake release speed in hoist mode

P2-08 Preset speed 8

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

Used for brake application speed in hoist mode

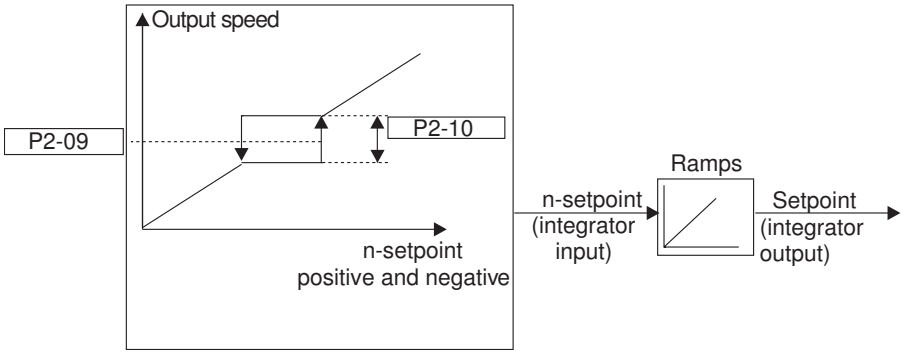
21270996/EN – 01/2015

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	Enable frequency inverter	Logic 1 when frequency inverter is enabled (running)
1	Frequency inverter ok (digital)	Logic 1 when there is no frequency 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 with a speed > 0
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)	

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

Setting	Function	Explanation
8	Motor speed (analog)	The amplitude of the analog output signal represents the motor speed. It is scaled from 0 to the maximum speed limit defined in *P1-01*.
9	Motor current (analog)	The amplitude of the analog output signal represents the motor load 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 output effective power of the frequency inverter. It is scaled from 0 to 200% of the frequency inverter rated power.
12	Feldbus/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** – 12

See table "P2-11 / P2-13 Analog outputs" (→ 🗎 126).

21270996/EN – 01/2015

P2-12 Analog output 1 format

0 – 10 V

10 – 0 V

0 – 20 mA, 20 – 0 mA

4 – 20 mA, 20 – 4 mA

P2-13 Analog output 2 function selection

Setting range: 0 – **9** – 12

See table P2-11 – P2-14 (→ 🗎 126).

P2-14 Analog output 2 format

0 – 10 V

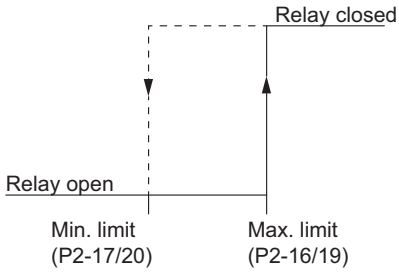
10 – 0 V

0 – 20 mA, 20 – 0 mA

4 – 20 mA, 20 – 4 mA

P2-15 – P2-20 Relay outputs

You can select the function for the relay outputs in the table below. If the relay control depends on a limit value, the relay behaves as follows:



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Settings	Function	Explanation
0	Enable frequency inverter	Relay contacts closed when frequency inverter is enabled
1	Frequency inverter ok (digital) = no fault	Relay contacts closed when frequency inverter is ok (no fault)
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 frequency inverter now controls the relay contact for hoist mode. (Value cannot be changed if *P4-12* = 1)
9	STO state	Relay contacts open if STO circuit is open (inverter indicates "inhibit")

Settings	Function	Explanation
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 frequency inverter is referenced, the relay output is closed. This option is available for sizes 2 and 3 only.

1) In connection with LTX only.

P2-15 User relay output 1 function selection

Setting range: 0 – **1** – 11

See table "P2-15 – P2-20 Relay outputs" (→ 🗎 127).

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

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

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

Setting range: **0.0** – P2-16

P2-18 User relay output 2 function selection

Setting range: 0 – **3** – 11

See table "P2-15 – P2-20 Relay outputs" (→ 🗎 127).

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

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

P2-20 Lower limit 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 the motor speed, motor current, and motor power. Pressing the "Navigate" key toggles the display between realtime 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

Used in conjunction with a CCU or MultiMotion (also as a factor for the direction of rotation reversal). If the value is negative, the speed specification is accurately interpreted as being inverted. A CCU restart is required after any change.

21270996/EN – 01/2015

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 4 096.

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 frequency 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 frequency inverter is disabled. This function is usually used together with the relay output function so that the frequency inverter issues a relay control signal before the frequency inverter output is inhibited.

P2-24 PWM switching frequency

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

Setting for 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.

The frequency inverter automatically reduces the switching frequency when the heat sink temperature is excessively high.

P2-25 Second deceleration ramp, rapid stop ramp

Setting range:

Sizes 2 and 3: Coast (coast to stop) – 0.01 – **2.0** – 600 s

Sizes 4 – 7: Coast (coast to stop) – 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 activated, the motor starts from the detected rotor speed. Short deceleration possible if the rotor is at a standstill. Only possible if *P4-01* = 0 or 2. If the motor rotates against the speed enabled by the frequency 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

21270996/EN – 01/2015

When *P2-27* > 0, the frequency inverter goes to standby mode (output inhibited) 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 parameters

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

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

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, 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 – 10 V, 10 – 0 V / unipolar voltage range

-10 – 10 V / bipolar voltage input

0 – 20 mA / current input

t4 – 20 mA, t20-4 mA

r4 – 20 mA, r20-4 mA

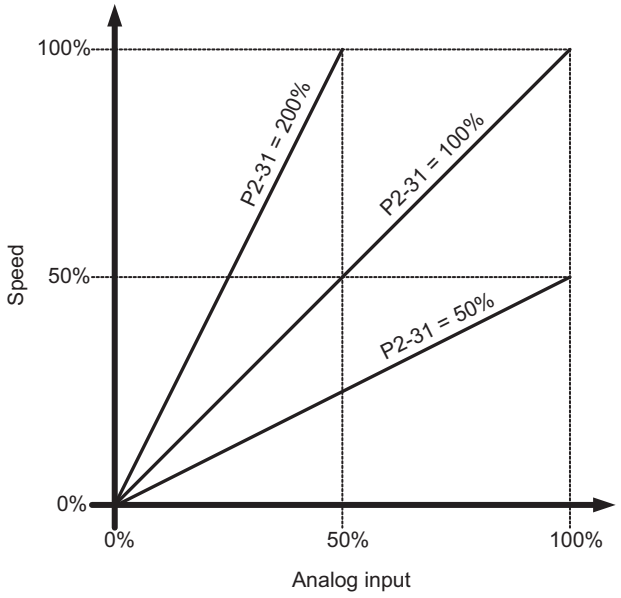
"t" indicates that the inverter shuts down when the signal is removed while the inverter is enabled. t4 – 20 mA, t20 – 4 mA

"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

21270996/EN – 01/2015

P2-31 Analog input 1 scaling

Setting range: 0 – **100** – 500%



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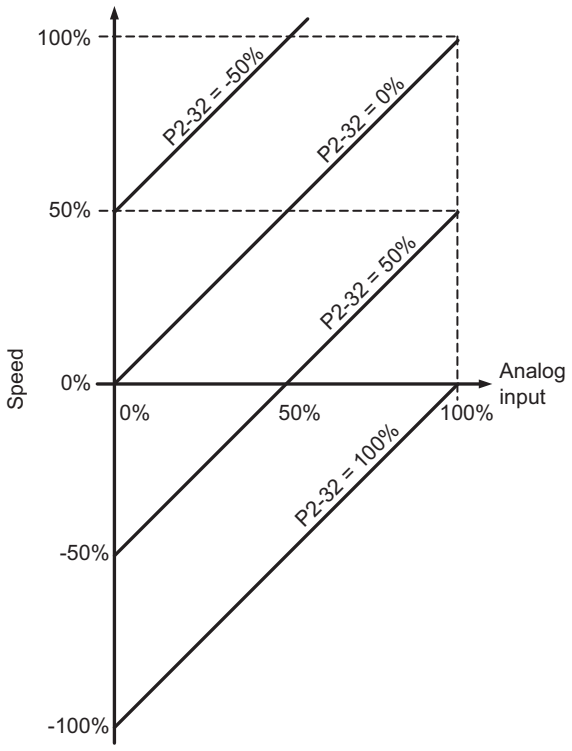
P2-32 Analog input 1 offset

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

0 – 10 V, 10 – 0 V / / unipolar voltage input

PTC-th / motor thermistor input

0 – 20 mA / current input

t4 – 20 mA, t20 – 4 mA

"t" indicates that the frequency inverter shuts down when the signal is removed while the frequency inverter is enabled.

r4 – 20 mA, r 20 – 4 mA

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

PTC-th has to be selected together with *P1-15* as a response to an external fault to ensure thermal motor protection.

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

Defines the frequency inverter behavior with reference to the enable digital input and configures the automatic restart function.

Edge-r

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

Auto-0

⚠ WARNING

If both the setting "Auto-0" and the enable signal are set, there is a risk of automatically restarting the drive after acknowledging an error message (reset) or switching on the voltage.

Fatal or severe injuries and damage to property.

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

- **Auto-0:** If digital input 1 is closed, the frequency inverter starts automatically after a switch-on or reset if the enable signal is set.

21270996/EN – 01/2015

Auto-1 – Auto-5

⚠ WARNING

If both the setting "Auto-1 – Auto-5" and the enable signal are set, there is a risk of automatically restarting the drive after eliminating a fault or switching on the voltage because the frequency inverter automatically tries (one to five times) to acknowledge the error.

Fatal or severe injuries and damage to property.

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

- Auto-1 – Auto-5: After a switch-off with fault (trip), the frequency inverter makes up to five restart attempts (at 20 second intervals). The interval duration is defined in *P6-03*. The number of attempted restarts is counted. If the frequency inverter fails to start with the final attempt, the frequency inverter switches to a fault status and prompts the user to reset the fault manually. A reset also resets the counter.

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 frequency inverter returns to the value prior to stopping that was last set using the keypad.
- 2 / Current speed. If the frequency 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 frequency inverter continues to run with the last operating speed.
- 3 / Preset speed 8. Following a stop or restart, the frequency inverter always runs at preset speed 8 (*P2-08*).
- 4 / Minimum speed (terminal mode). Following a stop or restart, the frequency inverter always runs at the minimum speed set in *P1-02*.
- 5 / Last speed (terminal mode). Following a stop or restart, the frequency inverter returns to the value entered prior to stopping.
- 6 / Current speed (terminal mode). If the frequency 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 frequency inverter continues to run with the last operating speed.
- 7 / Preset speed 8 (terminal mode). Following a stop or restart, the frequency inverter always runs at preset speed 8 (*P2-08*).

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

21270996/EN – 01/2015

P2-38 Mains loss stop control

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

- **0** / The frequency 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 frequency inverter will restart as soon as the line voltage is restored.
- 1 / The frequency 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, the flying start function (*P2-26*) must be activated, if required.
- 2 / The frequency inverter stops along the rapid stop ramp set in *P2-25*.
- 3 / DC bus supply if the frequency inverter is supplied directly via the DC+ and DC terminals. This function can be used to disable power failure detection.

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.

10.2.4 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 to the frequency inverter output frequency as a response to minor changes to 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

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

P3-04 PID operating mode

- **0 / Direct operation** – The motor speed decreases as the feedback signal increases.
- 1 / Inverse operation – The motor speed increases as the feedback signal increases.

21270996/EN – 01/2015

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" (→ 🗎 145).

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%**

Upper limit of PID controller 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 limit

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

P3-10 PID feedback selection

Selects the source for the PID feedback signal.

- **0/analog input 2**
- 1 / Analog input 1

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.

21270996/EN – 01/2015

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, and so on. 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.

21270996/EN – 01/2015

10.2.5 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 magnetization 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 magnetization current is controlled independently. Activating 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 activated in this operating mode. In this case, the tuning process is less complex and can be carried out more quickly.

- 3 / PM motor speed control

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

- 4 / PM motor torque control

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

- 5 / PM motor position control

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

INFORMATION

Auto tune must be performed each time the control mode changes.

P4-02 "Auto tune"

- **0 / Inhibited**
- 1 / Enabled

Enable the frequency inverter only after you have correctly entered all rated motor data in the relevant parameters. Once you have entered the motor data, you can also use parameter *P4-02* to start auto tune manually.

After a reset to factory settings, auto tune starts after the first enable and lasts for up to two minutes, depending on the control mode.

INFORMATION

"Auto tune" must be restarted each time the rated motor data changes. The frequency 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: adjust the value to match the connected load by gradually increasing the value while 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 may be necessary to reduce the gain for loads with high inertia and low friction.

INFORMATION

At first, parameter *P7-10* should always be used to optimize the controller. Internally, this affects parameters *P4-03 / P4-04*.

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

At first, parameter *P7-10* should always be used to optimize the controller. Internally, this affects parameters *P4-03 / P4-04*.

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).

21270996/EN – 01/2015

P4-06 Torque reference (limit value) source

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

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

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

In V/f mode, however, compliance with the torque limit is less dynamic.

The torque reference/limit value source can be determined by the selection options specified below.

The motor torque reference value is determined in *P4-07* as a percentage of the rated motor torque, whereby the latter is automatically determined 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 moment reference/limit.
- 2 / Analog input 2 determines the torque moment reference/limit.

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

  – Select the required 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*.

  – Select the required digital input function, for example, *P1-15* = 3 (torque specified in analog input 2).

  – Adjust the timeout time for the maximum torque limit in *P6-17* analog input 2.
- 3 / Fieldbus communication

  Fieldbus torque setpoint. If this option is selected, the fieldbus master specifies the motor torque limit. A value of 0 to 200% of *P4-07* can be entered.
- 4 / Master frequency inverter

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

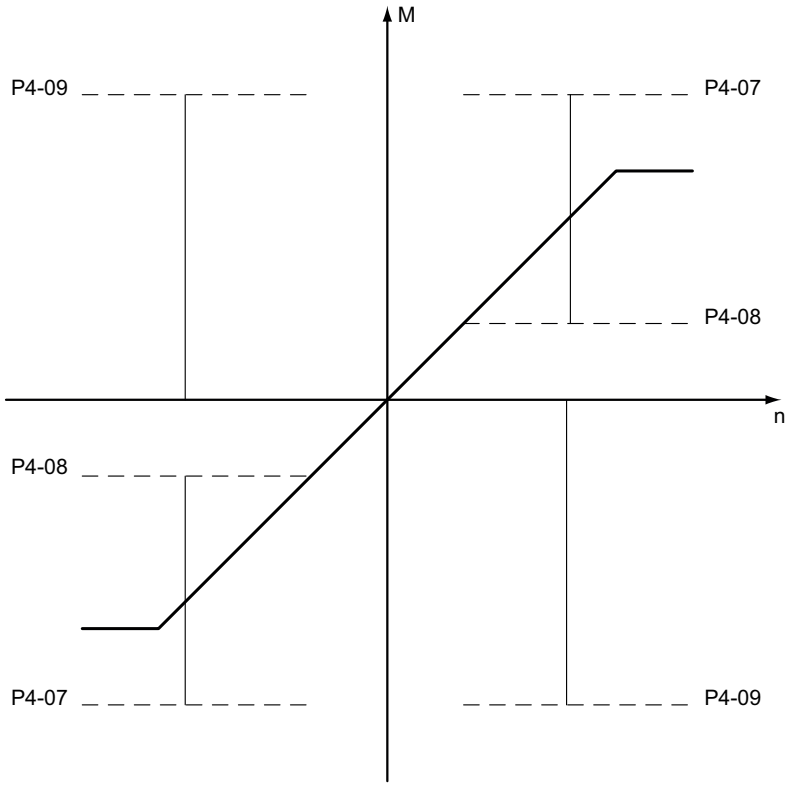
  The output of the PID controller provides the torque setpoint.

21270996/EN – 01/2015

P4-07 – P4-09 Motor torque limit settings

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

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 sets the maximum torque limit. The limit value source is specified in parameter *P4-06*.

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

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

V/f mode: *P4-07* limits the frequency inverter output current to the defined limit value before the frequency inverter output frequency for limiting the current is reduced.

Sample asynchronous motors:

Configure and verify the torque limit (*P4-07*) for asynchronous motors:

Asynchronous motor data:

P_n = 1.1 kW, I_n = I_s = 2.4 A, n_n = 1420 rpm, cos phi = 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.

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

21270996/EN – 01/2015

To verify the torque-producing inverter current in P0-15:

I_q = cos(phi) × I_s = cos(0.79) × 2.4 A = 1.89 A

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

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

Sample synchronous motors:

Configure and verify the torque limit (*P4-07*) for synchronous motors:

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

Synchronous motor data: I_0 = 1.5 A, M_0 = 0.8 Nm

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

To verify the torque-producing inverter current in P0-15:

I_d = 0, Standard for synchronous motors with vector control, resulting in $I_q \approx M$.

If a torque limit of 200% is calculated, *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 all times while the motor is running.

When this parameter is set to > 0 and the maximum speed of the inverter is so high that it is not reached during the travel cycle, the inverter is always motor-driven. In other words, depending on the application, a braking resistor may not be 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 may be exceeded.

P4-09 Max. regenerative torque limit

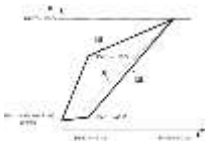
Setting range: *P4-08* – **200** – 500%

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 aggressively in regenerative mode. If the value is too small, the output torque of the motor may drop in regenerative mode.

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

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

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



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[1] Normal V/f characteristic curve

[2] Adjusted V/f characteristic curve

[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

Activates the hoist function of the frequency inverter.

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

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

- **0 / Disabled**
- 1 / Enabled

For examples, refer to chapter "Hoist function" (→ 🗎 75).

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 especially in hoists.

P4-15 Torque threshold for brake release

Setting range: 0.0 – 200 s

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. With V/f control, torque detection is not activated. This is only recommended for applications with horizontal movement.

21270996/EN – 01/2015

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 / Enabled

The frequency inverters come equipped with a thermal motor protection function in accordance with NEC in order to protect the motor from overload. The motor current is accumulated over time in an internal memory.

The frequency inverter switches to a fault status as soon as the thermal limit is exceeded (I.t-trP).

Once the output current of the frequency inverter is less than the set nominal 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.

21270996/EN – 01/2015

10.2.6 Parameter group 5: Fieldbus communication (level 2)

P5-01 Frequency inverter address

Setting range: 0 − **1** – 63

Specifies the general frequency inverter address for SBus, Modbus, fieldbus, and master/slave.

P5-02 SBus baud rate

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

- 125 / 125 kBd
- 250 / 250 kBd
- **500 / 500 kBd**
- 1000 / 1 000 kBd

P5-03 Modbus baud rate

Sets the expected Modbus baud rate.

- 9.6 / 9 600 Bd
- 19.2 / 19 200 Bd
- 38.4 / 38 400 Bd
- 57.6 / 57 600 Bd
- **115.2 / 115 200 Bd**

P5-04 Modbus data format

Sets the expected Modbus data format.

- **n-1 / No parity, 1 stop bit**
- n-2 / No parity, 2 stop bits
- O-1 / Odd parity, 1 stop bit
- E-1 / Even parity, 1 stop bit

P5-05 Response to communication failure

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

- 0 / Fault and coast to stop
- 1 / Stop ramp and fault
- **2 / Stop ramp (without fault)**
- 3 / Preset 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.

21270996/EN – 01/2015

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 / Enabled

P5-08 Synchronization duration

Setting range: **0**, 5 – 20 ms

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

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

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

- 0 / Speed rpm (1 = 0.2 rpm) → only possible if *P1-10* ≠ 0.
- 1 / Speed % (0x4000 = 100% *P1-01*)
- 2 / Torque setpoint value/limit value % (1 = 0.1%) → set frequency inverter to *P4-06* = 3.
- 3 / Ramp time (1 = 1 ms) up to a maximum of 65535 ms
- 4 / PID reference (0x1000 = 100%) → *P1-12* = 3 (control signal source)
- 5 / Analog output 1 (0x1000 = 100%)[1)]
- 6 / Analog output 2 (0x1000 = 100%)[1)]
- 7 / No function

1) If the analog outputs are controlled by fieldbus or SBus, you must also set parameter P2-11 or P2-13 = 12 (fieldbus/SBus(analog)).

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

This is the definition of the process data words sent from the frequency inverter to the PLC/gateway.

- 0[1)] / Speed: rpm (1 = 0.2 rpm)

21270996/EN – 01/2015

- 1 / Speed % (0x4000 = 100% *P1-01*)
- 2 / Current % (1 = 0.1% I_{rated} nominal frequency inverter current)
- 3 / Torque % (1 = 0.1%)
- 4 / Power % (1 = 0.1%)
- 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 unit and option

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

* Available only with a suitable option module.

RL = Relay

- 10[2)] / LTX position low byte (number of increments within a revolution)
- 11[2)] / LTX position high byte (number of revolutions)

1) Only possible when P1-10 ≠ 0.
2) Only with a connected 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*

21270996/EN – 01/2015

P5-15 Expansion relay 3 function selection

INFORMATION

Only available and visible when IO expansion module is connected.

Defines the function of expansion relay 3.

- 0 / Frequency inverter enabled
- 1 / Frequency inverter ok
- 2 / Motor runs at setpoint speed
- 3 / Motor speed > 0
- 4 / Motor speed > limit value
- 5 / Motor current > limit value
- 6 / Motor torque > limit value
- 7 / Analog input 2 > limit value
- 8 / Fieldbus control
- 9 / STO status
- 10 / PID error ≥ limit value

P5-16 Relay 3 upper limit

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

P5-17 Relay 3 lower limit

Setting range: **0.0** – 200.0%

P5-18 Expansion relay 4 function selection

Defines the function of expansion relay 4.

Parameter description like *P5-15*.

P5-19 Relay 4 upper limit

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

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".

21270996/EN – 01/2015

10.2.7 Parameter group 6: Extended parameters (level 3)

P6-01 Firmware upgrade enable

Activates firmware upgrade mode, which 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

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

- 0 / Disabled
- **1 / Enabled**

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
97°C	Overtemperature error message

P6-03 Auto-reset delay time

Setting range: 1 – **20** – 60 s

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

P6-04 User relay hysteresis band

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 range, the frequency 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.

21270996/EN – 01/2015

P6-05 Encoder feedback enable

Setting 1 activates encoder feedback. This parameter is automatically activated as soon as an LTX module is connected.

- **0 / Disabled**
- 1 / Enabled

P6-06 Encoder PPR

Setting range: **0** – 65 535 PPR (pulses per revolution)

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

INFORMATION

HTL/TTL encoders require at least 512 increments for operation.

P6-07 Speed error trigger threshold

Setting range: 1.0 – **5.0** – 100%

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

The parameter is active 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 frequency inverter is switched off and has a speed error (SP-Err or ENC02) depending on the firmware version. When set to "100%", the speed error is disabled.

P6-08 Max. frequency for speed setpoint

Setting range: 0; **5** – 20 kHz

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.

21270996/EN – 01/2015

P6-09 Droop speed control/load sharing

Setting range: **0.0** – 25.0

This parameter applies only when the frequency inverter runs in vector speed control mode (*P4-01* = 0). When set to zero, the control function for droop speed/load sharing is disabled. When *P6-09* > 0, this parameter defines a slip speed at rated motor output torque.

Droop speed P6-09 (as a percentage) refers to the rated motor frequency *P1-09*. Depending on the motor load condition, the reference speed is reduced by a certain droop value before it enters the speed controller. Following the calculation:

Droop speed = *P6-09* × *P1-09*

Droop value = droop speed × (actual motor torque/rated motor torque)

Speed controller input = speed setpoint – droop value

Droop control can be used to achieve a slight reduction in motor speed in proportion to the applied load. This function can be useful when several motors drive a common load and the load is to be shared evenly among the motors. In general, a very small value is adequate in *P6-09*. Often, a speed adjustment of 1 - 2 rpm is enough to achieve evenly distributed load sharing.

P6-10 Reserved

P6-11 Speed holding time on enable (preset speed 7)

Setting range: **0.0** – 250 s

Defines the time during which the frequency inverter runs at preset speed 7 (*P2-07*) when the enable signal is applied to the frequency inverter. The preset 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. It allows the user to program the frequency 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 (preset speed 8)

Setting range: **0.0** – 250 s

Defines the time during which the frequency inverter runs at preset speed 8 (*P2-08*) after having removed the enable signal.

INFORMATION

Setting this parameter to a value > 0 lets the frequency inverter continue to run at the preset 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", the function is disabled.

21270996/EN – 01/2015

P6-13 Fire mode logic

Activates emergency fire mode. In this mode, the frequency inverter ignores a multitude of faults. If the frequency inverter has switched to a fault status, the frequency inverter resets itself every 5 s until it fails completely or a power failure occurs.

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

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

P6-14 Fire mode speed

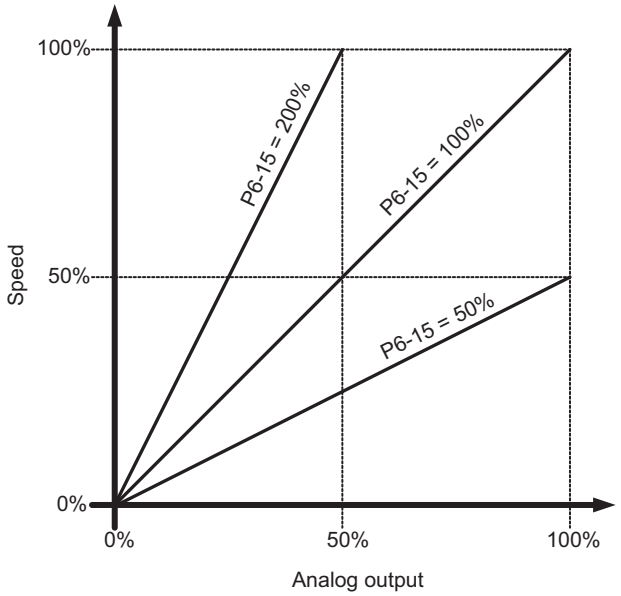
Setting range: *-P1-01* – **0** – *P1-01* Hz

This is the speed used in fire 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.



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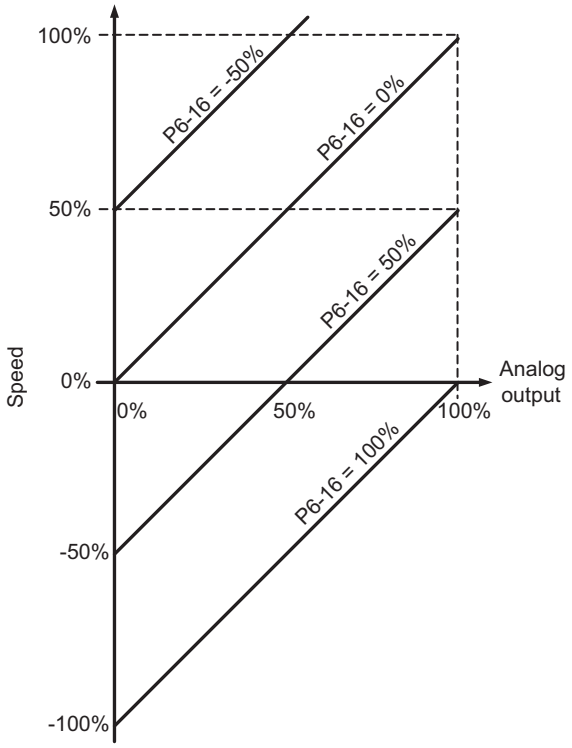
P6-16 Analog output 1 offset

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

Specifies the offset in % used for analog output 1.



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P6-17 Max. torque limit timeout

Setting range: 0.0 – **0.5** − 25.0 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 activated only 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 frequency inverter.

When set to "0", the protection function for the braking resistor is disabled.

21270996/EN – 01/2015

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 undertemperature duty cycle

Setting range: **0.0** – 20.0%

This parameter is used to specify the duty cycle for the brake chopper when the frequency inverter switches to an undertemperature fault status. To warm up the frequency inverter, mount a braking resistor onto the heat sink of the frequency inverter until the correct operating temperature is reached. Use this parameter with great care. An incorrect setting may cause the rated power capacity of the braking resistor to be exceeded. To prevent this, always use external thermal protection for the braking resistor.

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

P6-22 Reset fan runtime

- **0 / Disabled**
- 1 / Reset runtime

When set to "1", the internal runtime counter for the fan is reset to "0" (as displayed in *P0-35*).

P6-23 Reset kWh meter

- **0 / Disabled**
- 1 / Reset kWh meter

When set to "1", the internal kWh meter is reset to "0" (as displayed in *P0-26* and *P0-27*).

P6-24 Parameter default settings

Frequency inverter factory settings:

The frequency inverter must not be enabled and "Inhibit" must be shown on the display.

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

P6-25 Access code level

Setting range: 0 – **201** – 9 999

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

21270996/EN – 01/2015

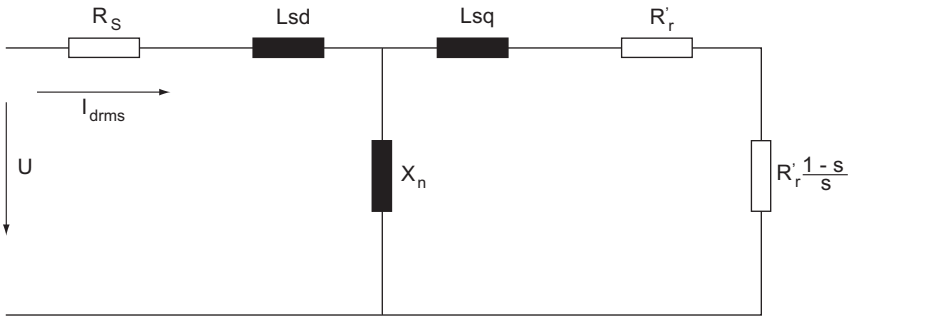
10.2.8 Parameter group 7: Motor control parameters (level 3)

NOTICE

Possible damage to the frequency inverter

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 should be made only by experienced users who fully understand the functions of these parameters.

Equivalent wiring diagram for AC motors.



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P7-01 Motor stator resistance (Rs)

Setting range: 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.

P7-03 Motor stator inductance (Lsd)

Setting range: depends on the motor (H)

For induction motors: Phase stator inductance value.

For permanent magnet 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: Magnetization 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.

21270996/EN – 01/2015

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

Setting range: depends on the motor (H)

For permanent magnet 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 frequency 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 frequency 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 continues to be decelerated.

21270996/EN – 01/2015

P7-10 Motor load inertia ratio/stiffness

Setting range: 0 – **10** – 600

P7-10 is used to improve the control response for control modes without encoder feedback. The inertia ratio between the motor and the connected load is entered in this parameter. This value can usually remain set to the default value "10". The inertia ratio is used by the control algorithm of the frequency inverter as a precontrol value for all motors in order to provide the optimum 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. Internally, the inertia ratio *P7-10* affects the following gains:

$$\text{P7-10} = \left(\frac{J_{ext}}{J_{Mot}} \right) \times 10$$

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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 frequency inverter.

Time = value × 16.67 ns

P7-12 Pre-magnetization time

Setting range: 0 – 2 000 ms

Use this parameter to define a pre-magnetization time. Consequently, there is a corresponding start delay when the frequency inverter is enabled. If the value is too small, the frequency inverter may 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 frequency 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.

21270996/EN – 01/2015

P7-14 Low-frequency torque boost / pre-magnetization current

Setting range: **0.0** – 100%

The boost current applied at start-up as a % of the rated motor current (*P1-08*). The frequency 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 frequency inverter at the lowest frequency required for the application. Increase the values to provide the required torque and to ensure smooth operation.

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

P7-15 Torque boost frequency limit

Setting range: **0.0** – 50%

Frequency range for the applied boost current (*P7-14*) as a % of the rated motor frequency (*P1-09*). In this parameter, set the frequency limit value above which a boost current is no longer applied to the motor.

P7-16 Motor nameplate speed

Setting range: **0.0** – 6 000 rpm

10.2.9 Parameter group 8: User-specific parameters (only applicable to LTX) (level 3)

INFORMATION

For more information, refer to the addendum to the operating instructions "MOVITRAC® LTX servo module for MOVITRAC® LTP-B" in chapter "LTX function parameter set (level 3)".

P8-01 Simulated encoder scaling

Setting range: $\mathbf{2}^0$ – 2^3

P8-02 Input pulse scaling value

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

P8-03 Lag error low word

Setting range: 0 – **65 535**

Number of increments within a revolution.

P8-04 Lag error high word

Setting range: **0** – 65 535

Number of revolutions.

21270996/EN – 01/2015

P8-05 Reference travel type

- **0 / Disabled**
- 1 / Zero pulse for negative direction of travel
- 2/ Zero pulse for positive direction of travel
- 3 / End of reference cam negative direction of travel
- 4 / End of reference cam positive direction of travel
- 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 feedforward 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 frequency inverter.

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

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

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

P8-10 Acceleration feedforward gain

Setting range: **0** – 400%

21270996/EN – 01/2015

P8-11 Reference offset low word

Setting range: **0** – 65 535

P8-12 Reference offset high word

Setting range: **0** – 65 535

P8-13 Reserved

P8-14 Reference enable torque

Setting range: 0 – **100** – 500%

10.2.10 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 frequency inverter behavior in complex applications that require specific parameter settings. Use the parameters of this group with utmost care. Only users who are absolutely familiar with the use of the frequency inverter and its control functions should adjust the parameters in this group.

Overview of functions

Parameter group 9 allows for the advanced programming of the frequency inverter, including user-defined functions for the digital and analog inputs of the frequency 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 frequency 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
	STO input	Linked to the status of STO inputs, if allowed
	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 status (requires extended I/O option)
	Digital input 7	Function linked to digital input 7 status (requires extended I/O option)
	Digital input 8	Function linked to digital input 8 status (requires extended I/O option)

The control sources for the frequency inverter are handled in the following order of priority (from highest to lowest priority):

- STO circuit
- External fault
- Rapid stop
- Enable
- Terminal control override
- Clockwise / counterclockwise
- Reset

21270996/EN – 01/2015

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*)
	Preset speed	Selected preset 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 PI2
	User defined speed setpoint	User defined speed setpoint (PLC function)
	Frequency input	Pulse frequency input reference

P9-01 Enable input source

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

This parameter specifies the source of the frequency inverter enable function. This function is usually assigned to digital input 1. It facilitates 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. In 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.

INFORMATION

When the CW rotation and CCW rotation commands are applied to the motor simultaneously, the frequency 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 frequency 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.

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 frequency 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 frequency 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 frequency inverter does not have to be stopped and restarted.

P9-10 Speed source 1

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

Specifies the source of the speed.

21270996/EN – 01/2015

P9-13 Speed source 4

Setting range: Ain-1, Ain-2, preset 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, preset 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, preset speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
Specifies the source of the speed.

P9-16 Speed source 7

Setting range: Ain-1, Ain-2, preset 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, preset speed 1–8, d-Pot, PID, Sub-dr, F-bus, user, pulse
Specifies the source of the speed.

21270996/EN – 01/2015

P9-18 – P9-20 Speed selection input

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 in accordance with 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 Speed selection input 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 Speed selection input 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 Speed selection input 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 Preset speed selection input

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

P9-23	P9-22	P9-21	Preset speed
0	0	0	1 (*P2-01*)
0	0	1	2 (*P2-02*)
0	1	0	3 (*P2-03*)
0	1	1	4 (*P2-04*)
1	0	0	5 (*P2-05*)
1	0	1	6 (*P2-06*)
1	1	0	7 (*P2-07*)
1	1	1	8 (*P2-08*)

21270996/EN – 01/2015

P9-21 Preset 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 preset speed.

P9-22 Preset 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 preset speed.

P9-23 Preset 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 preset 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

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*.

21270996/EN – 01/2015

P9-30 Speed-limit switch CW

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 limit the speed in clockwise rotation. When the specified signal source is logic 1 and the motor is operated in clockwise rotation, the speed is reduced to 0.0 Hz.

P9-31 Speed-limit switch CCW

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 limit the speed in counterclockwise direction. When the specified signal source is logic 1 and the motor is operated in counterclockwise rotation, the speed is reduced to 0.0 Hz.

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 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 emergency fire mode. In this mode, the frequency inverter ignores all faults and/or disconnections and operates until there is a total failure or lack of power.

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".

10.2.11 P1-15 Digital inputs function selection

Users can parameterize the functions of the digital inputs of the frequency inverter. In other words, 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".

21270996/EN – 01/2015

Frequency inverter operation

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 using parameter group P9-xx
1	**0: Stop (controller inhibit) 1: Start (enable)**	**0: Clockwise rotation 1: Counterclockwise rotation**	**0: Selected speed setpoint 1: Preset speed 1, 2**	**Analog 1 speed setpoint**	**0: Preset speed 1 1: Preset speed 2**	**–**
2	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: Counterclockwise rotation	0: Open	0: Open	0: Open	Preset speed 1
			1: Closed	0: Open	0: Open	Preset speed 2
			0: Open	1: Closed	0: Open	Preset speed 3
			1: Closed	1: Closed	0: Open	Preset speed 4
			0: Open	0: Open	1: Closed	Preset speed 5
			1: Closed	0: Open	1: Closed	Preset speed 6
			0: Open	1: Closed	1: Closed	Preset speed 7
			1: Closed	1: Closed	1: Closed	Preset speed 8
3	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: Counterclockwise rotation	0: Selected speed setpoint 1: Preset 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: Counterclockwise rotation	0: Selected speed setpoint 1: Preset 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: Counterclockwise 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: Counterclockwise rotation	0: Selected speed setpoint 1: Preset 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: Counterclockwise rotation	0: Open	0: Open	External fault[1)] 0: Error 1: Start	Preset speed 1
			1: Closed	0: Open		Preset speed 2
			0: Open	1: Closed		Preset speed 3
			1: Closed	1: Closed		Preset speed 4
8	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: Counterclockwise rotation	0: Open	0: Open	0: Decel. ramp 1 1: Decel. ramp 2	Preset speed 1
			1: Closed	0: Open		Preset speed 2
			0: Open	1: Closed		Preset speed 3
			1: Closed	1: Closed		Preset speed 4
9	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: Counterclockwise rotation	0: Open	0: Open	0: Selected speed setpoint 1: Preset speed 1 – 4	Preset speed 1
			1: Closed	0: Open		Preset speed 2
			0: Open	1: Closed		Preset speed 3
			1: Closed	1: Closed		Preset speed 4
10	0: Stop (controller inhibit) 1: Start (enable)	0: Clockwise rotation 1: Counterclockwise rotation	N.O. contact The speed increases when closing.	N.O. contact The speed decreases when closing.	0: Selected speed setpoint 1: Preset speed 1	–
11	0: Stop (controller inhibit) 1: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	0: Selected speed setpoint 1: Preset speed 1, 2	Analog 1 speed setpoint	0: Preset speed 1 1: Preset 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: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	0: Open	0: Open	0: Open	Preset speed 1
			1: Closed	0: Open	0: Open	Preset speed 2
			0: Open	1: Closed	0: Open	Preset speed 3
			1: Closed	1: Closed	0: Open	Preset speed 4
			0: Open	0: Open	1: Closed	Preset speed 5
			1: Closed	0: Open	1: Closed	Preset speed 6
			0: Open	1: Closed	1: Closed	Preset speed 7
			1: Closed	1: Closed	1: Closed	Preset speed 8
13	0: Stop (controller inhibit) 1: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	0: Selected speed setpoint 1: Preset speed 1	Analog 1 speed setpoint	Analog torque reference Set *P4-06* = 2 here.	–
14	0: Stop (controller inhibit) 1: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	0: Selected speed setpoint 1: Preset speed 1	Analog 1 speed setpoint	0: Decel. ramp 1 1: Decel. ramp 2	–
15	0: Stop (controller inhibit) 1: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	0: Selected speed setpoint 1: Analog input 2	Analog 1 speed setpoint	Analog 2 speed setpoint	–
16	0: Stop (controller inhibit) 1: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	0: Selected speed setpoint 1: Preset speed 1	Analog 1 speed setpoint	External fault[1)] 0: Error 1: Start	–
17	0: Stop (controller inhibit) 1: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	0: Open	0: Open	External fault[1)] 0: Error 1: Start	Preset speed 1
			1: Closed	0: Open		Preset speed 2
			0: Open	1: Closed		Preset speed 3
			1: Closed	1: Closed		Preset speed 4
18	0: Stop (controller inhibit) 1: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	0: Open	0: Open	0: Decel. ramp 1 1: Decel. ramp 2	Preset speed 1
			1: Closed	0: Open		Preset speed 2
			0: Open	1: Closed		Preset speed 3
			1: Closed	1: Closed		Preset speed 4
19	0: Stop (controller inhibit) 1: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	0: Open	0: Open	0: Selected speed setpoint 1: Preset speed 1 – 4	Preset speed 1
			1: Closed	0: Open		Preset speed 2
			0: Open	1: Closed		Preset speed 3
			1: Closed	1: Closed		Preset speed 4
20	0: Stop (controller inhibit) 1: Clockwise rotation	0: Stop (controller inhibit) 1: Counterclockwise rotation	N.O. contact The speed increases when closing.	N.O. contact The speed decreases when closing.	0: Selected speed setpoint 1: Preset 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: Preset speed 1	Function enabled if *P1-12* = 0.

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

INFORMATION

When you use a TF/TH, set *P2-33* to PTC-th. Read also the connection information in chapter "Motor thermal protection (TF/TH)" (→ 🗎 48).

21270996/EN – 01/2015

11 Technical data

The next chapter contains the technical data.

11.1 Conformity

All products meet the following international standards:

- CE marking in accordance with the low voltage directive
- UL 508C power converter
- EN 61800-3 Variable-speed electrical drives – part 3
- EN 61000-6 / -2, -3, -4 Generic standard for interference immunity/interference emission (EMC)
- Degree of protection in accordance with NEMA 250, EN55011:2007
- Flammability class in accordance with UL 94
- C-Tick
- cUL
- RoHS
- EAC (requirements in the technical regulations of the Customs Union of Russia, Kazakhstan, and Belarus)

INFORMATION

TÜV approval of the STO function is relevant for drives with a TÜV logo on their nameplate.

11.2 Ambient conditions

Ambient temperature range during operation	-10°C to +50°C for PWM frequency of 2 kHz (IP20) -10°C to +40°C for PWM frequency of 2 kHz (IP55, NEMA 12K)
Maximum derating depending on the ambient temperature	2.5%/°C to 60°C for sizes 2 and 3 IP20 2.5%/°C to 50°C for sizes 2 and 3 IP55 1.5%/°C to 50°C for sizes 4 − 7 IP55
Ambient temperature range for storage	-40°C to +60°C
Maximum installation altitude for nominal operation	1 000 m
Derating above 1000 m	1%/100 m to max. 2 000 m with UL and to max. 4 000 m without UL
Maximum relative humidity	95% (condensation not permitted)
Degree of protection for standard housing	IP20

21270996/EN – 01/2015

Higher degree of protection for frequency inverter housing	IP55, NEMA 12K

11.3 Output power and current load

The "Horsepower" (HP) specification is defined as follows:

- 200 – 240 V units: NEC2002, table 430-150, 230 V
- 380 – 480 V units: NEC2002, table 430-150, 460 V
- 500 – 600 V units: NEC2002, table 430-150, 575 V

11.3.1 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 fusing and the selection of cable cross sections.

MOVITRAC® LTPB – EMC filter class C1 in accordance with EN 61800-3					
		Power in kW	**0.75**	**1.5**	**2.2**
IP20/NEMA 1 housing	Type	MC LTP-B..	0008-2B1-4-00	0015-2B1-4-00	0022-2B1-4-00
	Part number		18251382	18251528	18251641
IP55/NEMA 12K housing	Type	MC LTP-B..	0008-2B1-4-10	0015-2B1-4-10	0022-2B1-4-10
	Part number		18251390	18251536	18251668
INPUT					
Line voltage V_{line} in accordance with EN 50160		V	1 × AC 200 – 240 ± 10%		
Line frequency f_{line}		Hz	50/60 ± 5%		
Recommended power supply cable cross section		mm^2	1.5		2.5
		AWG	14		12
Input fuse		A	16		25 (35)[1)]
Rated 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
Maximum output frequency		Hz	500		
Cross section of motor cable Cu 75C		mm^2	1.5		2.5
		AWG	14		12
Maximum motor cable length	Shielded	m	100		
	Unshielded		150		
GENERAL INFORMATION					
Size			2		
Heat loss at nominal output power		W	22	45	66
Minimum braking resistance value		Ω	27		
Tightening torque		$Nm/lb_f.in$	1/9		
Maximum unit terminal cross section		AWG	8		
		mm²	10		

21270996/EN – 01/2015

MOVITRAC® LTPB – EMC filter class C1 in accordance with EN 61800-3				
	Power in kW	**0.75**	**1.5**	**2.2**
Maximum control terminal cross section	AWG	30 – 12		
	mm²	0.05 – 2.5		

1) Recommended values for UL compliance

21270996/EN – 01/2015

11.3.2 3-phase system AC 200 – 240 V

Sizes 2 and 3

MOVITRAC® LTP-B – EMC filter class C2 in accordance with EN 61800-3								
		Power in kW	0.75	1.5	2.2	3	4	5.5
IP20/NEMA 1 housing	Type	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
IP55/NEMA 12K housing	Type	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								
Line voltage V_{line} in accordance with 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
Input fuse		A	10		16	20 (35)[1]	25 (35)[1]	35
Rated 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
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					
	Unshielded		150					
GENERAL INFORMATION								
Size			2			3		3/4[2]
Heat loss at nominal output power		W	22	45	66	90	120	165
Minimum braking resistance value		Ω	27					22
Tightening torque		$Nm/lb_f.in$	1/9					
Maximum unit terminal cross section		AWG	8					8/6[2]
		mm^2	10					10/16[2]
Maximum control terminal cross section		AWG	30 – 12					
		mm^2	0.05 – 2.5					

1) Recommended values for UL compliance

2) IP20 housing: Size 3/IP55 housing: Size 4

21270996/EN – 01/2015

Sizes 4 and 5

MOVITRAC® LTP-B – EMC filter class C2 in accordance with EN 61800-3						
		Power in kW	**7.5**	**11**	**15**	**18.5**
IP55/NEMA 12K housing	Type	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						
Line voltage V_{line} in accordance with 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
Input fuse		A	50	63	80	100
Rated 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
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			
	Unshielded		150			
GENERAL INFORMATION						
Size			4		5	
Heat loss at nominal output power		W	225	330	450	555
Minimum braking resistance value		Ω	22	12		6
Tightening torque		$Nm/lb_f.in$	4/35		15/133	
Maximum unit terminal cross section		AWG	6		2	
		mm^2	16		35	
Maximum control terminal cross section		AWG	30 – 12			
		mm^2	0.05 – 2.5			

21270996/EN – 01/2015

Size 6

MOVITRAC® LTP-B – EMC filter class C2 in accordance with EN 61800-3						
		Power in kW	22	30	37	45
IP55/NEMA 12K housing	Type	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						
Line voltage V_{line} in accordance with 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	
Input fuse		A	100	150	200	
Rated 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
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			
	Unshielded		150			
GENERAL INFORMATION						
Size			6			
Heat loss at nominal output power		W	660	900	1110	1350
Minimum braking resistance value		Ω	6	3		
Tightening torque		$Nm/lb_f.in$	20/177			
Maximum unit terminal cross section		AWG	–			
			M10 bolt with nut max. 70 mm^2 M8 braking resistor connection, max. 70 mm^2 Crimp cable lug DIN 46235			
Maximum control terminal cross section		AWG	30 – 12			
		mm^2	0.05 – 2.5			

21270996/EN – 01/2015

Size 7

MOVITRAC® LTP-B – EMC filter class C2 in accordance with EN 61800-3				
		Power in kW	**55**	**75**
IP55/NEMA 12K housing	Type	MC LTP-B..	0550-2A3-4-10	0750-2A3-4-10
	Part number		18252206	18252230
INPUT				
Line voltage V_{line} in accordance with 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	–
Input fuse		A	250	315
Rated 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
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	
	Unshielded		150	
GENERAL INFORMATION				
Size			7	
Heat loss at nominal output power		W	1650	2250
Minimum braking resistance value		Ω	3	
Tightening torque		$Nm/lb_f.in$	20/177	
Maximum unit terminal cross section		AWG	–	
			M10 bolt with nut max. 70 mm² M8 braking resistor connection, max. 70 mm^2 Crimp cable lug DIN 46235	
Maximum control terminal cross section		AWG	30 – 12	
		mm²	0.05 – 2.5	

21270996/EN – 01/2015

11.3.3 3-phase system AC 380 – 480 V

Sizes 2 and 3

MOVITRAC® LTP-B – EMC filter class C2 in accordance with EN 61800-3									
Power in kW			0.75	1.5	2.2	4	5.5	7.5	11
IP20/ NEMA 1 housing	Type	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
IP55/ NEMA 12K housing	Type	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									
Line voltage V_{line} in accordance with 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
Input fuse		A	10			16 (15)[1]	16	20	35
Rated 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
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						
	Unshielded		150						
GENERAL INFORMATION									
Size			2				3		3/4[2]
Heat loss at nominal output power		W	22	45	66	120	165	225	330
Minimum braking resistance value		Ω	68				39		
Tightening torque		Nm/ lb_f.in	1/9						1/9 (4/35)[2]
Maximum unit terminal cross section		AWG	8						8/6[2]
		mm^2	10						10/16[2]
Maximum control terminal cross section		AWG	30 – 12						
		mm^2	0.05 – 2.5						

1) Recommended values for UL compliance

2) IP20 housing: Size 3/IP55 housing: Size 4

21270996/EN – 01/2015

Sizes 4 and 5

MOVITRAC® LTP-B – EMC filter class C2 in accordance with EN 61800-3							
		Power in kW	15	18.5	22	30	37
IP55/NEMA 12K housing	Type	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							
Line voltage V_{line} in accordance with 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
Input fuse		A	35	50	63	80	100
Rated 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
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				
	Unshielded		150				
GENERAL INFORMATION							
Size			4			5	
Heat loss at nominal output power		W	450	555	660	900	1110
Minimum braking resistance value		Ω	22			12	
Tightening torque		$Nm/lb_f.in$	4/35			15/133	
Maximum unit terminal cross section		AWG	6			2	
		mm^2	16			35	
Maximum control terminal cross section		AWG	30 – 12				
		mm^2	0.05 – 2.5				

21270996/EN – 01/2015

Size 6

MOVITRAC® LTP-B – EMC filter class C2 in accordance with EN 61800-3						
		Power in kW	**45**	**55**	**75**	**90**
IP55/NEMA 12K housing	Type	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						
Line voltage V_{line} in accordance with 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
Input fuse		A	125	150	200	250
Rated 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
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			
	Unshielded		150			
GENERAL INFORMATION						
Size			6			
Heat loss at nominal output power		W	1350	1650	2250	2700
Minimum braking resistance value		Ω	6			
Tightening torque		$Nm/lb_f.in$	20/177			
Maximum unit terminal cross section		AWG	–			
			M10 bolt with nut max. 70 mm^2 M8 braking resistor connection, max. 70 mm^2 Crimp cable lug DIN 46235			
Maximum control terminal cross section		AWG	30 – 12			
		mm^2	0.05 – 2.5			

21270996/EN – 01/2015

Size 7

MOVITRAC® LTP-B – EMC filter class C2 in accordance with EN 61800-3					
		Power in kW	**110**	**132**	**160**
IP55/NEMA 12K housing	Type	MC LTP-B..	1100-5A3-4-10	1320-5A3-4-10	1600-5A3-4-10
	Part number		18252303	18252311	18252346
INPUT					
Line voltage V_{line} in accordance with 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	–	–
Input fuse		A	250	315	355
Rated 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
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		
	Unshielded		150		
GENERAL INFORMATION					
Size			7		
Heat loss at nominal output power		W	3300	3960	4800
Minimum braking resistance value		Ω	6		
Tightening torque		$Nm/lb_f.in$	20/177		
Maximum unit terminal cross section		AWG	–		
			M10 bolt with nut max. 70 mm^2 M8 braking resistor connection, max. 70 mm^2 Crimp cable lug DIN 46235		
Maximum control terminal cross section		AWG	30 – 12		
		mm^2	0.05 – 2.5		

11.3.4 3-phase system AC 500 – 600 V

Size 2

MOVITRAC® LTP-B – EMC filter class 0 in accordance with EN 61800-3							
		Power in kW	**0.75**	**1.5**	**2.2**	**4**	**5.5**
IP20/NEMA 1 housing	Type	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
IP55/NEMA 12K housing	Type	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							
Line voltage V_{line} in accordance with 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
Input fuse		A	10 / (6)[1]		10		16 / (15)[1]
Rated 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
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				
	Unshielded		150				
GENERAL INFORMATION							
Size			2				
Heat loss at nominal output power		W	22	45	66	120	165
Minimum braking resistance value		Ω	68				
Tightening torque		$Nm/lb_f.in$	1/9				
Maximum unit terminal cross section		AWG	8				
		mm^2	10				
Maximum control terminal cross section		AWG	30 – 12				
		mm^2	0.05 – 2.5				

1) Recommended values for UL compliance in brackets

21270996/EN – 01/2015

Sizes 3 and 4

MOVITRAC® LTP-B – EMC filter class 0 in accordance with EN 61800-3								
		Power in kW	7.5	11	15	18.5	22	30
IP20/NEMA 1 housing	Type	MC LTP-B..	0075-603-4-00	0110-603-4-00	0150-603-4-00	-	-	-
	Part number		18410855	18410863	18410871	-	-	-
IP55/NEMA 12K housing	Type	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								
Line voltage V_{line} in accordance with 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
Input fuse		A	20	25 / (30)[1]	35	40 / (45)[1]	50 / (60)[1]	63 / (70)[1]
Rated 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
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					
	Unshielded		150					
GENERAL INFORMATION								
Size			3		3/4[2]	4		
Heat loss at nominal output power		W	225	330	450	555	660	900
Minimum braking resistance value		Ω	39			22		
Tightening torque		$Nm/lb_f.in$	1/9		1/9 (4/35)[2]	4/35		
Maximum unit terminal cross section		AWG	8		8/6[2]	6		
		mm^2	10		10/16[2]	16		
Maximum control terminal cross section		AWG	30 – 12					
		mm^2	0.05 – 2.5					

1) Recommended values for UL compliance in brackets

2) IP20 housing: Size 3/IP55 housing: Size 4

Sizes 5 and 6

MOVITRAC® LTP-B – EMC filter class 0 in accordance with EN 61800-3								
		Power in kW	37	45	55	75	90	110
IP55/NEMA 12K housing	Type	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								
Line voltage V_{line} in accordance with 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
Input fuse		A	80	100		125 / (150)[1]	160 / (175)[1]	200
Rated 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
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					
	Unshielded		150					
GENERAL INFORMATION								
Size			5		6			
Heat loss at nominal output power		W	1110	1350	1650	2250	2700	3300
Minimum braking resistance value		Ω	22		12		6	
Tightening torque		$Nm/lb_f.in$	15/133		20/177			
Maximum unit terminal cross section		AWG	2		–			
		mm^2	35		M10 bolt with nut max. 70 mm^2 M8 braking resistor connection, max. 70 mm^2 Crimp cable lug DIN 46235			
Maximum control terminal cross section		AWG	30 – 12					
		mm^2	0.05 – 2.5					

1) Recommended values for UL compliance in brackets

21270996/EN – 01/2015

12 Declaration of conformity

EC Declaration of Conformity

SEW EURODRIVE

901790012

SEW-EURODRIVE GmbH & Co KG
Ernst-Blickle-Straße 42, D-76646 Bruchsal

declares under sole responsibility that the

frequency inverters of the series	**MOVITRAC® LTP-B**	
are in conformity with		
Low Voltage Directive	**2006/95/EC**	
EMC Directive	**2004/108/EC**	**4)**
Applied harmonized standards	**EN 61800-5-1:2007** **EN 60204-1:2006 + A1:2009** **EN 61800-3:2004 + A1:2012** **EN 55011:2009 + A1:2010**	

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. The assessment was verified for a typical system constellation, but not for the individual product.

Bruchsal	19.03.13	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

21270996/EN – 01/2015

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21270996/EN – 01/2015

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21270996/EN – 01/2015

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21270996/EN – 01/2015

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21270996/EN – 01/2015

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21270996/EN – 01/2015

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21270996/EN – 01/2015

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Sales	Skopje	Boznos DOOEL Dime Anicin 2A/7A 1000 Skopje	Tel. +389 23256553 Fax +389 23256554 http://www.boznos.mk
Madagascar			
Sales	Antananarivo	Ocean Trade BP21bis. Andraharo Antananarivo 101 Madagascar	Tel. +261 20 2330303 Fax +261 20 2330330 oceantrabp@moov.mg
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 SA DE CV SEM-981118-M93 Tequisquiapan No. 102 Parque Industrial Quéretaro C.P. 76220 Quéretaro, México	Tel. +52 442 1030-300 Fax +52 442 1030-301 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx
Mongolia			
Technical Office	Ulaanbaatar	SEW-EURODRIVE LLP Representative office in Mongolia Suite 407, Tushig Centre Seoul street 23, Sukhbaatar district, Ulaanbaatar 14250	Tel. +976-77109997 Fax +976-77109997 http://www.sew-eurodrive.mn sew@sew-eurodrive.mn
Morocco			
Sales Service	Mohammedia	SEW-EURODRIVE SARL 2 bis, Rue Al Jahid 28810 Mohammedia	Tel. +212 523 32 27 80/81 Fax +212 523 32 27 89 http://www.sew-eurodrive.ma sew@sew-eurodrive.ma

21270996/EN – 01/2015

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 NL-3044 AS Rotterdam Postbus 10085 NL-3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 Service: 0800-SEWHELP http://www.sew-eurodrive.nl info@sew-eurodrive.nl
New Zealand			
Assembly Sales Service	Auckland	SEW-EURODRIVE NEW ZEALAND LTD. P.O. Box 58-428 82 Greenmount drive East Tamaki Auckland	Tel. +64 9 2745627 Fax +64 9 2740165 http://www.sew-eurodrive.co.nz sales@sew-eurodrive.co.nz
	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 10 Settlers Crescent, Ferrymead Christchurch	Tel. +64 3 384-6251 Fax +64 3 384-6455 sales@sew-eurodrive.co.nz
Nigeria			
Sales	Lagos	EISNL Engineering Solutions and Drives Ltd Plot 9, Block A, Ikeja Industrial Estate (Ogba Scheme) Adeniyi Jones St. End Off ACME Road, Ogba, Ikeja, Lagos	Tel. +234 1 217 4332 http://www.eisnl.com team.sew@eisnl.com
Norway			
Assembly Sales Service	Moss	SEW-EURODRIVE A/S Solgaard skog 71 N-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 PL-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

21270996/EN – 01/2015

Portugal			
Assembly Sales Service	Coimbra	SEW-EURODRIVE, LDA. Apartado 15 P-3050-901 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	ZAO SEW-EURODRIVE P.O. Box 36 RUS-195220 St. Petersburg	Tel. +7 812 3332522 / +7 812 5357142 Fax +7 812 3332523 http://www.sew-eurodrive.ru sew@sew-eurodrive.ru
Sambia			
is supported by 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 SRB-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 SK-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 SK-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 SLO - 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

21270996/EN – 01/2015

South Africa			
	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
	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 E-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 S-55303 Jönköping Box 3100 S-55003 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 CH-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 central.mailbox@sew.co.tz

21270996/EN – 01/2015

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
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
United Arab Emirates			
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Uruguay			
Assembly Sales	Montevideo	SEW-EURODRIVE Uruguay, S. A. Jose Serrato 3569 Esqina Corumbe CP 12000 Montevideo	Tel. +598 2 21181-89 Fax +598 2 21181-90 sewuy@sew-eurodrive.com.uy
USA			
Production Assembly Sales Service	Southeast Region	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Production +1 864 439-9948 Fax Assembly +1 864 439-0566 Fax Confidential/HR +1 864 949-5557 http://www.seweurodrive.com cslyman@seweurodrive.com
Assembly Sales Service	Northeast Region	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Midwest Region	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 332-0038 cstroy@seweurodrive.com
	Southwest Region	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Western Region	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, CA 94544	Tel. +1 510 487-3560 Fax +1 510 487-6433 cshayward@seweurodrive.com
	Additional addresses for service in USA 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

21270996/EN – 01/2015

Venezuela			
Assembly Sales Service	Valencia	SEW-EURODRIVE Venezuela S.A. Av. Norte Sur No. 3, Galpon 84-319 Zona Industrial Municipal Norte Valencia, Estado Carabobo	Tel. +58 241 832-9804 Fax +58 241 838-6275 http://www.sew-eurodrive.com.ve ventas@sew-eurodrive.com.ve sewfinanzas@cantv.net
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

21270996/EN – 01/2015

Index

Numerical

A

B

C

D

E

F

G

H

I

21270996/EN – 01/15

21270996/EN – 01/15

21270996/EN – 01/15

21270996/EN – 01/15

R

S

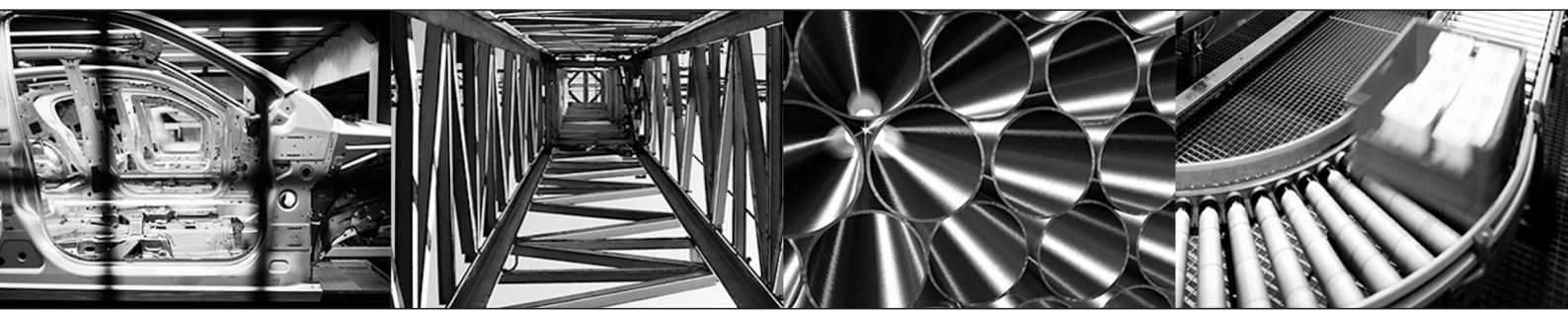
21270996/EN – 01/15

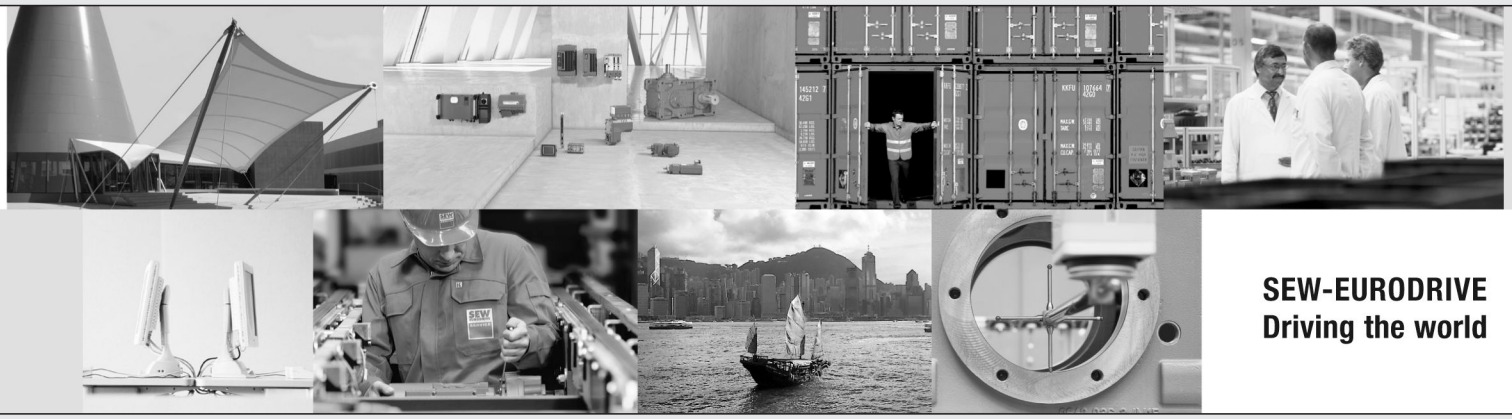
T

U

V

21270996/EN – 01/15





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