BU 0870 – en

NORDAC *ON* + / FC1000

Manual with installation instructions

Read document and keep for future reference

Read this document carefully prior to performing any work on or putting the device into operation. It is essential to read and observe the instructions in this document. They serve as the prerequisite for smooth and safe operation and the fulfilment of any warranty claims.

Contact Getriebebau NORD GmbH & Co. KG if your questions regarding the handling of the device are not answered in this document or if you require further information.

The German version of this document is the original. The German document is always decisive. If this document is available in other languages, this will be a translation of the original document.

Keep this document in the vicinity of the device so that it is available if required.

Please also note the following documents:

- Catalogue “NORDAC electronic drive technology” (E3000),
- Documentation for optional accessories
- Documentation for equipment which is attached or provided.

Please contact Getriebebau NORD GmbH & Co. KG if you require further information.

Documentation

Title:	BU 0870	
Order no.:	6078702	
Series:	SK 3xxP	
Device series:	SK 310P, SK 311P	
Device types:	*SK 3xxP-360-340-A … SK 3xxP-301-340-A*	0.37 kW – 3.00 kW, 3~ 400 V

Version list

Title, Date	Order number	Software version of device	Remarks
BU 0870, January 2022	6078702/ 0422	V 1.2 R6	• First issue
BU 0870, November 2022	6078702/ 4622	V 1.2 R6	• General corrections • Supplementation of size 3 • Revision of the scaling tables • Supplement disposal notes

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Publisher

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Member of the NORD DRIVESYSTEMS Group

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1 General

The devices have sensorless current vector control with a wide range of settings. In combination with suitable motor models, which always provide an optimised voltage/frequency ratio, all three-phase asynchronous motors that are suitable for inverter operation and permanently excited synchronous motors (IE4, IE5+) can be driven. For the drive unit, this means very high starting and overload torques with constant speed.

The power range is from 0,37 kW to 3,0 kW.

The device series can be adapted to individual requirements by means of modular assemblies.

This manual is based on the device software as stated in the version list (see P707). If the frequency inverter uses a different software version, this may cause differences. If necessary, the current manual can be downloaded from the Internet (http://www.nord.com/).

Additional descriptions exist for optional functions and bus systems (http://www.nord.com/).

Information

Accessories

The accessories that are mentioned in the manual are also subject to changes. Current details of these are included in separate data sheets, which are listed under www.nord.com under the heading *Documentation → Manuals → Electronic drive technology → Techn. info / Data sheet*. The data sheets available at the date of publication of this manual are listed by name in the relevant sections (TI ...).

The device is either mounted directly on a motor or in the vicinity of the motor (on the wall or on a machine frame).

All electrical connections (power connections and control connections) are made with plug connectors. This simplifies the installation of the device.

Parameters can be accessed as follows:

- Via Ethernet connection
  The three Ethernet dialects PROFINET IO, EtherNet/IP and EtherCAT are available for this.
- Via the diagnostic port **D1**
  The diagnostic port is designed as an RJ12 port and offers the possibility of using the following via an internal RS232/RS485 interface
  - an optional SimpleBox or ParameterBox, or
  - the NORDAC *ACCESS BT* (SK TIE5 BT stick), or
  - a PC with the installed NORDCON software.

The parameter settings modified by the operator are backed up in the integrated, non-volatile memory of the device.

The device is configured according to the customer's individual requirements. The device equipment is therefore realised ex works. Later retrofitting of options or device conversions are not planned.

Information

The device does not need to be opened at any time during its service life. All mounting, installation and commissioning works are only done on the closed device.

- Assembly is done via freely accessible mounting holes.
- Electrical connection is exclusively established via plug connectors.
- Operational settings are made via parameter adjustments.
- Blind plugs may only be removed for works in connection with commissioning and must be properly replaced afterwards.
- Diagnostic LEDs for displaying switching and operating states are externally visible.
- The cover cap of the diagnostic port **D1** only requires removal for the connection of parameterisation tools such as a PC or ParameterBox. After successful parameterisation, the cover cap must be replaced.

1.1 Overview

Basic characteristics of the NORDAC *ON+ / FC1000*

- High starting torque and precise motor speed control by means of sensorless current vector control
- Mounting on the motor or close-to-motor mounting as wall mounting
- Permissible ambient temperature -30 °C to 40 °C (please refer to technical data)
- Integrated EMC mains filter
- External 24 V supply
- Four separate online switchable parameter sets
- Four digital inputs, two of them usable as digital outputs
- LEDs for diagnosis (including signal statuses DIs/DOs)
- RS232/RS485 interface via RJ12 port
- Operation of *three-phase **as**ynchronous **m**otors* (ASM)
- Integrated PLC → BU 0550
- Integrated Industrial Ethernet Interface → BU 0820
- Optional: Connection facility for functional safety (only size 2 and higher)
- Optional: Internal braking resistor (only size 2 and higher)
- In addition: RS 485 encoder interface for positioning tasks
- Optional: nsd tupH surfaces for the food industry

Optional features

The FI can be individually adapted to the drive task. For this, a comprehensive selection of interfaces, plug connections and control elements are available, which can be used during the manufacture of the FI according to the customer's requirements.

Depending on the configuration, the meaning of the individual LEDs, function or assignment of individual plug connectors or the function of control elements (e.g. switches) may differ. The possible combinations will be illustrated and explained in the course of this manual. The individual configuration of the FI can be identified using the type plate and can be compared with the details in the manual.

1.2 Delivery

Examine the frequency inverter for transport damage or loose components **immediately** on delivery / unpacking.

In case of damage, contact the carrier immediately and arrange for a careful survey.

Important! This also applies if the packaging is undamaged.

1.3 Scope of delivery

NOTICE

Defect in the device

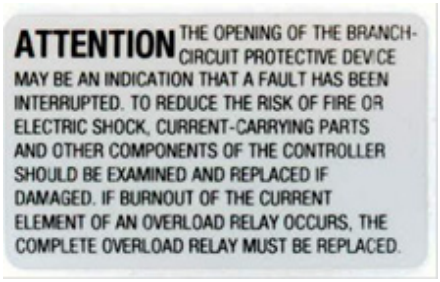
Use of impermissible accessories and options (e.g. also options for other inverter series) may result in defects of interconnected components.

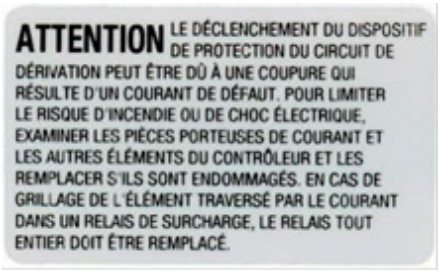
- Only use accessories and options which are explicitly intended for use with this device and stated in this manual.

Standard version:

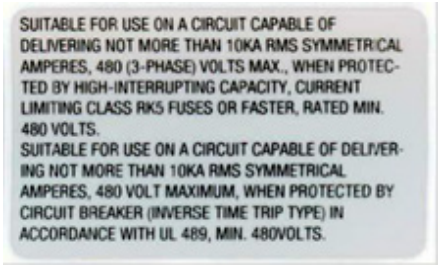
- IP55 version
- Operating instructions as PDF file on CD ROM including NORDCON, (PC parametrisation software)

- Warning signs as addition for assembly near to the device according to UL/cUL, 1x each in the languages English and French:





- Warning sign as addition for assembly near to the device according to UL, 1x in English language:



1.4 Presentation conventions

1.4.1 Warning information

Warning information for the safety of users are marked as follows:

DANGER

This warning information warns of danger to persons that results in severe injuries or death.

WARNING

This warning information warns of danger to persons that could result in severe injuries or death.

CAUTION

This warning information warns of danger to persons that could usually result in moderate injuries.

NOTICE

This warning information warns of material damage.

1.4.2 Other information

Information

This information shows tips and important information.

1.4.3 Text markings

The following markings are used to differentiate between various types of information:

Text

Type of information	Example	Marking
Instructions	1. 2.	Instructions whose sequence must be complied with are numbered sequentially.
Bullet points	•	Bullet points are marked with a dot.
Parameter	**P162**	Parameters are indicated by a “P” prefix, a three-digit number and bold lettering.
Arrays	[-01]	Arrays are indicated by square brackets.
Factory settings	{ 0.0 }	Factory settings are indicated by curly brackets.
Software descriptions	“**Cancel**”	Menus, fields, windows, buttons and tabs are indicated by quotation marks and bold lettering.

Numbers

Type of information	Example	Marking
Binary numbers	100001b	Binary numbers are indicated by the suffix “b”.
Hexadecimal numbers	0000h	Hexadecimal numbers are indicated by the suffix “h”.

1.5 Safety, installation and application information

Before working on or with the device, please read the following safety instructions extremely carefully. Please pay attention to all other information from the device manual.

Non-compliance can result in serious or fatal injuries and damage to the device or its surroundings.

These safety instructions must be kept in a safe place!

1. General

Do not use defective devices or devices with defective or damaged housings or missing covers (e.g. blind plugs for cable glands). Otherwise, there is a risk of serious injury or death from electric shock or rupture of electrical components, e.g. high power capacitors.

Unauthorised removal of covers, improper use, incorrect installation or operation causes a risk of serious personal injury or material damage.

Depending on its protection class, the devices may have live, bare, moving or rotating parts or hot surfaces during operation.

The device is operated with hazardous voltage. Dangerous voltage may be present at the supply lines, contact strips and PCBs of all connecting terminals (e.g. mains input, motor connection), even if the device is not working or the motor is not rotating (e.g. caused by electronic disabling, jamming of the drive or a short circuit at the output terminals).

The device is not equipped with a master mains switch and is thus always live when connected to mains voltage. Voltages may therefore be connected to a connected motor at standstill.

A connected motor may also rotate if the drive is disconnected from the mains and possibly generate hazardous voltage.

If persons come into contact with dangerous voltage such as this, there is a risk of an electric shock, which can lead to serious or fatal injuries.

The device and any power plug connectors must not be disconnected while a voltage is applied to the device. Failure to comply with this may cause arcing, which in addition to the risk of injury, also may result in a risk of damage or destruction of the device.

The fact that the status LED or other indicators are not illuminated does not safely indicate that the device has been disconnected from the mains and is without voltage.

The heat sink and all other metal components can heat up to temperatures above 70°C.

Touching these parts can result in local burns to the body parts concerned (cooling times and clearance from neighbouring components must be complied with).

All work on the device, e.g. transportation, installation, commissioning and maintenance work must be carried out by qualified personnel (observe IEC 364 or CENELEC HD 384 or DIN VDE 0100 and IEC 664 or DIN VDE 0110 and national accident prevention regulations). In particular, the general and regional installation and safety regulations for work on low-voltage systems (e.g. VDE) must be complied with, as must the regulations concerning correct use of tools and the use of personal protection equipment.

During all work on the device, take care that no foreign bodies, loose parts, moisture or dust enter or remain in the device (risk of short circuit, fire and corrosion).

Further information can be found in this documentation.

Triggering of a circuit breaker

If the device is secured by a circuit breaker and if this was triggered, this may indicate that a residual current was interrupted. A component (e.g. device, cable or plug connector) in this circuit may have caused an overload (e.g. short circuit or earth fault).

A direct reset of the circuit breaker may lead to the circuit breaker not being triggered afterwards although the fault cause is still present. As a result, any current flowing into the fault location may cause overheating and ignite the surrounding material.

After each triggering of a circuit breaker, all live components within this circuit must thus be visually checked for defects and flashover tracks. Also check the connections at the device's connection terminals.

In case of no faults found or after the replacement of the defect components, switch on the power supply by resetting the circuit breaker. Carefully observe the components keeping a safe physical distance. As soon as you observe a malfunction (e.g. smoke, heat or unusual odours), the occurrence of a new fault or if the status LED on the device does not light up, switch off the circuit breaker immediately and disconnect the defect component from the mains. Replace the defect component.

2. Qualified specialist personnel

Within the meaning of this basic safety information, qualified specialist personnel are persons who are familiar with the installation, assembly, commissioning and operation of the product and who have the qualifications appropriate to their work.

In addition, the device and the accessories associated with it must only be installed and commissioned by a qualified electrician. A qualified electrician is a person who, because of his/her technical training and experience, has sufficient knowledge with regard to

- switching on, switching off, disconnection, earthing and labelling of electric circuits and devices,
- correct maintenance and use of protective devices according to specified safety standards.

3. Intended use – general

Frequency inverters are devices for industrial and commercial systems that are used to operate three-phase asynchronous motors with squirrel-cage rotors and Permanent Magnet Synchronous Motors – PMSM (IE4, IE5+). These motors must be suitable for operation with frequency inverters, other loads must not be connected to the devices.

The devices are components intended for installation in electrical systems or machines.

Technical data and information for connection conditions can be found on the rating plate and in the documentation, and must be complied with.

The devices may only be used for safety functions which are described and explicitly approved.

CE-labelled devices meet the requirements of the Low Voltage Directive 2014/35/EU. The stated harmonized standards for the devices are used in the declaration of conformity.

a. Supplement: Intended use within the European Union

When installed in machines, commissioning of the devices (i.e. commencement of proper use) is prohibited until it has been ensured that the machine fulfils the provisions of EC Directive 2006/42/EC (Machinery Directive); EN 60204-1 must also be complied with.
Commissioning (i.e. start of intended use) is only permitted if the EMC directive (2014/30/EU) is complied with.

b. Supplement: Intended use outside the European Union

The local conditions of the operator for the installation and commissioning of the device must be complied with at the usage location (see also "a. Supplement: Intended use within the European Union").

4. Phases of life

Transport, storage

The information in the manual regarding transport, storage and correct handling must be complied with.

The permissible mechanical and climatic ambient conditions (see technical data in the manual for the device) must be complied with.

If necessary, suitable, adequately dimensioned means of transport (e.g. lifting gear, rope guides) must be used.

Installation and assembly

The installation and cooling of the device must be implemented according to the regulations in the corresponding documentation. The permissible mechanical and climatic ambient conditions (see technical data in the manual for the device) must be complied with.

The device must be protected against impermissible loads. In particular, components must not be deformed and/or insulation distances must not be changed. Touching of electronic components and contacts must be avoided.

The device and its optional modules contain electrostatically sensitive components, which can be easily damaged by incorrect handling. Electrical components must not be mechanically damaged or destroyed.

Electrical connection

Ensure that the device and the motor are specified for the correct supply voltage.

Installation, maintenance and repair work must not be carried out unless the device has been disconnected from the voltage and at least 5 minutes have elapsed since the mains was switched off! (Due to charged capacitors, hazardous voltages may be present on the device for up to 5 minutes after being switched off from the mains). Before starting work it is essential to check by measurement that all contacts of the power plug connections or the connection terminals are voltage-free.

The electrical installation must be implemented according to the applicable regulations (e.g. cable cross-section, fuses, earth lead connections). Further instructions can be found in the documentation or manual for the device.

Information regarding EMC-compliant installations such as shielding, earthing, location of filters and routing of cables can be found in the documentation for the devices and in the technical information manual TI 80-0011. This information must always be observed even with devices with a CE label. Compliance with the limit values specified in the EMC regulations is the responsibility of the manufacturer of the system or machine.

In case of a fault, inadequate earthing may result in electric shock, possibly with fatal consequences.

The device may only be operated with effective earth connections which comply with local regulations for large leakage currents (> 3.5 mA). Detailed information regarding connections and operating conditions can be obtained from the technical Information manual TI 80-0019.

Connection of the supply voltage may directly or indirectly set the device into operation. Contact with electrically live components may result in electric shock, possibly with fatal consequences.

All poles of cable connections (e.g. power supply) must always be disconnected.

Setup, troubleshooting and commissioning

When working on live devices, the applicable national accident prevention regulations must be complied with.

Connection of the supply voltage may directly or indirectly set the device into operation. Contact with electrically live components may result in electric shock, possibly with fatal consequences.

The parametrisation and configuration of the devices must be selected so that no hazards can occur.

With certain setting conditions, the device or the motor which is connected to it may start automatically when the mains are switched on. The machinery which it drives (press / chain hoist / roller / fan etc.) may then make an unexpected movement. This may cause various injuries, including to third parties.

Before switching on the mains, secure the danger area by warning and removing all persons from the danger area.

Operation

Where necessary, systems in which the devices are installed must be equipped with additional monitoring and protective equipment according to the applicable safety requirements (e.g. legislation concerning technical equipment, accident prevention regulations, etc.).

All covers must be kept closed during operation.

With certain setting conditions, the device or the motor which is connected to it may start automatically when the mains are switched on. The machinery which it drives (press / chain hoist / roller / fan etc.) may then make an unexpected movement. This may cause various injuries, including to third parties.

Before switching on the mains, secure the danger area by warning and removing all persons from the danger area.

Due to its operation, the device produces noises within the audible frequency range. These noises may cause long-term stress, discomfort and fatigue, with negative effects on concentration. The frequency range or the noise can be shifted to a less disturbing or almost inaudible range by adjustment of the pulse frequency. However, this may possibly result in derating (lower power) of the device.

Maintenance, repair and decommissioning

Installation, maintenance and repair work must not be carried out unless the device has been disconnected from the voltage and at least 5 minutes have elapsed since the mains was switched off! (Due to charged capacitors, hazardous voltages may be present on the device for up to 5 minutes after being switched off from the mains). Before starting the work, it is essential to check by measurement that all contacts of the power plug connectors or the connection terminals are voltage-free.

Disposal

The product and its parts and accessories must not be disposed of as domestic waste. At the end of its life, the product must be properly disposed of according to the local regulations for industrial waste. In particular, this product contains integrated semiconductor circuits (PCBs and various electronic components, including high power electrolytic capacitors). In case of incorrect disposal there is a risk of formation of toxic gases, which may cause contamination of the environment and direct or indirect injuries (e.g. chemical burns). In the case of high power electrolytic capacitors, there is also a risk of explosion, with the associated risk of injury.

5. Potentially explosive environment (ATEX)

The device is not approved for operation or maintenance work in potentially explosive environments (ATEX).

1.6 Warning and hazard information

Under certain circumstances, hazardous situations may occur in association with the frequency inverter. In order to give explicit warning of possibly hazardous situations, clear warning and hazard information can be found on the device and in the relevant documentation.

1.6.1 Warning and hazard information on the product

The following warning and hazard information is used on the product.

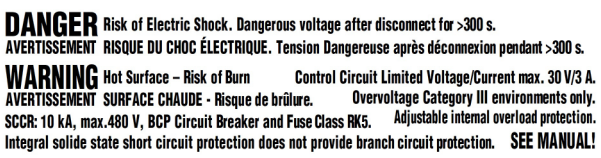
Symbol	Supplement to symbol [1]	Meaning
	DANGER Device is live > 5min after removing mains voltage	**Danger** — **Electric shock** The device contains powerful capacitors. Because of this, there may be a hazardous voltage for more than 5 minutes after disconnection from the mains. Before starting work, check that the device is free of voltage at all power contacts by means of suitable measuring equipment.
		It is essential to read the manual in order to prevent hazards!
		**CAUTION** — **Hot surfaces** The heat sink and all other metal components as well as the surfaces of plug connectors may heat up to temperatures in excess of 70°C. • Danger of injury due to local burns on contact. • Heat damage to adjacent objects Allow sufficient cooling time before starting work on the device. Check the surface temperatures with suitable measuring equipment. Maintain an adequate distance to adjacent components or provide protection against contact.
		***NOTICE*** — **EDS** The device contains electrostatically sensitive components, which can be easily damaged by incorrect handling. Avoid all contact (indirect contact by tools or similar, or direct contact) with PCBs and their components.

1) Texts are written in English.

Table 1: Warning and hazard information on the product

1.6.2 Warning information on the upper shell

Important information regarding danger of electric shock and hot surfaces can be found at the side of the upper shell of the device.



1.7 Standards and approvals

All devices across the entire series comply with the standards and directives listed below.

Approval	Directive		Applied standards	Certificates	Label
CE *(European Union)*	Low Voltage	2014/35/EU	EN 61800-5-1 EN 60529 EN 61800-3 EN 63000 EN 61800-9-1 EN 61800-9-2	C310001_0921	CE
	EMC	2014/30/EU			
	RoHS	2011/65/EU			
	Delegated Directive (EU)	2015/863			
	Ecodesign	2009/125/EC			
	EU Ecodesign Directive	2019/1781			
UL *(USA)*			UL 61800-5-1	E171342	c UL us LISTED IND.CONT.EQ. E171342
CSA *(Canada)*			C22.2 No.274-13	E171342	
RCM *(Australia)*	F2018L00028		EN 61800-3	------	
EAC *(Eurasia)*	TR CU 004/2011, TR CU 020/2011		IEC 61800-5-1 IEC 61800-3	EA-----	EAC
UkrSEPRO *(Ukraine)*			EN 61800-5-1 EN 60529 EN 61800-3 EN 63000 EN 60947-1 EN 60947-4 EN 61558-1 EN 50581	C311900	
UKCA *(United Kingdom)*			EN 61800-5-1 EN 60529 EN 61800-3 EN 63000 EN 61800-9-1 EN 61800-9-2	C352000	UKCA

Table 2: Standards and approvals

1.7.1 UL and CSA approval

File No. E171342

The categorisation of protective equipment approved by the UL according to United States standards for the devices described in this manual is listed below, basically with the original wording. The categorisation of the individually relevant fuses or circuit breakers can be found in the “Electrical Data” section of this manual.

All devices have a parameterisable motor overload protection (see P533, P535). UL recognised (7 "Technical data").

Additional adhesive labels with supplementary warning information

Attach the signs enclosed with the device and listed according to Section 1.3 "Scope of delivery"in a clearly visible position in the immediate vicinity of the device.

Conditions UL/CSA according to report

Information

- “Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code and any additional local codes”.
  CSA: For Canada: “Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code, Part I”.
- “Use 60 °C Copper Conductors Only”, or “Use min. 60°C rated Copper Conductors Only”, or equivalent. Higher temperature ratings are acceptable.
- For installations according to Canadian National Standard C22.2 No. 274:
  “For use in Pollution Degree 2 and Overvoltage Category III environments only”, or equivalent.
- “Maximum surrounding air Temperature 40°C.”
- The devices are not allowed for use in corner grounded supplies, with that the maximum working voltage to ground is considered to be 240Vac or 277Vac.

Frame Size	description
all	“Suitable For Use On A Circuit Capable Of Delivering Not More Than 5000 DC Symmetrical Amperes, 410 Volts (-123 Devices) or 715 Volts (-340 Devices) Max., When Protected by R/C Semiconductor fuses, type_____, manufactured by _____”, as listed in [1)]
all	“Suitable For Use On A Circuit Capable Of Delivering Not More Than _____ rms Symmetrical Amperes, 240 (1-phase) or 480 (3-phase) Volts Max., When Protected by High-Interrupting Capacity, Current Limiting Class ____Fuses or faster, rated _____Amperes, and ____Volts”, as listed in [1)]
all	“Suitable for Use On A Circuit Capable Of Delivering Not More Than _____ rms Symmetrical Amperes, ____ Volt maximum” (240V for 1-phase models or 480V for 3-phase models), “When Protected by Circuit Breaker (inverse time trip type) in accordance with UL 489, rated _____ Amperes, and _____Volts”, as listed in [1)]
1, 2	“Suitable for motor group installation on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240 (1-phase) or 480 (3-phase) V max, when Protected by High-Interrupting Capacity, Current Limiting Class RK5 Fuses or faster, rated max. 15 Amperes.
3	“Suitable for motor group installation on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240 (1-phase) or 480 (3-phase) V max, when Protected by High-Interrupting Capacity, Current Limiting Class RK5 Fuses or faster, rated max. 30 Amperes”.
4	“Suitable for motor group installation on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 (3-phase) V max, when Protected by High-Interrupting Capacity, Current Limiting Class J Fuses or faster, rated max. 125 Amperes”.
1, 2	“Suitable for motor group installation on a circuit capable of delivering not more than 20000 rms symmetrical amperes, 240 (1-phase) or 480 (3-phase) V max, when Protected by High-Interrupting Capacity, Current Limiting Class J Fuses or faster, rated max. 15 Amperes”.
1, 2	“Suitable for motor group installation on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240 (1-phase) or 480 (3-phase) V max, when Protected by Circuit Breaker (inverse time trip type) in accordance with UL 489, rated 15 Amperes and respectively 240 or 480 Volts min.”.
3	“Suitable for motor group installation on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240 (1-phase) or 480 (3-phase) V max, when Protected by Circuit Breaker (inverse time trip type) in accordance with UL 489, rated 30 Amperes and respectively 240 or 480 Volts min.”.
4	“Suitable for motor group installation on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 (3-phase) V max, when Protected by Circuit Breaker (inverse time trip type) in accordance with UL 489, rated max. 125 Amperes and 480 Volts min.”.
1	“Suitable for motor group installation on a circuit capable of delivering not more than 5000 rms symmetrical amperes, DC 715 V max, when Protected by 50 215 26 from SIBA rated max. 20 Amperes”

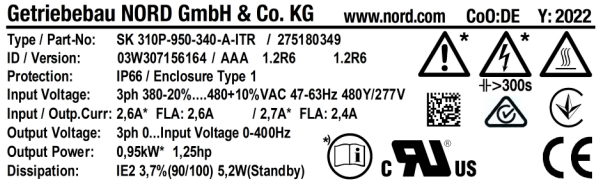
1) 7.2.1 "Electrical data 3~400 V
"

1.8 Type code / nomenclature

The type code of the device depicts the basic features. A unique identification of the device including all customer-specific features is only possible via the device's order or serial number.

1.8.1 Name plate

All of the information which is relevant for the device, including information for the identification of the device, can be obtained from the name plate. The name plate is located on the front side of the upper device shell.



Frequency inverter type code

SK 310P–360–340–A –(C) –ITR

Version:	**ITR** = Interroll
Protection class:	**C** = IP66
Radio interference suppression:	**A** = Class **A1 (C2)**
Mains voltage:	x**40** = **400** V
Number of mains phases:	**3**xx = **3**-phase
Power:	**360** = 0.37 kW, in size 1 **370** = 0.37 kW, in size 2 **450** = 0.45 kW, in size 1 **750** = 0.75 kW, in size 2 **950** = 0.95 kW, in size 2 **111** = 1.10 kW in size 3 **151** = 1.50 kW in size 3 **221** = 2.20 kW in size 3 **301** = 3.00 kW in size 3
Frequency inverter type:	**310P** = NORDAC *ON*+ without functional safety **311P** = NORDAC *ON*+ with functional safety

2 Assembly and installation

No options can be retrofitted. All options must be recorded by NORD when ordering and before the production process. For wall mounting, the device has lugs that are freely accessible from the outside. The electrical connection of mains, motor and signal cables is only possible via respective plug connectors.

2.1 Installation

Depending on the version, the devices are mounted on the motor or are installed close to the motor at the wall on a metal frame. Due to their protection class, a control cabinet is not required.

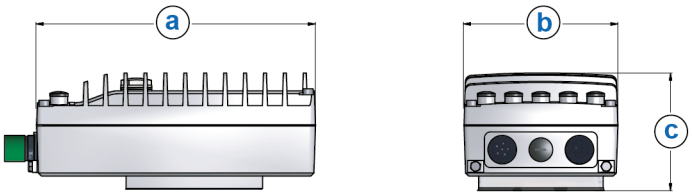
Ventilation:

- The devices require sufficient ventilation for protection against overheating and must therefore not be covered.
- In case of wall mounting, the devices can be placed next to each other. Maintain the required distances for the connection cable routing.

Installation position:

- The following restrictions equally apply to wall-mounted and motor-mounted devices of the SK 31xP series.
  - **A hanging installation position with the upper part of the device pointing downwards is not permissible.** (Danger of possible heat accumulation)
  - **Vertical installation positions leading to a horizontal position of the cooling ribs are only possible with power reduction due to reduced air circulation.**

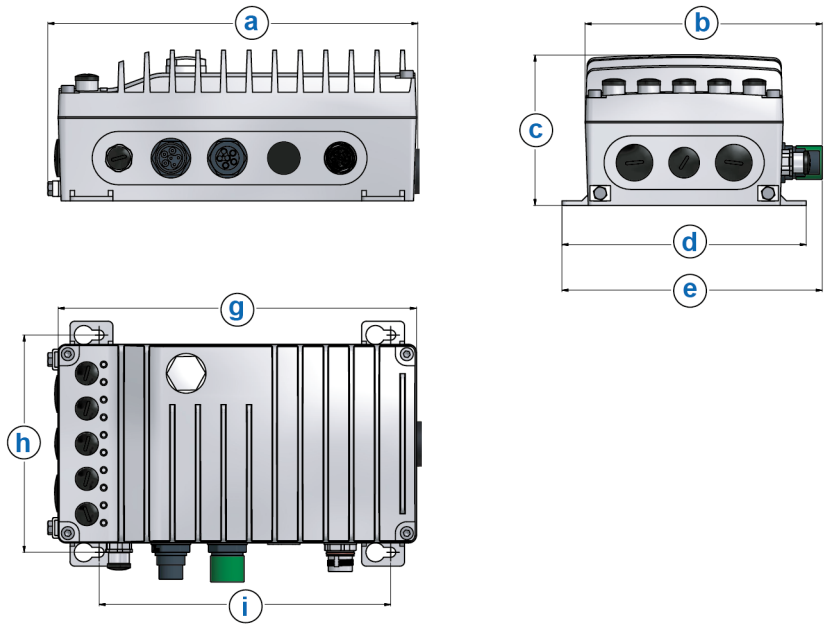
2.2 Dimensions NORDAC *ON*+, motor-mounted



Device type	Size	Housing dimensions [mm]			Weight [kg]
		a	b	c	
SK 300P-360-340-A SK 301P-450-340-A	1	205	120.5	86.7	1.5
SK 31xP-370-340-A SK 31xP-750-340-A SK 31xP-950-340-A	2	235	130	91.5	1.85
SK 31xP-111-340-A SK 31xP-151-340-A	3	265	160	115	tbd
SK 31xP-221-340-A [1] SK 31xP-301-340-A [1]	3	265	160	135	tbd

1) Devices with additional fan cover

2.3 Dimensions NORDAC *ON+ / FC1000*, wall-mounted



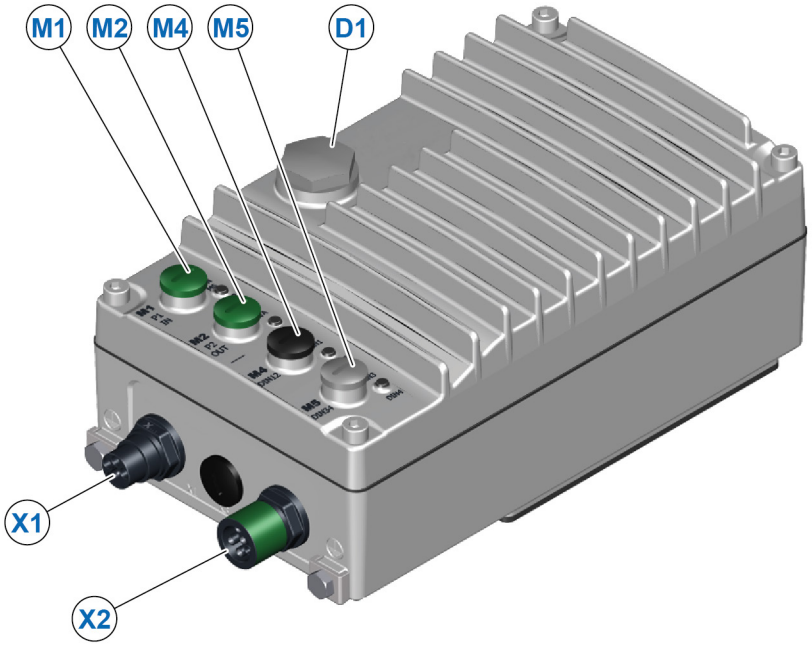
Device type	Size	Housing dimensions [mm]								Weight [kg]
		a	b	c	d	e	g	h	i	
SK 300P-360-340-A SK 300P-450-340-A	1	211	146	83.25	150	160.4	205.5	132	161	1.65
SK 3xxP-370-340-A SK 3xxP-750-340-A SK 3xxP-950-340-A	2	243.5	155	98.3	160	170.4	235	142	191	2.1
SK 31xP-111-340-A SK 31xP-151-340-A	3	271.5	185	117	190.5	200.5	221	172	221	tbd
SK 31xP-221-340-A [1)] SK 31xP-301-340-A [1)]	3	271.5	1850	136.5	190.5	200.5	221	172	221	tbd

1) Devices with additional fan cover

2.4 Connections

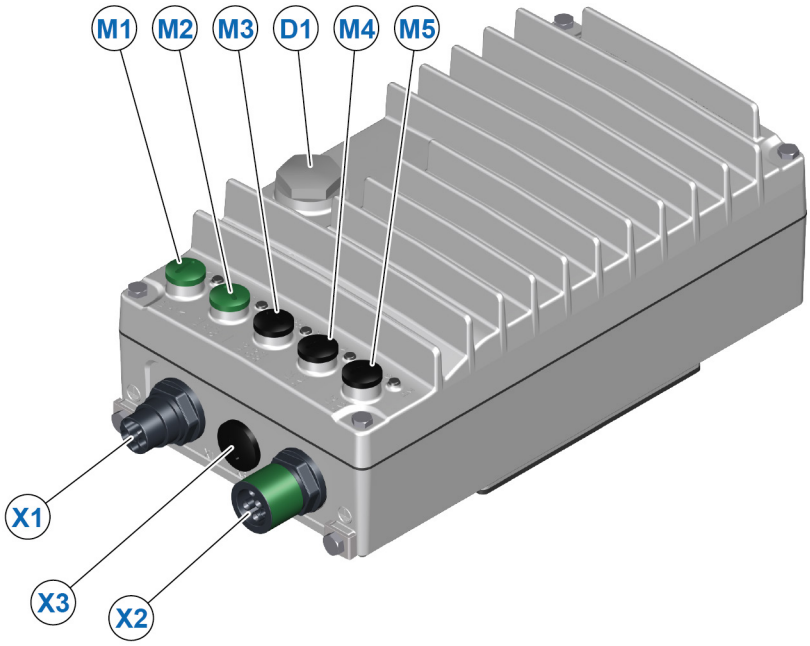
The device is configured according to the customer specification. Defined positions on the device apply for the selected options and features.

2.4.1 NORDAC *ON* +, motor-mounted, size 1



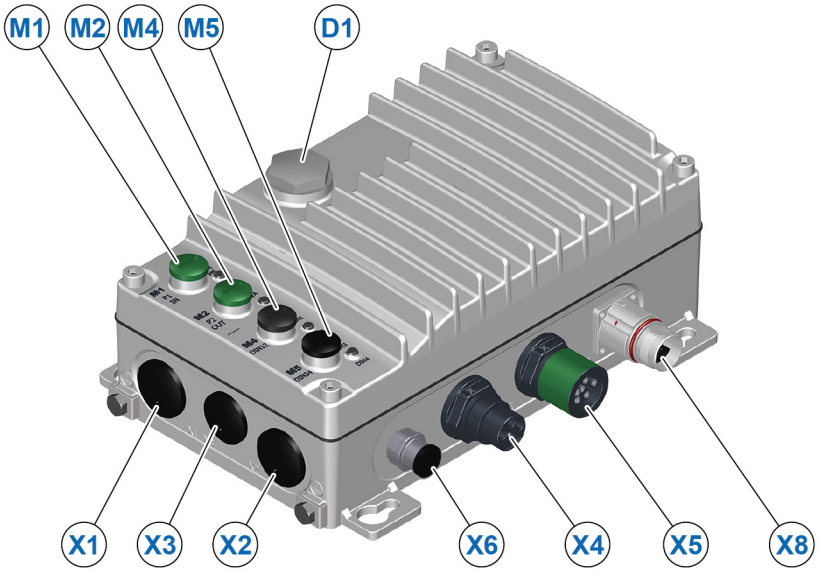
Connection	Function
M1	Ethernet-In
M2	Ethernet-Out
M4	DIN1 and DIN2 or DIN1 and DOUT1
M5	DIN3 and DIN4 or DIN3 and DOUT2
D1	Diagnostic LED and diagnostic connection RS485/RS232
X1	Mains/24V-In (power connection, mains input)
X2	Mains/24V-Out (power connection, mains output)

2.4.2 NORDAC *ON*+, motor-mounted, sizes 2 and 3



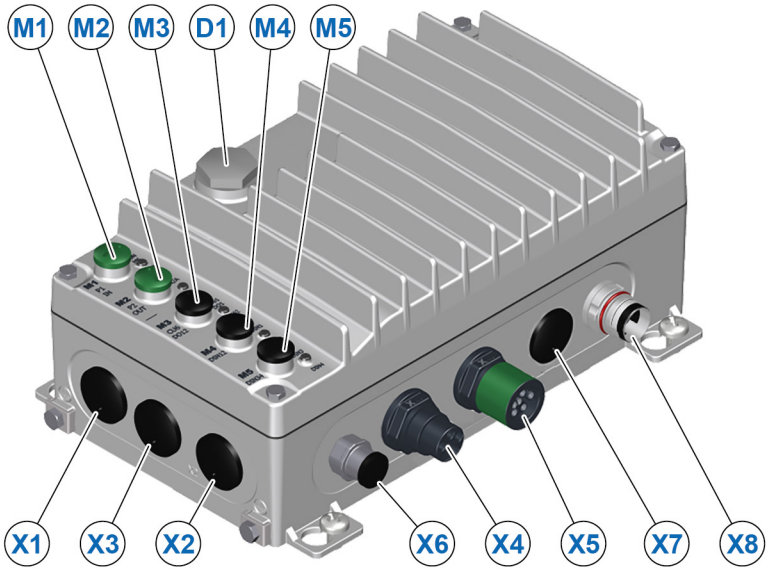
Connection	Function	
	SK 310P without SK CU6-STO	SK 311P with SK CU6-STO
M1	Ethernet-In	
M2	Ethernet-Out	
M3	DOUT1 and DOUT2	Functional safety connection
M4	DIN1 and DIN2	DIN1 and DIN2 or DIN1 and DOUT1
M5	DIN3 and DIN4	DIN3 and DIN4 or DIN3 and DOUT2
D1	Diagnostic LED and diagnostic connection RS485/RS232	
X1	Mains/24V-In (power connection, mains input)	
X2	Mains/24V-Out (power connection, mains output)	
X3	Not equipped	

2.4.3 NORDAC *ON*+, wall-mounted, size 1



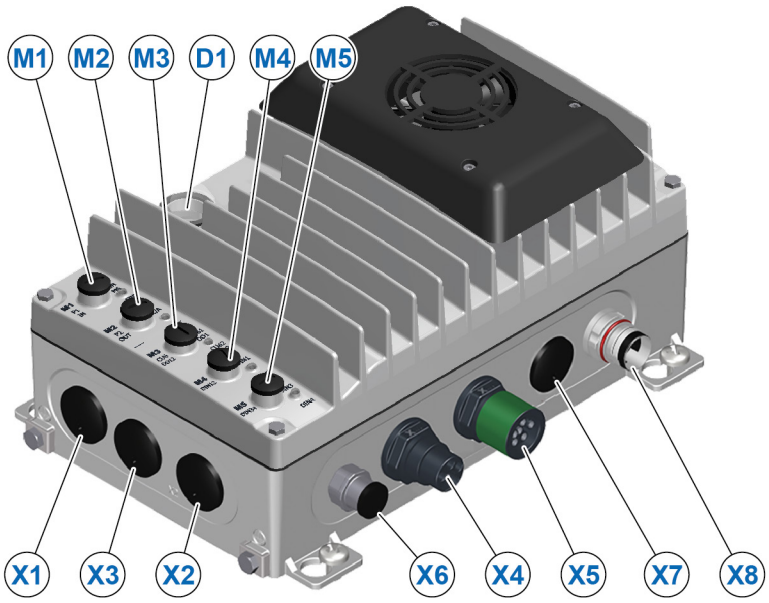
Connection	Function
M1	Ethernet-In
M2	Ethernet-Out
M4	DIN1 and DIN2 or DIN1 and DOUT1
M5	DIN3 and DIN4 or DIN3 and DOUT2
D1	Diagnostic LED and diagnostic connection RS485/RS232
X1	Not equipped
X2	Not equipped
X3	Not equipped
X4	Mains/24V-In (power connection, mains input)
X5	Mains/24V-Out (power connection, mains output)
X6	Encoder connection
X8	Motor connection

2.4.4 NORDAC *ON*+, wall-mounted, size 2



Connection	Function	
	SK 310P without SK CU6-STO	SK 311P with SK CU6-STO
M1	Ethernet-In	
M2	Ethernet-Out	
M3	DOUT1 and DOUT2	Functional safety connection
M4	DIN1 and DIN2	DIN1 and DIN2 or DIN1 and DOUT1
M5	DIN3 and DIN4	DIN3 and DIN4 or DIN3 and DOUT2
D1	Diagnostic LED and diagnostic connection RS485/RS232	
X1	Not equipped	
X2	Not equipped	
X3	Not equipped	
X4	Mains/24V-In (power connection, mains input)	
X5	Mains/24V-Out (power connection, mains output)	
X6	Encoder connection	
X7	Not equipped	
X8	Motor connection	

2.4.5 NORDAC *ON*+, wall-mounted, size 3



Connection	Function	
	SK 310P without SK CU6-STO	SK 311P with SK CU6-STO
M1	Ethernet-In	
M2	Ethernet-Out	
M3	DOUT1 and DOUT2	Functional safety connection
M4	DIN1 and DIN2	DIN1 and DIN2 or DIN1 and DOUT1
M5	DIN3 and DIN4	DIN3 and DIN4 or DIN3 and DOUT2
D1	Diagnostic LED and diagnostic connection RS485/RS232	
X1	Not equipped	
X2	Not equipped	
X3	Not equipped	
X4	Mains/24V-In (power connection, mains input)	
X5	Mains/24V-Out (power connection, mains output)	
X6	Encoder connection	
X7	Connection of external braking resistor	
X8	Motor connection	

2.5 Electrical Connection

WARNING

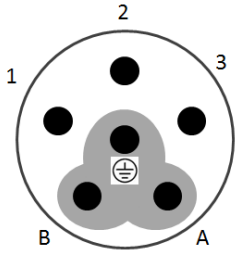
Electric shock

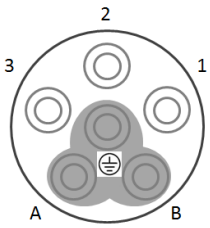
Dangerous voltages may be present at the plug contacts for the power connections (e.g. mains cable, motor cable) even when the device is not in operation.

- Before starting work, check that all relevant components (voltage source, connection cables) are free of voltage using suitable measuring equipment.
- Use insulated tools (e.g. screwdrivers).
- Earth devices.

Electrical connections are made exclusively with plug connectors.

2.5.1 Mains connection

<table>
<tr><th>Power connection</th><th>Connection</th><th colspan="7">Contact assignment</th></tr>
<tr><td>Mains input:</td><td></td><td></td><td>1</td><td>2</td><td>3</td><td>⏚</td><td>A</td><td>B</td></tr>
<tr><td colspan="2">Motor mounting</td><td rowspan="4">NQ16 [1]
 

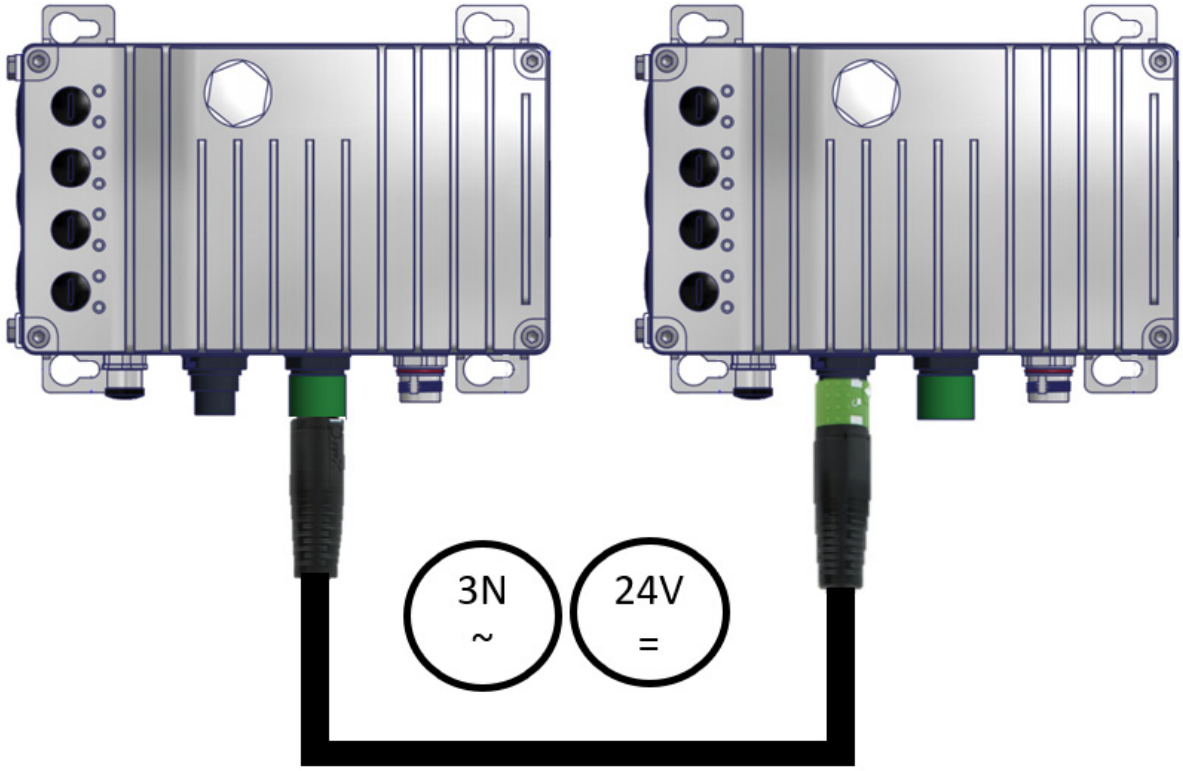
Male</td><td rowspan="4">L1</td><td rowspan="4">L2</td><td rowspan="4">L3</td><td rowspan="4">PE</td><td rowspan="4">24 V</td><td rowspan="4">GND</td></tr>
<tr><td>NORDAC ON</td><td>X1</td></tr>
<tr><td>NORDAC ON+</td><td>X4</td></tr>
<tr><td colspan="2">Wall mounting</td></tr>
<tr><td>NORDAC ON
NORDAC ON+</td><td>X4</td></tr>
<tr><td>Mains output:</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Motor mounting</td><td rowspan="4">NQ16 [1]
 

Female</td><td rowspan="4">L1</td><td rowspan="4">L2</td><td rowspan="4">L3</td><td rowspan="4">PE</td><td rowspan="4">24 V</td><td rowspan="4">GND</td></tr>
<tr><td>NORDAC ON</td><td>X2</td></tr>
<tr><td>NORDAC ON+</td><td>X5</td></tr>
<tr><td colspan="2">Wall mounting</td></tr>
<tr><td>NORDAC ON
NORDAC ON+</td><td>X5</td></tr>
</table>

1) NQ16 = MQ15 from Murr or XTEC15 from LQ Group

2.5.2 Daisy chain connection

Power connections provide the possibility of setting up a daisy chain. This way, the wiring effort for devices close to each other can be reduced.



2.5.3 Motor connection

The external motor connection is only available for wall mounting.

⚠ CAUTION

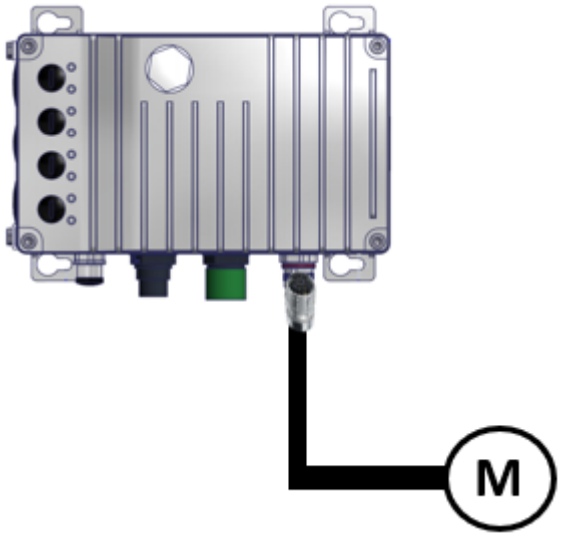
Hazardous voltage at the MB+ and MB- contacts

Touching the contacts may lead to an electric shock.

- If the MB+ and MB- contacts are not used, the open wire ends must be insulated.
- Open wire ends must not be bridged.

		Contact assignment							
		1	2	3	4	5	6	7	⏚
Motor connection	Phoenix ST-7ES1N8A6100S – 1613592  Socket	U	V	W	MB+ 1)	MB- 1)	TF+	TF-	PE

1) Only for size 2 and above



2.5.4 Wiring guidelines

The devices have been developed for use in an industrial environment. In this environment, electromagnetic interference can affect the device. In general, correct installation ensures safe and problem-free operation. To meet the limiting values of the EMC directives, the following instructions should be complied with.

1. Ensure that all devices are securely earthed to a common earthing point or earthing rail using short earthing cables with a large cross-section. It is especially important that each control unit which is connected to the electronic drive technology (e.g. an automatic device) has a short cable with a

large cross-section, which is connected to the same earthing point as the device itself. Flat cables (e.g. metal clamps) are preferable, as they have a lower impedance at high frequencies.

2. The bonding cable of the motor controlled by the soft starter should be connected directly to the earthing terminal of the associated device. The presence of a central earthing bar in the control cabinet and the grouping together of all bonding conductors to this bar normally ensures safe operation.
3. Where possible, shielded cables should be used for control circuits. The shielding at the cable end should be carefully sealed and it must be ensured that the wires are not laid over longer distances without shielding.
4. The control cables should be installed as far as possible from power cables, using separate cable ducts, etc. Where cables cross, an angle of 90° should be ensured as far as possible.
5. Ensure that the contactors in the cabinet are interference protected, either by RC circuits in the case of AC contactors or by free-wheeling diodes for DC contactors, for which **the interference traps must be positioned on the contactor coils**. Varistors for over-voltage limitation are also effective.
6. Shielded or armoured cables should be used for the load connections (motor cable). The shielding or armouring must be earthed at both ends. The shielding or armouring must be connected over a large area on the plug connector housing.

Furthermore, attention must be paid to the EMC-compliant wiring.

During the installation of the devices, the safety requirements must not be violated under any circumstances!

NOTICE!

Damage due to high voltage

The device may be damaged by electrical loads which do not correspond to its specification.

- Do not perform any high voltage tests on the device itself.
- Disconnect the cable which is to be tested from the device before performing a high voltage insulation test.

If the device is installed according to the recommendations in this manual, it meets all EMC directive requirements, as per the EMC product standard EN 61800-3.

2.5.5 Electrical connection of power unit

NOTICE

EMC interference to the environment

This device produces high-frequency interference, which may make additional suppression measures necessary in domestic environments (📖 8.1 "Electromagnetic compatibility (EMC)").

The use of shielded motor cables is essential in order to maintain the specified radio interference suppression level.

When connecting the device, observe the following:

- The mains supply provides the correct voltage and is suitable for the current required (📖 7 "Technical data").
- Suitable electrical fuses with the specified nominal current range are installed between the voltage source and the device.
- Mains cable connection: on option slot **X1 in NORDAC *ON* motor-mounted, X4 in NORDAC *ON*+ motor-mounted, NORDAC *ON* and NORDAC *ON*+ wall-mounted.**
- Motor cable connection: on option slot **X8**
  At least one four-core motor cable must be used and **U-V-W** and **PE** connected to the plug connector.

- Only copper cables with temperature class 80 °C or equivalent may be used for all connections.

2.5.5.1 Mains connection

No special fuses are required on the mains input side of the device. It is advisable to use mains fuses (see technical data) and a main switch or contactor.

Isolation from or connection to the mains must always be carried out synchronously and for all poles.

In the standard version, the device is configured for operation in TN or TT networks. The mains filter provides its normal effect and the resulting leakage current. A star point-earthed mains must be used.

⚠ WARNING

Unexpected movement in case of mains faults

In case of a mains fault (short circuit to earth) a frequency inverter which is switched off may switch on automatically. Depending on the parameterisation, this may cause the drive unit to start automatically and therefore cause a risk of injury.

- Secure the system against unexpected movement (block, decouple mechanical drive, provide protection against falling, etc.)

NOTICE

Defect in the device

In case of daisy chain installation, the max. permissible current flowing through the cables is limited by conductor strips. If the max. permissible current is exceeded, conductor strips in the device may be damaged.

- Limit the current flowing through the daisy chain cables in such an installation to 12 A.

2.5.5.2 Motor cable

If a shielded motor cable is used or if the cable is installed in a metallic and well-grounded duct, the total length should not exceed **5 m** (connect cable shield to PE at both ends).

Pre-assembled motor cables are available on request.

NOTICE!

Output switching

Switching a motor cable under load causes an impermissible increase of the load on the device. Components in the power section may be damaged and destroyed either immediately or in the long term.

- Only switch the motor cable when the frequency inverter is no longer pulsing. I.e. the device must be in the state "ready for switch-on" or "switch-on block".

2.5.5.3 Braking resistor (optionally with size 2 and above)

During dynamic braking (frequency reduction) of a three-phase motor, electrical energy is returned to the inverter as necessary. With size 2 and above, an internal braking resistor can be used to avoid shut-down of the device due to overvoltage. With this, the integrated brake chopper (electronic switch) pulses the link circuit voltage (switching threshold approx. 720 V DC) into the braking resistor. The braking resistor converts excess energy into heat.

Internal braking resistor (optionally with size 2 and above)

Installation of a braking resistor is optionally possible. This is carried out at the factory and must therefore be taken into account in the order. Retrofitting is not possible.

Frequency inverter	Size	Resistance	Continuous power [1]	Energy consumption E_{max} [2]
SK30xP-370-340-A … -950-340-A	2	400 Ω	70 W	0.9 kWs
SK30xP -111-340-A … -301-340-A	3	300 Ω	100 W	1.3 kWs
SK31xP-370-340-A … 950-340-A	2	400 Ω	70 W	0.9 kWs
SK31xP-111-340-A …-301-340-A	3 [3]	300 Ω	100 W	1.3 kWs
SK31xP-111-340-A …-301-340-A	3 [4]	200 Ω	200 W	2.0 kWs

1) Reduction of the continuous power of the braking resistor to 25% of the rated power
2) Permissible max. once within 10 s
3) Only for wall-mounted devices
4) Only for motor-mounted devices

2.5.5.4 Electromechanical brake (optionally with size 2 and above)

For the control of an electromechanical brake, the device generates a PWM signal from the link circuit provided at the motor plug's contacts (MB+ and MB-).

The behaviour of the electromechanical brake is determined by the parameters **P280**, **P281** and **P282**.

The device checks the brake during operation and generates the following messages in the event of a fault:

Short circuit at the brake connection	→ E004.5 [1]
Coil resistance	→ E016.5 [2]
Release time	→ E016.6 [2]

1) Message is always taken into account
2) Message is only taken into account after activation via **P282**.

Irrespective of the supply/mains voltage of the frequency inverter, the brake voltage can be set via the parameter **P281** (factory setting: 180 V).

NOTICE

Dielectric strength of the brake

The brake is loaded with pulse voltages of approx. 1000 V by the PWM signal from the brake control.

- The brake to be controlled must be sufficiently voltage-proof to prevent damage to the brake.

Information

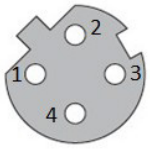
Parameters P280 / P281 / P107 / P114

When connecting an electromechanical brake to the respective terminals of the device, you need to adjust the parameters **P280** and **P281** (current and voltage mechan. brake) as well as the parameters **P107** and **P114** (brake reaction time and delay off). Set value ≠ 0 in parameter **P107** to avoid damage to the brake control.

2.5.6 Electrical connection Ethernet communication and digital input/outputs

Connection of the control cables is made exclusively via M12 plug connectors. The plug connectors are permanently installed at the factory. They enable the use of straight and angled (encapsulated) cable plug connectors. The use of cable plug connectors assembled by the customer must be checked in individual cases.

Ethernet M1, M2

Connection	Function	M12 socket, D-coded	Contact assignment 1	2	3	4	Colour
M1	ETH (Bus-IN)		TX+	RX+	TX-	RX-	Green
M2	ETH (Bus-OUT)		TX+	RX+	TX-	RX-	Green

Digital outputs M3

From Size 2 and above, an additional **M3** option slot is available. Both digital outputs DOUT1 and DOUT2 are available.

Function	M12 socket, A-coded	Contact assignment 1	2	3	4	5	Colour
DOUT1 DOUT2		24 V	DOUT2	GND	DOUT1	–	Black

In case option SK CU6-STO is installed in the device, connections for functional safety are available at this option slot, see also the functional safety manual BU 0830.

Digital inputs M4, M5

Function	M12 socket, A-coded	Contact assignment 1	2	3	4	5	Colour
DIN1/ DIN2		24 V	DIN2	GND	DIN1/ DOUT1	–	Black
DIN3/ DIN4		24 V	DIN4	GND	DIN3/ DOUT2	–	Black

The digital outputs **DOUT1** and **DOUT2** are only available at the option slots **M4** and **M5** if the option SK CU6-STO has been installed. Without the option SK CU6-STO installed, digital outputs are only available at **M3**.

Information

Cable laying

All control cables (including thermistors) must be routed separately from the mains and the motor cables to prevent interference in the device.

If the cables are routed in parallel, a minimum distance of 20 cm must be maintained from cables which carry a voltage of > 60 V. The minimum distance may be reduced by screening the cables which carry a voltage, or by the use of earthed metal partitions within the cable conduits.

2.5.6.1 Control connection details

Meaning, Functions	Description / Technical data		
Contact (designation)	Meaning	Parameter No.	Function of factory setting
Digital outputs	Signalling of the operating statuses of the FI		
	According to EN 61131-2 24 V DC With inductive loads: Provide protection via free-wheeling diode!	Maximum load 20 mA	
DOUT1	Digital output 1	P434 [-01]	No function
DOUT2	Digital output 2	P434 [-02]	No function

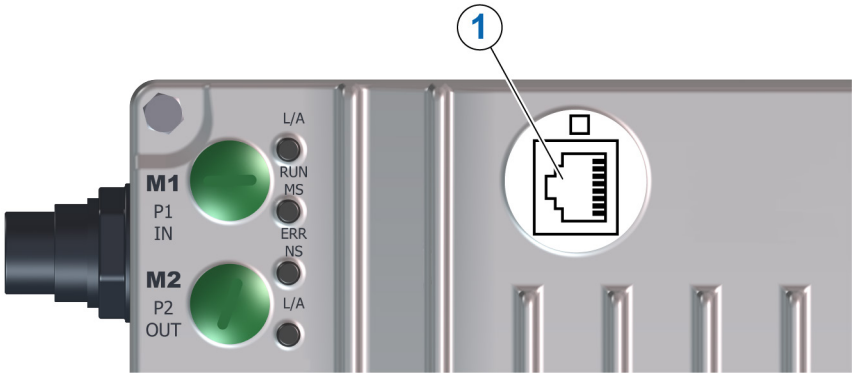
Information regarding bus control:
Digital outputs can be set with the user bits in the control word.
DOUT1: P480 [-11] = Bit8 bus controlword, setting 83/84
DOUT2: P480 [-12] = Bit9 bus controlword, setting 83/84
With P420, the digital outputs can be directly linked to a digital input P420 [-01 … -04], setting value 83/84.
P420 and P480 have priority over P434.

Digital inputs	Actuation of device using an external controller, switch or similar.
	DIN1-4 according to EN 61131-2, type 1 low: 0-5 V (~ 9.5 kΩ) high: 14-30 V (~ 2.5 - 3.5 kΩ) *Scan time:* 1 ms *Response time:* 3 ms
DIN1	Digital input 1, see P420 [-01]
DIN2	Digital input 2, see P420 [-02]
DIN3	Digital input 3, see P420 [-03]
DIN4	Digital input 4, see P420 [-04]

Control voltage connection	Supply voltage for the device		
	24 V DC ± 25% 300 mA … 600 mA, depending on the load on inputs and outputs and use of options		
24 V	Input voltage	-	-
GND / 0V	Reference potential GND	-	-

Brake control (only size 2 and above)	Connection and control of an electromechanical brake. The device generates a PWM signal from the DC link voltage. The brake is always on this potential. The assignment of the correct brake coil voltage must be considered in the selection.		
	Connected loads: (📖 Section 2.5.5.4 "Electromechanical brake (optionally with size 2 and above) ")) Current: ≤ 500 mA	Permissible cycle time: up to 150 Nm ≤ 1/s up to 250 Nm ≤ 0.5/s	
MB+	Brake control	P107/114 P280/P281/P282	0 / 0
MB-	Brake control		

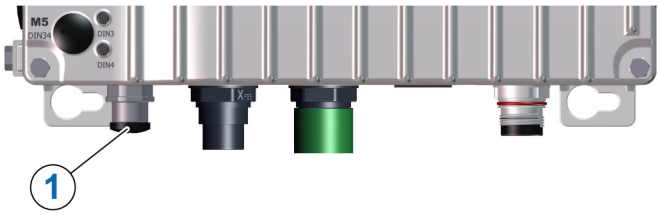
2.6 Diagnostic connection



The frequency inverter is equipped with an RJ12 diagnostic interface (1). Either a PC, a Bluetooth stick or a manual control unit can be connected here via RS 232/ RS 485.

Communication interface		Device connected to different communication tools		
		24 VDC ± 20%	*RS 485 (*For connecting a parametrisation box) 9600 … 38400 Baud *Terminating resistance* (1 kΩ) fixed *RS 232 (*For connecting to a PC (NORD CON)) 9600 … 38400 Baud	
1	RS485 A+	Data cable RS485	P502… P513 [-02]	 1 - 2 - 3 - 4 - 5 - 6
2	RS485 B-	Data cable RS485		
3	GND	Reference potential of bus signals		
4	RS232 TXD	Data cable RS232		
5	RS232 RXD	Data cable RS232		
6	+24 V	Voltage output		

2.7 Encoder



The NORDAC *ON*+ is equipped with an encoder interface (1). High-resolution encoders can transmit their information to the frequency inverter in real time via this interface.

Signal incremental encoder	Signal SSI encoder	Pin
GND	GND	1
+5 V DC	+5 V DC	2
A+	Data+	3
A-	Data-	4
B+	Cycle+	5
B-	Cycle-	6

Note the current consumption of the encoder (normally up to 150 mA) and the permissible load on the voltage source.

To use the encoder, parameter (**P300**) or (**P600**) must be activated according to the requirements (speed feedback / servo mode or positioning).

Information

Motor-mounted versions are equipped with an integrated encoder connected to the control unit. An external encoder connection is not available.

The encoders described below can also be used.

Encoder type	Signal	Connection type		Number of poles	NORDAC *ON*+ SK 31xP
Universal – SSI/BISS	GND + V Data- Data+ CLK- CLK+	Motor mounting	Internal	6	X
		Wall mounting	Via **X6**		
Universal – TTL, f_{max}: 500 kHz	GND + V A+ A- B+ B-	Motor mounting	Internal	6	X
		Wall mounting	Via **X6**		
HTL [1)]	GND + V A+ A-	Motor mounting Wall mounting	Via **DIN3** and **DIN4** in **M5**	4	X

1) In the motor-mounted version, the HTL encoder connection, due to its design, is not intended for motor speed control, but for the determination of application positions or speeds.

Encoder input

The incremental encoder connection is an input for a type with two tracks and TTL-compatible signals for EIA RS 422-compliant drivers. The maximum current consumption of the incremental encoder must not exceed 150 mA.

The pulse number per rotation can be between 16 and 8192 increments. This is set with the normal scaling via parameter **P301** "Incremental encoder pulse number" in the "Speed control" menu group. For cable lengths >20 m and motor speeds above 1500 min^{-1}, the encoder should not have more than 2048 pulses/revolution.

Information

Encoder signal faults

Wires that are not required (e.g. Track A inverse/ B inverse) must be insulated. Otherwise, if these wires come into contact with each other or the cable shield, short-circuits may occur, which can cause encoder signal problems or destruction of the encoder.

Information

Rotation direction

The counting direction of the incremental encoder must correspond to the direction of rotation of the motor. If the two directions are not identical, the connections of the encoder tracks (Track A and Track B) must be switched. Alternatively, the resolution (pulse number) of the encoder in **P301** can be set with a negative prefix.

Alternatively, the motor phase sequence can be changed via parameter **P583**. In this way the direction of rotation can be changed using the software only.

Incremental encoder

According to the resolution (pulse number), incremental encoders generate a defined number of pulses for each rotation of the encoder shaft (Track A / Track A inverse) With this, the precise speed of the encoder or motor can be measured by the frequency inverter. By the use of a second track (B / B inverse) shifted by 90° (¼ period), the direction of rotation can also be determined.

The supply voltage for the encoder is 5 ... 30 V. An external source or the internal voltage can be used as the voltage source.

TTL encoder

Special terminals are available for connection of a rotary encoder with TTL signals. Parameterisation of the corresponding functions is made with the parameters from the "Speed control" group (**P300** et seq.).

HTL encoder

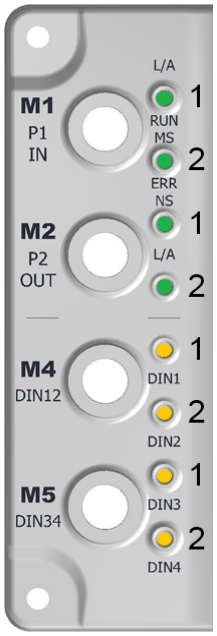
The digital inputs **DIN3** and **DIN4** are used to connect an encoder with an HTL signal. Parameterisation of the corresponding functions is performed with parameters **P420 [-03/-04]**.

3 Display

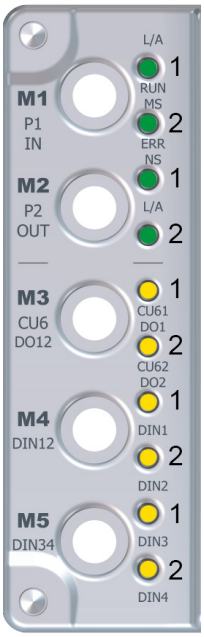
3.1 LEDs

The LEDs of the Ethernet connections **M1** and **M2** indicate the operating states of the respective slave when used for bus communication. The meaning of the display depends on the bus protocol in use.

In case initiators or actuators are used, the LEDs of the digital inputs **M4** and **M5** indicate the corresponding signal states.



LEDs for size 1



LEDs for size 2 and above

3.1.1 Display of M1 and M2 when using EtherCAT

LED	Labelling	Display	Meaning
M1 – 1	L/A (Link activity)	Off	No connection
		Yellow flashing	Connection is established, data is being transmitted
		Green on	Connection is established, no data transmission
M1 – 2	**RUN** MS	**RUN = Ethernet state**	
		Off	No communication of process data and parameters
		Flashing (4 Hz)	Parameter communication active, no process data communication
		Single flash	Parameter communication active Restricted process data communication, No restrictions to actual values, Setpoints not evaluated
		Green on	Parameter communication active, Unrestricted process data communication

LED	Labelling	Display	Meaning
M2 – 1	**ERR** NS	**ERROR = Ethernet Error**	
		Off	EtherCAT functioning normally on the bus interface
		Flashing (4 Hz)	General EtherCAT configuration error
		Single flash	Bus interface has changed the EtherCAT state without authorisation
		Double flash	EtherCAT or FI time-out (P513, P151)
M2 – 2	L/A (Link activity)	Off	No connection
		Yellow flashing	Connection is established, data is being transmitted
		Green on	Connection is established, no data transmission

3.1.2 Display of M1 and M2 when using EthernetIP

LED	Labelling	Display	Meaning
M1 – 1	L/A (Link activity)	Off	No connection
		Yellow flashing	Connection is established, data is being transmitted
		Green on	Connection is established, no data transmission
M1 – 2	RUN **MS**	**MS = Module State**	
		Off	No mains or control voltage
		Green on	Bus interface working correctly
		Green flashing (4 Hz)	Bus interface not configured
		Red flashing (4 Hz)	Minor errors, faulty configuration
		Red on	Unrecoverable error
		Red and Green flashing alter-nately (4 Hz)	Power-up, self test
M2 – 1	ERR **NS**	**NS = Network State**	
		Off	No operating voltage, no IP address
		Green on	CIP connection available
		Green flashing (4 Hz)	IP address configured but no CIP connection available
		Green flashing (0.5 Hz)	Frequency inverter is ready to switch-on, but not enabled
		Red flashing (4 Hz)	Time-out, an "exclusive owner connection” has a time-out error
		Red on	Dual IP. The IP address used by the bus interface is already in use
		Red and Green flashing alter-nately (4 Hz)	Power-up, self test
M2 – 2	L/A (Link activity)	Off	No connection
		Yellow flashing	Connection is established, data is being transmitted
		Green on	Connection is established, no data transmission

3.1.3 Display of M1 and M2 when using PROFINET

LED	Labelling	Display	Meaning
M1 – 1	L/A (Link activity)	Off	No connection
		Yellow flashing	Connection is established, data is being transmitted
		Green on	Connection is established, no data transmission
M1 – 2	**RUN** MS	**RUN = Ethernet state**	
		Off	No error
		Red flashing (1 Hz)	DCP signal service is triggered via the bus
		Red on	System error / Alarm
M2 – 1	ERR NS	**BF = Ethernet Error**	
		Off	No error
		Flashing (4 Hz)	Faulty configuration (PROFInet)
		On	No configuration or no physical connection
M2 – 2	L/A (Link activity)	Off	No connection
		Red flashing	No data exchange
		Red on	No configuration / no physical connection

3.1.4 Display M3

For devices from size 2 onwards, the **M3** LEDs indicate the level of the digital outputs. The meaning of the display depends on whether the SK CU6-STO option is installed.

LED	Labelling	Display	Meaning
M3 – 1	CU61 **DO1**	Yellow on	Digital output 1 = high
		Green on	Digital output 1 = low
M3 – 2	CU62 **DO2**	Yellow on	Digital output 2 = high
		Green on	Digital output 2 = low

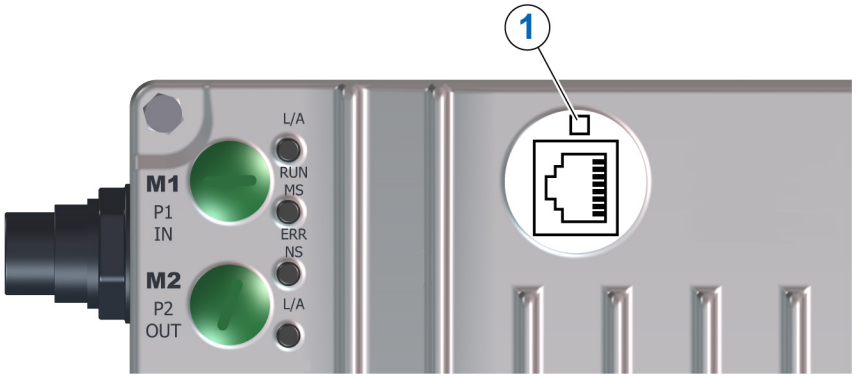
Display of M3 if SK CU6-STO (SK 3x1P) is installed

LED	Labelling	Display	Meaning
M3-1	**CU61** S-DIN1	Yellow on	Safety input Dig.In = high
		Off	Safety input Dig.In = low
M3-2	**CU62** S-DIN2	Yellow on	Safety input Dig.In = high
		Off	Safety input Dig.In = low

3.1.5 Display of M4 and M5

LED	Labelling	Display	Meaning
M4 – 1	DIN1	Yellow on	Digital input 1 = high
		Off	Digital input 1 = low
		Red on	Overload
M4 – 2	DIN2	Yellow on	Digital input 2 = high
		Off	Digital input 2 = low
		Red on	Overload
M5 – 1	DIN3	Yellow on	Digital input 3 = high
		Off	Digital input 3 = low
		Red on	Overload
M5 – 2	DIN4	Yellow on	Digital input 4 = high
		Off	Digital input 4 = low
		Red on	Overload

3.2 Diagnostic LED



LED			Signal status		Meaning
No.	**Colour**	**Description**			
1	Dual red/green	Device status	Off		Device is not ready for operation, • No mains or control voltage
			Green on		Device is enabled (inverter is working)
			Flashing green	0.5 Hz	Device is ready to switch-on, but not enabled
				4 Hz	Device is in switch-on inhibit
			Red/green	4 Hz	Warning
			Changing	1…25 Hz	Overload level of the switched on device
			Flashing red		Error, Flashing frequency = error code (group) (e.g. 3 x flashing = E003)

4 Commissioning

WARNING

Unexpected movement

Connection of the supply voltage may directly or indirectly set the drive unit into motion. This can cause unexpected movement of the drive and the attached machine, which may result in serious or fatal injuries and/or material damage. Possible causes of unexpected movements are e.g.:

- Parameterisation of an "automatic start"
- Incorrect parameterisation
- Control of the device with an enabling signal from a higher level control unit (via IO or bus signals)
- Incorrect motor data
- Incorrect encoder connection
- Release of a mechanical holding brake
- External influences such as gravity or other kinetic energy which acts on the drive unit
- In IT networks: Earth fault (short circuit to earth)

• To avoid any resulting hazard the drive or drive chain must be secured against unexpected movements (mechanical blocking and/or decoupling, provision of protection against falling, etc.) In addition, it must be ensured that there are no persons within the area of action and the danger area of the system.

4.1 Starting up the device

To establish basic operation capability, after the mechanical installation of the device on a suitable wall or mounted on the motor, the electrical connections must be made (📖 Section 2.5.5 "Electrical connection of power unit").

The supply with 24 V DC control voltage is mandatory for commissioning the device.

Information

Factory settings

Before recommissioning it must be ensured that the device is in its factory settings (**P523**).

Parameters are pre-set (factory settings).

Set the correct motor data and the selection of the operating mode in the parameters. Adaptations to the drive application, communication settings for other devices or a control unit, as well as optimisation of the operating characteristics are also carried out via parameter settings (see 5 "Parameter").

For the correct operation of the drive unit, it is necessary to enter the motor data (rating plate) as precisely as possible. In particular, automatic stator resistance measurement using parameter **P220** is recommended.

Motor data for IE3 motors are provided via the NORDCON software. With the aid of the "Import motor parameter" function (also refer to the NORDCON software manual BU 0000), the required data set can be selected and imported into the frequency inverter.

4.2 Firmware update

With the integrated bus interface, the frequency inverter offers the option to update both the firmware of the frequency inverter and the firmware of the integrated bus interface. Details on the different options can be found in 🕮 BU 0820 „Supplementary instructions for SK 300P series“.Selecting the operating mode for motor control

Motors from NORD are designed as asynchronous motors in efficiency classes IE1 to IE3, and IE4 and IE5 motors are designed as synchronous motors.

The NORDAC *ON* frequency inverter is able to control asynchronous motors with efficiency classes IE1 to IE3. The NORDAC *ON+* frequency inverter is able to control motors with efficiency class IE5+.

In terms of control technology, IE4 motor operation shows many special features. The frequency inverter is designed for the control of IE4 and IE5 motors from NORD. In terms of structure, these IE4 motors match the type of an IPMSM (Interior Permanent Magnet Synchronous Motor). In these motors, the permanent magnets are embedded in the rotor.

The operation of other manufacturer's motors must be checked by NORD, if required. Observe the following additional information:

- IE4 synchronous motors: Technical information TI 80-0010 “Planning and Commissioning Guideline for NORD IE4 Motors with NORD Frequency Inverters”.
- IE5 synchronous motors: Catalogue M5000 “Synchronous motors with IE5+ energy efficiency”.

4.2.1 Explanation of the operating modes (P300)

The frequency inverter provides different operating modes for the control of a motor. All operating modes can be used with either an ASM (asynchronous motor) or a PMSM (Permanent Magnet Synchronous Motor), however various constraints must be complied with. In principle, all these methods are "flux oriented control methods.

1. VFC open-loop mode (P300, setting "0")

   This operating mode is based on a voltage-governed flux oriented control method (Voltage Flux Control Mode (*VFC*)). This is used for both ASMs as well as PMSMs. In association with the operation of asynchronous motors this is often referred to as "ISD control".
   Control is carried out without the use of encoders and exclusively on the basis of fixed parameters and the measurement results of actual electrical values. No specific control parameter settings are necessary for the use of this mode. However, parameterisation of the precise motor data is an essential prerequisite for efficient operation.
   As a special feature for the operation of an ASM there is also the possibility of control according to a simple V/f characteristic curve. This mode of operation is important if several motors which are not mechanically coupled are to be operated with a single frequency inverter, or if it is only possible to determine the motor data in a comparatively imprecise manner.
   Operation according to a V/f characteristic curve is only suitable for drive applications with relatively low demands on the quality of speed control and dynamics (ramp times ≥ 1 s). For machines which tend to have relatively large mechanical vibrations due to their construction, control according to a V/f characteristic curve can also be advisable. Typically, V/f characteristic curves are used to control fans, certain types of pump drives or agitators. Operation according to a V/f characteristic curve is activated via parameters (P211) and (P212) (each set to "0").

2. CFC closed-loop – Mode (P300, setting “1”)

In comparison with setting “0” “VFC open-loop – Mode”, this is generally a control with current-controlled field orientation (Current Flux Control). For this operating mode, which with ASM is functionally identical to the designation previously listed under “servo control”, the use of an encoder is mandatory. This way, the motor’s exact speed characteristics are recorded and included in the calculation for the motor control. The determination of the rotor position is enabled by the encoder, where for the operation of a PMSM the initial value of the rotor position must be determined. This allows for a more precise and faster control of the drive.
For ASM and PMSM, this operating mode provides the optimal results in control behaviour, and is especially suitable for lifting gear applications or applications with requirements on optimal dynamic behaviour (ramp times ≥ 0.05 s). This operating mode has the greatest benefit in connection with a motor of energy efficiency class IE5+ (energy efficiency, dynamics, precision).

3. CFC open-loop –mode (P300, setting "2")

   CFC mode is also possible with the open-loop method, i.e. in operation without an encoder. Here, the speed and position detection are determined by "observation" of measurements and setting values. Precise setting of the current and speed controller is also essential for this operating mode. This mode is especially suitable for applications with higher demands for dynamics in comparison with VFC control (ramp times ≥ 0.25 s) and e.g. also for pump applications with high starting torques).

4.2.2 Overview of controller parameter settings

The following illustration provides an overview of all parameters which are important, depending on the selected operating mode. In principle, the following applies: The more precise the setting, the more accurate the control and the higher the possible values for the dynamics and precision of drive operation. A detailed description of the individual parameters can be found in 🕮 Section 5 "Parameter".

"Ø" =	Parameter has no meaning			"-" =	Leave the parameter in the factory setting		
"√" =	Change to the parameter is relevant						

Group	Parameter	Operating mode					
		VFC open-loop		CFC open-loop		CFC closed-loop	
		ASM	PMSM	ASM	PMSM	ASM	PMSM
Motor data	P201 … P209	√	√	√	√	√	√
	P210	√ 1)	√	√	√	√	√
	P211, P212	- 2)	-	-	-	-	-
	P215, P216	- 1)	-	-	-	-	-
	P217	√	√	√	√	Ø	Ø
	P220	√	√	√	√	√	√
	P240	-	√	-	√	-	√
	P241	-	√	-	√	-	√
	P243	-	√	-	√	-	√
	P244	-	√	-	√	-	√
	P246	-	-	√ 3)	√ 3)	√	√
	P245, 247	-	√	Ø	Ø	Ø	Ø
Controller data	P300	√	√	√	√	√	√
	P301	Ø	Ø	Ø	Ø	√	√
	P310, P311, P314, P317 … P320	Ø	Ø	√	√	√	√
	P312, P313, P315, P316	Ø	Ø	-	√	-	√
	P330 … P333	-	√	-	√	-	√
	P334	Ø	Ø	Ø	Ø	-	√

1) For the V/f characteristic curve: precise change to the parameter is important

2) For the V/f characteristic curve: typical setting "0"

3) Only effective above the switch-over point, because the CFC open-loop PMSM first starts with VFC (without the influence of **P246**) and CFC is only effective above the switch-over point

4.2.3 Motor control commissioning steps

The main commissioning steps are mentioned below in their ideal order. Correct assignment of the inverter/motor and the mains voltage selection are assumed. Detailed information, especially for optimisation of the current, speed and position control of asynchronous motors is described in the guide "Control optimisation" (AG 0100). Detailed commissioning and optimisation information for PMSM in CFC closed-loop mode can be found in the "Drive optimisation" guide (AG 0101). Please contact our Technical Support.

1. Carry out the inverter and motor connection as usual (note Δ / Y!). Connect the encoder, if present
2. Connect the mains supply.
3. Carry out the factory setting (P523)
4. Select the basic motor from the motor list (P200) (ASM types are at the beginning of the list, PMSM types are at the end, designated by their type (e.g. **…80T…**))
5. Check the motor data (P201 … P209) and compare with the name plate / motor data sheet
6. Measure the stator resistance (P220) → P208, P241[-01] are measured, P241[-02] is calculated. (Note: If an SPMSM is used, P241[-02] must be overwritten with the value from P241[-01])
7. Encoders: Check the settings (P301, P735)
8. With PMSM only:
   a. EMF voltage (P240) → motor name plate / motor data sheet
   b. Determine / set reluctance angle (P243) (not required with NORD motors)
   c. Peak current (P244) → motor data sheet
   d. For PMSM in VFC mode only:
      Determine (P245), (P247)
   e. Determine (P246)
9. Select the operating mode (P300)
10. Determine / adjust the current control (P312 … P316)
11. Determine / adjust the speed control P310, P311)
12. With PMSM only:
    a. Select the control method (P330)
    b. Make the settings for the starting behaviour (P331 … P333)
    c. Make the settings for the 0 pulse of the encoder P334 … P335)
    d. Activation of slip error monitoring (P327 ≠ 0)

Information

Further information for commissioning NORD IE5 motors with NORD frequency inverters can be found in catalogue M5000 “Synchronous motors with IE5+ energy efficiency”.

5 Parameter

WARNING

Unexpected movement

Connection of the supply voltage may directly or indirectly set the drive unit into motion. This can cause unexpected movement of the drive and the attached machine, which may result in serious or fatal injuries and/or material damage. Possible causes of unexpected movements are e.g.:

- Parameterisation of an "automatic start"
- Incorrect parameterisation
- Control of the device with an enabling signal from a higher level control unit (via IO or bus signals)
- Incorrect motor data
- Incorrect encoder connection
- Release of a mechanical holding brake
- External influences such as gravity or other kinetic energy which acts on the drive unit
- In IT networks: Earth fault (short circuit to earth)

- To avoid any resulting hazard the drive or drive chain must be secured against unexpected movements (mechanical blocking and/or decoupling, provision of protection against falling, etc.) In addition, it must be ensured that there are no persons within the area of action and the danger area of the system.

WARNING

Unexpected movement due to changes in the parameterisation

Parameter changes become effective immediately. Under certain conditions, dangerous situations may occur, even when the drive is in standstill. Functions such as **P428** “Automatic starting” can set the drive in motion and places persons at risk due to moving parts.

The following applies to parametrisation works:

- Only change the parameter settings if the Frequency Inverter is **not** released.
- The danger area of the system must not be entered.
- Take precautions that prevent accidental movement of the drive (e.g. dropping of lifting equipment).

WARNING

Unexpected movement due to overload

In case of overload of the drive there is a risk that the motor will "break down" (sudden loss of torque). An overload may be caused e.g. by inadequate dimensioning of the drive unit or by the occurrence of sudden peak loads. Sudden peak loads may be of a mechanical origin (e.g. blockage) or may be caused by extremely steep acceleration ramps (P102, P103, P426).

Depending on the type of application, "breakdown" of the motor may cause unexpected movement (e.g. dropping of loads by lifting equipment).

To prevent any risk, the following must be observed:

- For lifting equipment applications or applications with frequent large load changes, parameter P219 must remain in the factory setting (100 %).
- Do not inadequately dimension the drive unit, provide adequate overload reserves.
- If necessary, provide fall protection (e.g. for lifting equipment) or equivalent protective measures.

Parameters are accessed via one of the possible protocols (EtherCAT, EtherNet/IP or Profinet) with the customer control, and allow the device to be adapted to the drive application. Different device configurations can result in dependencies for the relevant parameters.

The parameters can only be accessed if the control unit of the device is active.

The relevant parameters for the device are described in the following. Explanations for parameters which relate e.g. to field bus options or special functionality, can be found in the respective supplementary manuals.

The individual parameters are combined into functional groups. The first digit of the parameter number indicates the assignment to a **menu group**:

Menu group	No.	Master function
Operating displays	(P0--)	Display of parameters and operational values
Basic parameters	(P1--)	Basic device settings such as behaviour when switching on/off
Motor data	(P2--)	Electrical settings for the motor (motor current or starting voltage)
Speed control	(P3--)	Setting for current and speed controls as well as encoder settings (incremental encoders)
		Settings for the integrated PLC (details in 🕮 BU0850)
Control terminals	(P4--)	Assignment of functions for the inputs and outputs
Additional parameters	(P5--)	Primarily monitoring functions and other parameters
Positioning	(P6--)	Setting of the positioning function (details 🕮 BU0810)
Information	(P7--)	Display of operating values and status messages
Bus parameters	(P8--)	Parameters for Industrial Ethernet (details in 🕮 BU0820)

Information

Factory setting P523

The factory settings of the entire parameter set can be loaded at any time using parameter **P523**. For example, this can be useful during commissioning if it is not known which device parameters have been previously changed and could have an unexpected influence on the operating behaviour of the drive.

The restoration of the factory settings (**P523**) normally affects all parameters. This means that all motor data must subsequently be checked or reconfigured. However, parameter **P523** also provides a facility for excluding the motor data or the parameters relating to bus communication when the factory settings are restored.

It is advisable to back up the present settings of the frequency inverter beforehand.

5.1 Parameter overview

Operating displays

P000 Operating para. disp	**P001** Select of disp.value	**P002** Display factor
P003 Supervisor-Code	**P004** Password	**P005** Change password

Basic parameters

P100 Parameter set	**P101** Copy parameter set	**P102** Acceleration time
P103 Deceleration time	**P104** Minimum frequency	**P105** Maximum frequency
P106 Ramp smoothing	**P107** Brake reaction time	**P108** Disconnection mode
P109 DC brake current	**P110** Time DC-brake on	**P111** P-factor torque limit
P112 Torque current limit	**P113** Jog frequency	**P114** Brake delay off

Motor data

P200 Motor list	**P201** Nominal frequency	**P202** Nominal speed
P203 Nominal current	**P204** Nominal voltage	**P205** Nominal power
P206 Cos phi	**P207** Star Delta con.	**P208** Stator resistance
P209 No-load current	**P210** Static boost	**P211** Dynamic boost
P212 Slip compensation	**P213** ISD ctrl. loop gain	**P214** Torque pre-control
P215 Boost pre-control	**P216** Time boost prectrl.	**P217** Oscillation damping
P218 Modulation depth	**P219** Auto.magn.adjustment	**P220** Par. identification
P240 EMF voltage PMSM	**P241** Inductivity PMSM	**P243** Reluct. angle IPMSM
P244 Peak current PMSM	**P245** Osc damping PMSM VFC	**P246** Mass inertia
P247 Switch freq VFC PMSM	**P280** Current mechan.brake	**P281** Voltage mechan.brake
P282 Mode mechan.brake		

Control parameters

P300 Control method	**P301** Incremental encoder (Only for NORDAC ON+)	**P302** Type Univers.encoder (Only for NORDAC ON+)
P310 Speed ctrl P	**P311** Speed ctrl I	**P312** Torque curr. ctrl. P
P313 Torque curr. ctrl. I	**P314** Torq curr ctrl limit	**P315** Field curr. ctrl. P
P316 Field curr. ctrl. I	**P317** Field curr. ctrl. lim.	**P318** P-weak
P319 P-weak I	**P320** Weak border	**P321** Speedctr.I brake off (Only for NORDAC ON+)
P325 Function encoder (Only for NORDAC ON+)	**P326** Ratio encoder (Only for NORDAC ON+)	**P327** Speed slip error (Only for NORDAC ON+)
P328 Speed slip delay (Only for NORDAC ON+)	**P330** Ident startrotor pos (Only for NORDAC ON+)	**P331** Switch over freq. CFC ol
P332 Hyst.switchover freq	**P333** Flux feedb.fact.PMSM	**P334** PMSM Encoder offset (Only for NORDAC ON+)
P336 Mode Rotorpos ident (Only for NORDAC ON+)	**P350** PLC functionality	**P351** PLC set val. select.
P355 PLC Integer setvalue	**P356** PLC long setvalue	**P360** PLC display value
P370 PLC status		

Control terminals

P410	Min. freq. a-in 1/2	**P411**	Max. freq. a-in 1/2	**P412**	Nom.val process ctrl
P413	PID control P comp.	**P414**	PID control I comp.	**P415**	PID control D comp.
P416	Ramptime PI setpoint	**P420**	Digital inputs	**P423**	Safety SS1 max. time
P424	Safe Dig.input	**P425**	Function PTC input	**P426**	Quick stop time
P427	Quick stop on Error	**P428**	Automatic starting	**P429**	Fixed frequency 1
P430	Fixed frequency 2	**P431**	Fixed frequency 3	**P432**	Fixed frequency 4
P433	Fixed frequency 5	**P434**	Digital out function	**P435**	Dig. out scaling
P436	Dig. out. hysteresis	**P460**	Watchdog time	**P464**	Fixed Frequency Mode
P465	Fixed freq. Array	**P466**	Min.freq. proc.ctrl.	**P475**	Delay on/off switch
P480	Funct. BusIO In Bits	**P481**	Funct-BusIO Out Bits	**P482**	Norm. BusIO Out Bits
P483	Hyst. BusIO Out Bits				

Additional parameters

P501	Inverter name	**P504**	Pulse frequency	**P505**	Absolute mini. freq.
P506	Automatic acknowled.	**P509**	Source control word	**P510**	Source setpoints
P511	USS baud rate	**P512**	USS address	**P513**	Telegram time-out
P516	Skip frequency 1	**P517**	Skip freq. area 1	**P518**	Skip frequency 2
P519	Skip freq. area 2	**P520**	Flying start	**P521**	Fly. start resol.
P522	Fly. start offset	**P523**	Factory setting	**P525**	Load control max.
P526	Load control min.	**P527**	Load control freq.	**P528**	Load control delay
P529	Mode Load control	**P533**	Factor I^2t	**P534**	Torque disconn.limit
P535	I^2t motor	**P536**	Current limit	**P537**	Pulse disconnection
P539	Check output voltage	**P540**	Mode phase sequence	**P541**	Set digital out
P543	Bus actual value	**P546**	Func. bus-setpoint	**P551**	Drive profile
P553	PLC set values	**P554**	Chopper min.	**P555**	P-limit chopper
P556	Braking resistor	**P557**	Brake resistor type	**P558**	Flux delay
P559	DC run-on time	**P560**	Mode of param. save	**P583**	Motor phase sequence

Information

P700	Current fault	**P701**	Last fault	**P702**	Freq. last error
P703	Current. last error	**P704**	Volt. last error	**P705**	Dc. link volt. last er.
P706	P set last error	**P707**	Software version	**P708**	State of digital in.
P711	State of digital out	**P712**	Energy consumption	**P713**	Energy break res.
P714	Operating time	**P715**	Running time	**P716**	Current frequency
P717	Current speed	**P718**	Current set freq.	**P719**	Actual current
P720	Act. torque current	**P721**	Actual field current	**P722**	Current voltage
P723	Voltage -d	**P724**	Voltage -q	**P725**	Current cos phi
P726	Apparent power	**P727**	Mechanical power	**P728**	Input voltage
P729	Torque	**P730**	Field	**P731**	Parameter set
P732	Phase U current	**P733**	Phase V current	**P734**	Phase W current
P735	Speed encoder (Only NORDAC ON+)	**P736**	DC link voltage	**P737**	Usage rate brakeres.
P738	Usage rate motor	**P739**	Temperature	**P740**	PZD bus in
P741	PZD bus out	**P742**	Database version	**P743**	Inverter ID
P744	Configuration	**P745**	Option version	**P746**	Option status
P747	Inverter Volt. Range	**P750**	Error statistics	**P751**	Counter statistics
P780	Device ID	**P799**	Op.-time last error		

P000 (parameter number)	**Operating para. disp.** (parameter name)		**S**	**P**
Setting range or display range	Display of typical display format (e.g. (bin = binary)) of possible setting range and number of decimal places			
Arrays	[-01]	If parameters have a substructure in several arrays, this is shown here.		
Factory setting	{ 0 }	Typical default setting of parameters in the as-delivered condition of the FI, or to which it is set after carrying out "Restore factory settings" (see parameter **P523**).		
Scope of application	List of variants for which this parameter applies. If the parameter is generally valid, i.e. for the entire model series, this line is omitted.			
Description	Description, function, meaning and similar for this parameter.			
Note	Additional notes about this parameter			
Setting values or display values	List of possible settings with description of their respective functions			

Figure 1: Explanation of parameter description

Information

Parameter description

Unused lines of information are not listed.

Notes / Explanations

Label	Designation	Meaning
S	Supervisor parameter	The parameter can only be displayed and changed if the relevant supervisor code has been set (see parameter **P003**).
P	Depending on the parameter set	The parameter provides various setting options which depend on the selected parameter set.

5.1.1 Operating displays

P000	Operating para. disp
Display range	0.01 … 9999
Description	The operating value selected in parameter **P001** is displayed. Important information about the operating status of the drive can be read out as required.

P001	Select of disp.value	
Setting range	0 … 63	
Factory setting	{ 0 }	
Description	Selection of the operating display for presentation via 7-segment display.	
Setting values	**Value**	**Meaning**

0	Actual frequency [Hz]	Currently supplied output frequency
1	Speed [rpm]	Calculated speed
2	Set point frequency [Hz]	Output frequency corresponding to the present setpoint. It does not need to match the actual output frequency.
3	Current [A]	Actually measured output current
4	Torque current [A]:	Torque-generating output current
5	Voltage [V AC]	Present AC voltage at the device output
6	D.c. link voltage [V DC]	"*D.c. link voltage*", internal direct current of the frequency inverter. Amongst other things, this depends on the level of the mains voltage.
7	Cos Phi [-]	Calculated value of actual power factor
8	Apparent power [kVA]	Calculated value of actual apparent power
9	Real Power [kW]	Calculated value of actual effective power
10	Torque [%]	Calculated value of actual torque
11	Field [%]	Calculated value of actual rotating field in the motor
12	On-time [h]	Time for which mains voltage has been supplied to the device
13	Run-time [h]	"*Run-time*" is the time for which the device has been enabled.
16, 17	[1]	*see POSICON*
19	Temp. of heat sink [°C]	Actual temperature of heat sink
20	Usage rate motor [%]	Average motor load based on motor data P201 … P209
21	Usage rate brakeres. [%]	"*Usage rate braking resistor*" is the average load on the braking resistor based on the resistance data P556 … P557
22	Inside inverter temp [°C]	Actual inside temperature of the device
30	Cur. set value MP-S [Hz] [1]	"*Current motor potentiometer function set value with storage*": P420 … = 71/72. For reading or presetting the set value.
40	PLC-Ctrlbox Value	Visualisation mode for PLC communication
50, 52, 53, 54, 56	[1]	*see POSICON*
60	R Stator Ident.	Stator resistance determined by measurement P220
61	R Rotor Ident.	Rotor resistance determined by measurement (P220 Function 2)
62	L Scat. Stator Ident	Stray inductance determined by measurement (P220 Function 2)
63	L Stator Ident	Inductance determined by measurement (P220 Function 2)

1) SK 310P and higher

P003	Supervisor code		
Setting range	0 … 9999		
Factory setting	{ 1 }		
Description	The scope of the visible parameters can be influenced by setting the supervisor code.		
Note	**Display via NORDCON** If parameterisation is carried out with the NORDCON software, the settings 2 ... 9999 the settings are as for the 0 setting.		
Setting values	**Value**		**Meaning**
	0	Supervisor mode Off	The supervisor parameters are not visible.
	1	Supervisor mode On	All parameters are visible.
	2	Supervisor mode Off	Only the menu group 0 (without supervisor parameter) is visible.

P004	Password	S
Setting range	- 32768 … 32767	
Factory setting	{ 0 }	
Description	Entry of the password from **P005** to unlock all standard parameters. Safety parameters are excluded from this.	
Note	The value which is entered here is lost when the control board / frequency inverter is switched off. Password protection is active again.	

P005	Change password	S
Setting range	-32768 … 32767	
Factory setting	{ 0 }	
Description	Specification of a password to protect the setting values of standard parameters from unauthorised changes. Password protection can be temporarily suspended via **P004**. Safety parameters are excluded from this.	
Note	The password is generally suspended with setting {0} in **P005**.	

5.1.2 Basic parameters

P100	Parameter set	S
Setting range	0 … 3	
Factory setting	{ 0 }	
Description	Selection of the parameters sets to be parameterised. Four parameter sets are available. The parameters to which different values can also be assigned in the four parameter sets are known as “parameter set-dependent” and are indicated with a “**P**” in the header in the following descriptions. The operating parameter set is selected via correspondingly parametrised digital inputs or BUS actuation. If enabling is via the keyboard of a ParameterBox, the operating parameter set corresponds to the settings in **P100**.	

P101	Copy parameter set	S
Setting range	0 … 4	
Factory setting	{ 0 }	
Description	“*Copy parameter set*”. By confirmation with the OK key, the active parameter set (set in **P100**) is copied into the selected parameter set.	
Setting values	**Value** / **Meaning**	

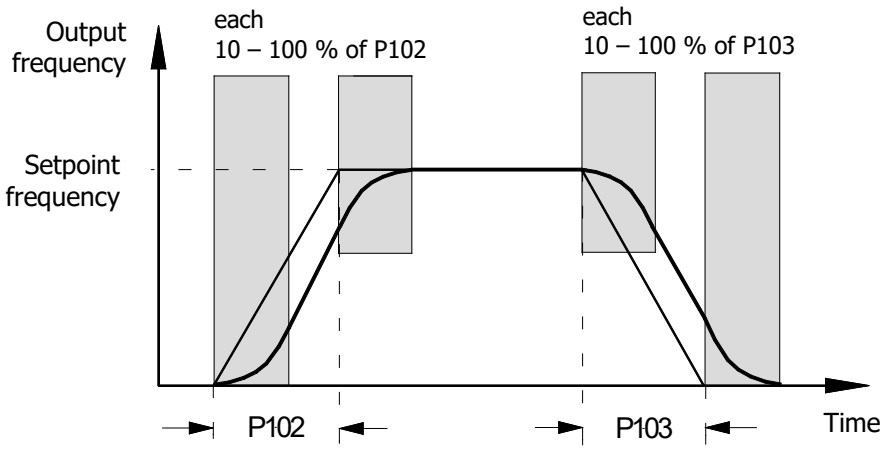
0	Do not copy	No copy process triggered.
1	Copy actual to P1	Copies the active parameter set to parameter set 1
2	Copy actual to P2	Copies the active parameter set to parameter set 2
3	Copy actual to P3	Copies the active parameter set to parameter set 3
4	Copy actual to P4	Copies the active parameter set to parameter set 4

P102	Acceleration time	P
Setting range	0.00 … 320.00 s	
Factory setting	{ 2.00 }	
Description	The acceleration time is the time which corresponds to the linear frequency increase from 0 Hz to the set maximum frequency **P105**. If an actual setpoint of <100 % is being used, the acceleration time is reduced linearly according to the setpoint which has been set. The acceleration time can be extended by certain circumstances, e.g. FI overload, setpoint delay, ramp smoothing, or if the current limit is reached.	
Note	Care must be taken that the parameter values are realistic. The setting **P102 = 0** is not permissible for drive units! **Ramp gradient:** Amongst other things, the ramp gradient is governed by the inertia of the rotor. A ramp with a gradient which is too steep may result in “breakdown” of the motor. Extremely steep ramps (e.g.: 0 – 50 Hz in < 0.1 s) should be avoided, as this may cause damage to the frequency inverter.	

P103	Deceleration time	P
Setting range	0.00 … 320.00 s	
Factory setting	{ 2.00 }	
Description	The deceleration time is the time corresponding to the linear frequency reduction from the set maximum frequency **P105** to 0 Hz. If an actual setpoint <100 % is being used, the deceleration time reduces accordingly. The deceleration time can be extended by certain circumstances, e.g. by the selected *“Disconnection mode”* **P108** or *“Ramp smoothing”* **P106**.	
Note	Care must be taken that the parameter values are realistic. The setting **P103 = 0** is not permissible for the drive units! **Notes on ramp gradient**: see **P102**	

P104	Minimum frequency	P
Setting range	0.0 … 400.0 Hz	
Factory setting	{ 0.0 }	
Description	The minimum frequency is the frequency supplied by the FI as soon as it is enabled and no additional setpoint is set. In combination with other setpoints (e.g. fixed frequencies), these are added to the set minimum frequency. This frequency is undershot when • The drive is accelerated from standstill. • The FI is blocked. The frequency then reduces to the absolute minimum frequency **P505** before it is blocked. • The FI reverses. Reversal of the rotation field takes place at the absolute minimum frequency **P505**. This frequency can be continuously undershot if the function *"Maintain the freq."* (Digit inputs function = 9) was executed during acceleration or deceleration.	

P105	Maximum frequency	P
Setting range	0.1 … 400.0 Hz	
Factory setting	{ 50.0 }	
Description	The frequency supplied by the FI after being enabled and once the maximum setpoint is present, (e.g. a correspondingly fixed frequency or maximum via a ParameterBox). This frequency can only be exceeded by the slip compensation **P212**, the function *"Maintain the freq."* (Digit inputs function = 9) and the switch to another parameter set with lower maximum frequency. Maximum frequencies are subject to certain restrictions, e.g. • Restrictions in weak field operation, • Compliance with mechanically permissible speeds, • PMSM: Restriction of the maximum frequency to a value which is slightly above the nominal frequency. This value is calculated from the motor data and the input voltage.	

P106	Ramp smoothing	S	P
Setting range	0 … 100 %		
Factory setting	{ 0 }		
Description	This parameter enables smoothing of the acceleration and deceleration ramps. This is necessary for applications where gentle, but dynamic speed change is important. Ramp smoothing is carried out for every setpoint change. The value to be set is based on the set acceleration and deceleration time, however values <10 % have no effect. The following then applies for the entire acceleration or deceleration time, including ramp smoothing: $t_{ges\ ACCELERATION\ TIME} = t_{P102} + t_{P102} \cdot \frac{P106[\%]}{100\%}$ $t_{ges\ BRAKING\ TIME} = t_{P103} + t_{P103} \cdot \frac{P106[\%]}{100\%}$ 		

P107	Brake reaction time	P
Setting range	0 … 2.50 s	
Factory setting	{ 0.00 }	
Description	Electromagnetic brakes have a physically-dependent delayed Brake reaction time when actuated. This can result in the dropping of the load in lifting equipment applications. The brake takes up the load after a delay. The reaction time must be taken into consideration by setting parameter **P107**. Within the adjustable reaction time, the FI supplies the set absolute minimum frequency **P505** and so prevents movement against the brake and load drop when stopping. If a time > 0 is set in **P107** or **P114**, at the moment the FI is switched on, the level of the excitation current (field current) is checked. If no excitation current is present, the FI remains in excitation mode and the motor brake is not released.	
Note	In order to achieve a shutdown and an error message **E016** in case of a too low excitation current, **P539** must be set to {2} or {3}.	
	To control an electromechanical brake, especially for bucket elevators, the connection of the brake rectifier MB+ and MB- can be used from size 2 and above. The absolute minimum frequency (**P505**) should never be less than 2.0 Hz.	

P108	Switch-off mode	S	P
Setting range	0 ... 14		
Factory setting	{ 1 }		
Description	This parameter determines the way in which the output frequency is reduced after "Blocking" (controller enable → Low).		

Setting values

Value		Meaning
0	Voltage disable	The output signal is switched off immediately. The FI no longer supplies an output frequency. The motor is only braked by mechanical friction. Switching the FI on again immediately can cause an error message.
1	Ramp down	The actual output frequency is reduced in proportion to the remaining deceleration time from **P103/P105**. The DC run-on **P559** follows the end of the ramp.
2	Delayed ramping	As with {1 "*Ramp*", however, for generational operation the brake ramp is extended, or for static operation the output frequency is increased. Under certain conditions, this function can prevent overvoltage switch-off or reduce braking resistor power dissipation. **Note**: This function must not be programmed if defined deceleration is required, e.g. for lifting equipment.
3	Immediate DC braking	The FI switches immediately to the preselected DC current **P109**. This DC current is supplied for the remaining proportion of the "*DC brake time*" **P110** Depending on the relationship of the actual output frequency to the max. frequency **P105**, the "*DC brake time*" is shortened. The time taken for the motor to stop depends on the application. The time taken to stop depends on the inertia of the load, friction and the DC current which is set in **P109**. With this type of braking, no energy is fed back into the FI. Heat losses primarily occur in the rotor of the motor. **Note**: ***This function is not suitable for PMSM motors***
4	Const. Braking distance	"*Constant brake distance*": Start of the brake ramp is delayed if operation is not at the maximum output frequency (**P105**). This results in an approximately similar braking distance for different actual frequencies. **Note:** This function cannot be used as a positioning function. This function should not be combined with ramp smoothing (**P106**).
5	Combined Braking	*"Combined braking"*: Depending on the actual link circuit voltage (UZW), a high frequency voltage is switched to the basic frequency (only for linear characteristic curves **P211 = 0** and **P212 = 0**). The braking time **P103** is complied with if possible. → Additional heating in the motor! **Note**: ***This function is not suitable for PMSM motors***
6	Quadratic ramp	The brake ramp does not follow a linear path, but rather a decreasing quadratic one.

7	Quad. Ramp with Delay	"*Quadratic ramp with delay*": Combination of {2 } and {6}.
8	Quad. comb. braking	"*Quadratic combined braking*": Combination of {5 } and {6}. **Note**: ***This function is not suitable for PMSM motors***
9	Const. Accel. Power	*"Constant acceleration power"*: Only applies in field weakening range. The drive is accelerated or braked with constant electrical power. The shape of the ramps depends on the load.
10	Distance calculator	Constant distance between actual frequency / speed and the set minimum output frequency **P104**. as for "*Const. braking distance*". However, function [10] only becomes active if the setpoint frequency undershoots the set minimum frequency. In this case, enabling must be retained.
11	Const. Accel. Power with Delay	*"Constant acceleration power with delay"*: Combination of {2 } and {9}.
12	Const. accel. power Mode 3	*"Constant acceleration power mode 3"* as for {11}, however with additional relief of the brake chopper.
13	Switch-off delay	*"Ramp with disconnection delay!"* as for {1 }*"Ramp"*, however, before the brake is applied, the drive unit remains at the absolute minimum frequency set in parameter **P505** for the time specified in parameter **P110.** Application example: Re-positioning for crane control

P109	**DC brake current**	**S**	**P**
Setting range	0 … 250 %		
Factory setting	{ 100 }		
Description	Current setting for the functions of DC current braking (**P108 = 3**) and combined braking (**P108 = 5**). The correct setting value depends on the mechanical load and the required deceleration time. A higher setting brings large loads to a standstill more quickly. The 100 % setting corresponds to a current value as stored in the "Nominal motor current" parameter **P203**.		
Note	The DC current (0 Hz) which the FI can supply is limited. For this value, please refer to the table in Section 8.2.3 "Reduced overcurrent due to output frequency ", column: 0 Hz. In the basic setting this limiting value is 110 %. ***DC Braking: Not for PMSM motors!***		

P110	**Time DC-brake on**	**S**	**P**
Setting range	0.00 … 60.00 s		
Factory setting	{ 2.00 }		
Description	The time for which the DC current selected in **P109** is applied to the motor. For this, function {3} *"Instant d.c. Braking""* must be set in **P108**. Depending on the relationship of the actual output frequency to the max. frequency **P105** , the "DC brake time" is shortened. The time starts running with the removal of the enable and can be interrupted by renewed enabling.		
Note	***DC Braking: Not for PMSM motors!***		

P111	**P - torque limit factor**	**S**	**P**
Setting range	25 … 400 %		
Factory setting	{ 100 }		
Description	"*P torque limit factor*". Directly affects the behaviour of the drive at the torque limit. The basic setting of 100 % is sufficient for most drive tasks. If the values are too high the drive tends to oscillate as it reaches the torque limit. If values are too low, the programmed torque limit can be exceeded.		

P112	Torque current limit	S	P
Setting range	25 … 400 % / 401		
Factory setting	{ 401 }		
Description	With this parameter, a limit value for the torque-generating current can be set. This can prevent mechanical overloading of the drive. However, it cannot provide protection against mechanical blockages. A slipping clutch which acts as a safety device is not replaceable. With the control method “CFC closed-loop” (Servo Mode) **P300**, setting {1}, a limit value of 0% is possible.		
Note	A torque limit is not permissible for lifting equipment applications!		
Setting values	**Value** / **Meaning** 401 / OFF / The torque current is not limited.		

P113	Jog frequency	S	P
Setting range	-400.0 … 400.0		
Factory setting	{ 0.0 }		
Description	When using the ParameterBox to control the FI, the jog frequency is the starting value after enabling. Alternatively, if control is via the control terminals, the jog frequency can be activated via one of the digital inputs. Setting of the jog frequency can be performed directly via this parameter or, if the FI is enabled via the keyboard, by pressing the OK key. In this case, the actual output frequency is applied to parameter **P113** and is then available for the next start.		
Note	Activation of the jog frequency via one of the digital inputs causes the remote control to be switched off in case of bus operation. In addition, any set point frequencies which are present are not taken into account. Exception: Analogue setpoints which are processed via the functions *“Frequency addition”* or *“Frequency subtract.”*.		

P114	Brake delay off	S	P
Setting range	0.00 … 2.50 s		
Factory setting	{ 0.00 }		
Description	Electromagnetic brakes have a delayed reaction time for their release, which depends on physical factors. This can lead to the motor running while the brake is still applied, which will cause the inverter to switch off with an overcurrent message. This release time can be taken into consideration by the parameter P114 (braking control). During the adjustable release time **P114**, the FI supplies the set absolute minimum frequency **P505** and thus prevents movement against the brake. See also parameter **P107** "Brake reaction time" (setting example).		
Note	If **P114** is set to {0}, then **P107** is the brake release and reaction time.		

5.1.3 Motor data

P200	Motor list	P
Setting range	0 / 1 / 100 ... 256	
Factory setting	{ 0 }	
Description	The factory settings for the motor data can be edited with this parameter. The factory setting for the parameters **P201 … P209**, **P240**, **P241**, **P243**, **P244** and **P246** for NORDAC *ON* is a 4-pole IE3 asynchronous standard motor, and for NORDAC *ON+* a IE3 synchronous motor which corresponds to the FI's nominal power. By selecting one of the possible setting values and pressing the OK key, all motor parameters **P201 … P209**, **P240**, **P241**, **P243**, **P244** and **P246** are matched to the selected motor power.	
Note	After confirmation of the selection, {0} is displayed again in **P200**. **P205** can be used to check if the nominal motor power has been applied.	

Setting values

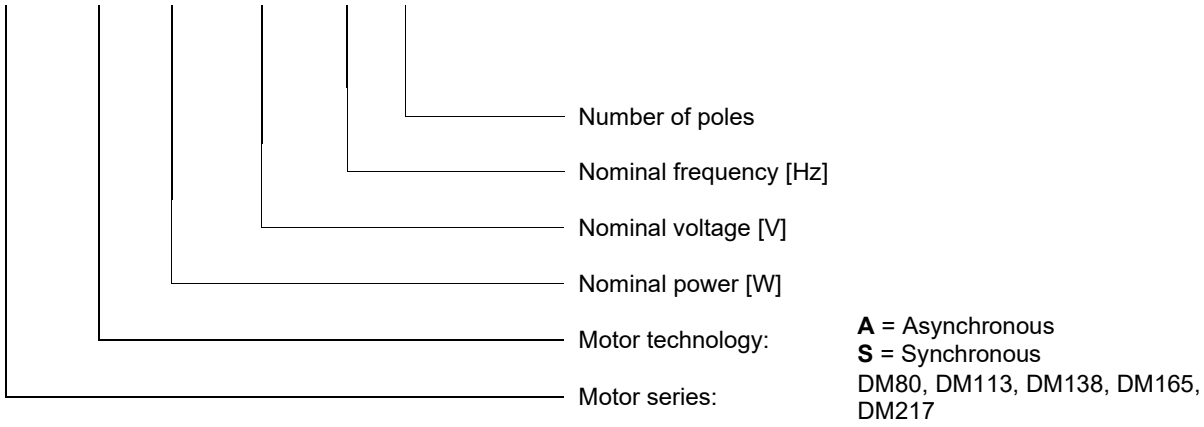
Value	Meaning
0	No change
1	No motor In this setting, the FI operates without current control, slip compensation and pre-magnetising time, and is therefore not recommended for operating a motor. The following motor data is set here: 50.0 Hz / 1500 rpm / 15.0 A / 400 V / 0.00 kW / cos φ=0.90 / Star / R_S 0.01 Ω / I_{LEER} 6.5 A

2	0.09 kW 230 V 56LP/4	11	0.24 PS 230 V 63LP/4	20	0.37 kW 400 V 71LP/4
3	0.12 PS 230 V 56LP/4	12	0.18 kW 400 V 63LP/4	21	0.50 PS 460 V 71LP/4
4	0.09 kW 400 V 56LP/4	13	0.24 PS 460 V 63LP/4	22	0.55 kW 230 V 80SP/4
5	0.12 PS 460 V 56LP/4	14	0.25 kW 230 V 71SP/4	23	0.75 PS 230 V 80SP/4
6	0.12 kW 230 V 63SP/4	15	0.33 PS 230 V 71SP/4	24	0.55 kW 400 V 80SP/4
7	0.16 PS 230 V 63SP/4	16	0.25 kW 400 V 71SP/4	25	0.75 PS 460 V 80SP/4
8	0.12 kW 400 V 63SP/4	17	0.33 PS 460 V 71SP/4	26	0.75 kW 230 V 80LP/4
9	0.16 PS 460 V 63SP/4	18	0.37 kW 230 V 71LP/4	27	1.00 PS 230 V 80LP/4
10	0.18 kW 230 V 63LP/4	19	0.50 PS 230 V 71LP/4	28	0.75 kW 400 V 80LP/4
				29	1.00 PS 460 V 80LP/4
		36	1.50 kW 400 V 90LP/4	46	4.00 kW 400 V 112MP/4
		37	2.00 PS 460 V 90LP/4	47	5.00 PS 460 V 112MP/4
		38	2.20 kW 230 V 100LP/4	48	5.5 kW 230V 132SP
		39	3.00 PS 230 V 100LP/4	49	7.5 PS 230 V 132SP
30	1.10 kW 230 V 90SP/4	40	2.20 kW 400 V 100LP/4	50	7.5 kW 230V 132MP
31	1.50 PS 230 V 90SP/4	41	3.00 PS 460 V 100LP/4	51	10.0 PS 230 V 132MP
32	1.10 kW 400 V 90SP/4	42	3.00 kW 230 V 100AP/4	52	0.75 kW 230 V 80T1/4
33	1.50 PS 460 V 90SP/4	43	3.00 kW 400 V 100AP/4	53	1.10 kW 230 V 90T1/4
34	1.50 kW 230 V 90LP/4	44	4.00 kW 230 V 112SP/4	54	1.10 kW 230 V 80T1/4
35	2.00 PS 230 V 90LP/4	45	5.00 PS 230 V 112SP/4	55	1.10 kW 400 V 80T1/4
56	1.50 kW 230 V 90T3/4	66	3.00 kW 400 V 100T2/4	76	0.35 kW 400 V 71N1/8
57	1.50 kW 230 V 90T1/4	67	3.00 kW 400 V 90T3/4	77	0.55 kW 400 V 71x2/8
58	1.50 kW 400 V 90T1/4	68	4.00 kW 230 V 100T5/4	78	0.70 kW 400 V 71x2/8
59	1.50 kW 400 V 80T1/4	69	4.00 kW 400 V 100T5/4	79	1.10 kW 400 V 90N1/8
60	2.20 kW 230 V 100T2/4	70	4.00 kW 400 V 100T2/4	80	1.50 kW 400 V 90N2/8
61	2.20 kW 230 V 90T3/4	71	5.50 kW 400 V 100T5/4	81	1.50 kW 400 V 90F2/8
62	2.20 kW 400 V 90T3/4	72	Reserved	82	2.20 kW 400 V 90N3/8
63	2.20 kW 400 V 90T1/4	73	Reserved	83	2.20 kW 400 V 90F3/8
64	3.00 kW 230 V 100T5/4	74	Reserved	84	3.00 kW 400 V 90F4/8
65	3.00 kW 230 V 100T2/4	75	Reserved	85	Reserved

86	Reserved	96	1.50 kW 230 V 90F2/8
87	Reserved	97	2.20 kW 230 V 90F3/8
88	Reserved	98	Reserved
89	Reserved	99	Reserved
90	Reserved	100	0.14 kW 400 V WIT
91	Reserved	101 … 257	tbd
92	0.35 kW 230 V 71N1/8		
93	0.55 kW 230 V 71N2/8		
94	0.70 kW 230 V 71N2/8		
95	1.10 kW 230 V 90N1/8		

Nomenclature Interroll drum motors

DM113 – A – 550 – 460 – 60 – 2



P201	Nominal frequency	S	P
Setting range	10.0 … 399.9 Hz		
Factory setting	The default setting depends on the nominal power of the FI.		
Description	The nominal motor frequency determines the V/f break point at which the FI supplies the nominal voltage (**P204**) at the output.		

P202	Nominal speed	S	P
Setting range	100 ... 24000 rpm		
Factory setting	The default setting depends on the nominal power of the FI.		
Description	The nominal motor speed is important for correct calculation and control of the motor slip and the speed display (**P001 = 1**).		

P203	Nominal current	S	P
Setting range	0.1 … 1000.0 A		
Factory setting	The default setting depends on the nominal power of the FI.		
Description	The nominal motor current is a decisive parameter for current vector control.		

P204	Nominal voltage	S	P
Setting range	100 … 800 V		
Factory setting	The default setting depends on the nominal power of the FI.		
Description	This parameter sets the nominal voltage. In combination with the nominal frequency, the voltage/frequency characteristic curve is produced.		

P205	Nominal power		P
Setting range	0.00 … 250.00 kW		
Factory setting	The default setting depends on the nominal power of the FI.		
Description	Displays the nominal motor power		

P206	Cos phi	S	P
Setting range	0.50 … 0.98		
Factory setting	The default setting depends on the nominal power of the FI.		
Description	The motor cos φ is a decisive parameter for current vector control.		

P207	Motor circuit	S	P
Setting range	0... 1		
Factory setting	The default setting depends on the nominal power of the FI.		
Description	The motor circuit is decisive for stator resistance measurement (**P220**) and therefore for current vector control.		
Setting values	**Value** / **Meaning**		
	0 — Star		
	1 — Delta		

P208	Stator resistance	S	P
Setting range	0.00 … 300.00 Ω		
Factory setting	The default setting depends on the nominal power of the FI.		
Description	Motor stator resistance → Resistance of a phase winding with a three-phase motor. The stator resistance has a direct influence on the current control of the FI. A value which is too high may result in overcurrent; a value which is too low may result in low motor torque. The result of the stator resistance measurement (see **P220**) is shown in **P208**. However, this value can also be overwritten there.		
Note	For optimum functioning of the current vector control, the stator resistance must be measured automatically by the FI.		

P209	No-load current	S	P
Setting range	0.0 … 1000.0 A		
Factory setting	The default setting depends on the nominal power of the FI.		
Description	This value is always calculated automatically from the motor data if there is a change in the parameter **P206** "Cos φ" and **P203** "Nominal current".		
Note	If the value is to be entered directly, then it must be set as the last value of the motor data. This is the only way to ensure that the value will not be overwritten.		

P210	Static boost		S	P
Setting range	0 ... 400 %			
Factory setting	{ 100 }			
Description	ASM	The static boost affects the current which generates the magnetic field. This corresponds to the no-load current of the respective motor and therefore does not depend on the load. The no-load current is calculated using the motor data. The factory setting is sufficient for typical applications.		
	PMSM	For permanent magnet synchronous motors (PMSM) the level of the current which is used for identification can be modified as a percentage. The duration of the dwell process can be set via **P558**.		

P211	Dynamic boost	S	P
Setting range	0 ... 150 %		
Factory setting	{ 100 }		
Description	Dynamic boost affects the torque-generating current and is therefore a load-dependent parameter. Here too, the factory setting is sufficient for typical applications. A value which is too high can result in overcurrent in the FI. Under load, the output current is increased too much. A value which is too low will result in insufficient torque.		
Note	In particular, applications with large inertial masses (e.g. fan operation) may require control according to a V/f characteristic curve. For this, parameters **P211** and **P212** must each be set to 0%.		

P212	Slip compensation	S	P
Setting range	0 ... 150 %		
Factory setting	{ 100 }		
Description	Slip compensation increases the output frequency depending on the load, in order to keep the three-phase asynchronous motor speed approximately constant. The factory setting of 100% is optimal for three-phase asynchronous motors if the correct motor data has been set. If several motors (different loads or outputs) are operated with a single FI, the slip compensation **P212 = 0%** must be set. This also applies to synchronous motors which do not have slip due to their design.		
Note	In particular, applications with large inertial masses (e.g. fan operation) may require control according to a V/f characteristic curve. For this, parameters **P211** and **P212** must each be set to 0%.		

P213	Amplification ISD control	S	P
Setting range	25 ... 400 %		
Factory setting	{ 100 }		
Description	"*ISD control amplification*". This parameter influences the control dynamics of the FI current vector control (ISD control). Higher settings make the controller faster, lower settings slower. Dependent on the type of application this parameter can be adjusted, e.g. to avoid unstable operation.		

P214	Torque precontrol	S	P
Setting range	-200 ... 200 %		
Factory setting	{ 0 }		
Description	This function allows a value for the expected torque requirement to be set in the current controller. This function can be used in lifting applications for better load take-up during starting.		
Note	Motor torques with "right" rotation field are entered with a positive sign, generator torques are entered with a negative sign. The reverse applies for the "left" rotation field.		

P215	Boost precontrol	S	P
Setting range	0 ... 200 %		
Factory setting	{ 0 }		
Description	Only advisable with linear characteristic curve (**P211 = 0 %** and **P212 = 0 %**). For drives which require a high starting torque, this parameter provides an option for switching in an additional current during the start phase. The application time is limited and can be selected in parameter "Boost precontrol**P216**. All current and torque current limits that may have been set **P112**, **P536**, **P537** are deactivated during the boost precontrol.		
Note	With active ISD control (**P211** and / or **P212 ≠ 0 %**), parameterisation of **P215 ≠ 0** results in incorrect control.		

P216	Time boost prectrl.	S	P
Setting range	0.0 ... 10.0 s		
Factory setting	{ 0.0 }		
Description	This parameter is used for 2 functionalities: 1. Time limit for the boost precontrol: Application time for the increased starting current. Only with linear characteristic curve (**P211 = 0%** and **P212 = 0%**). 2. Time limit for suppression of pulse disconnection **P537**: enables start-up under heavy load.		

P217	Oscillation damping	S	
Setting range	0... 400 %		
Factory setting	{ 10 }		
Description	Parameter is a measure of the damping power. Oscillations caused by resonance under no-load conditions can be suppressed with oscillation damping. For oscillation damping the oscillation component is filtered out of the torque current by means of a high pass filter. This is amplified by **P217**, inverted and switched to the output frequency. The limit for the value switched is also proportional to **P217**. The time constant for the high pass filter depends on **P213**. For higher values of **P213** the time constant is lower. With a set value of 10% for **P217**, a maximum of ± 0.045 Hz are switched in. At 400% in **P217**, this corresponds to ± 1.8 Hz		

P218	Modulation depth	S
Setting range	50 ... 110 %	
Factory setting	{ 100 }	
Description	This setting influences the maximum possible output voltage of the FI in relation to the mains voltage. Values <100% reduce the voltage to values which are less than the mains voltage. Values >100 % increase the output voltage to the motor. resulting in increased harmonics in the current, which may cause "hunting", i.e. fluctuating speed in some motors. The parameter should normally be set to 100%.	

P219	Auto. flux adjustment	S
Setting range	25 ... 100 % / 101	
Factory setting	{ 100 }	
Description	"*Automatic magn. adjustment*". With this parameter, the magnetic flux of the motor can be automatically matched to the motor load, so that the energy consumption is reduced to the amount which is actually required. **P219** is the limiting value, to which the field in the motor can be reduced. Reduction of the field is performed with a time constant of 7.5 s. If the load increases, the field is increased with a time constant of approx. 300 ms. The field is reduced so that the magnetisation current and the torque current are approximately equal, i.e. the motor is operated with “optimum efficiency”. This function is suitable for applications with relatively constant torque (e.g. pump and fan applications). Its effect therefore replaces a quadratic curve, as it adapts the voltage to the load.	
Note	For applications with rapid torque fluctuations (e.g. lifting equipment) this parameter should be left at the factory setting (100%). Otherwise, rapid load changes could cause shut-down due to overcurrent or "breakdown".	
	This parameter does not function with synchronous motors (IE4 motors).	

Setting values

Value		Meaning
100	Function disabled	
101	Automatic	Activation of automatic excitation current control. The ISD controller then operates with a subordinate flux controller, which improves the slippage calculation, especially at higher loads. The control times are considerably faster than with normal ISD control **P219 = 100**.

P220	Par.-identification			P
Setting range	0 ... 2			
Factory setting	{ 0 }			
Description	*"Parameter identification"*. For devices with an output up to 7,5 kW, the motor data is determined automatically by the device via this parameter. Do not switch off the mains voltage during the parameter's identification. Better drive behaviour is often achieved with measured motor data. If there is unfavourable operating behaviour after identification, set the parameters **P201... P208** manually.			
Note	• Before starting parameter identification, check the following motor data according to the name plate: – Nominal frequency **P201** – Nominal speed **P202** – Voltage **P204** – Power **P205** – Star Delta con. **P207** • Parameter identification should only be carried out when the motor is cold (15 … 25 °C). Warming of the motor during operation is taken into account. • The FI must be in "Ready for operation" condition For bus operation, the bus must be operating without error. • The motor power may only be one power level greater or three power levels lower than the nominal power of the FI. • A maximum motor cable length of 20 m must be complied with for reliable identification. • Take care that the connection to the motor is not interrupted during the measuring process. • If the identification cannot be completed successfully, error message **E019** is generated. • After parameter identification, **P220** is **= 0** again. • When using synchronous motors, the parameters P241, P243, P244 and P246 must be set up additionally.			
Setting values	**Value**	**Meaning**		
	0	No identification		
	1	R_S identification	The stator resistance (display in **P208**) is determined by multiple measurements.	
	2	Motor identification	This function can only be used with devices up to 7,5 kW. **ASM**: All motor parameters (**P202**, **P203**, **P206**, **P208**, **P209**) are determined. **PMSM**: The stator resistance **P208** and the inductance **P241** are determined	

P240	EMF voltage PMSM	S	P
Setting range	0 … 800 V		
Factory setting	Depending on the FI's nominal power		
Scope of application	NORDAC *ON+*		
Description	The EMF voltage PMSM describes the mutual induction voltage of the motor. The value to be set can be found on the data sheet for the motor or on the name plate and is scaled to 1000 rpm. As the rated speed of the motor is not usually 1000 rpm, these details must be converted accordingly: ***Example:*** E (EMF - constant, name plate): 89 V Nn (Nominal speed): 2100 rpm Value in P240: P240 = E * Nn/1000 P240 = 89 V * 2100 rpm/ 1000 rpm P240 = 187 V		
Setting values	**Value** / **Meaning** 0 – ASM is used – *"Asynchronous motor used"* No compensation		

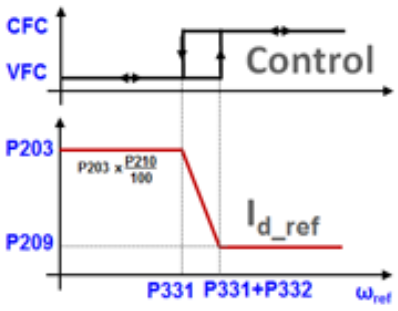
P241	PMSM inductance		S	P
Setting range	0.1 … 200.0 mH			
Arrays	[-01] = Ld	[-02] = Lq		
	[-03] = Unsaturated Ld	[-04] = Unsaturated Lq		
	[-05] = Saturated Ld	[-06] = Saturated Lq		
Factory setting	Depending on the FI's nominal power			
Scope of application	NORDAC *ON+*			
Description	The stator inductance of the d or q component of a permanently excited synchronous motor (PMSM). The stator inductances can be measured by the frequency inverter (**P220**).			

P243	Reluct. angle IPMSM	S	P
Setting range	0 … 30°		
Factory setting	Depending on the FI's nominal power		
Scope of application	NORDAC *ON+*		
Description	*"Reluct. angle IPMSM"* In addition to the synchronous torque, synchronous machines with embedded magnets (IPMSM) also have a reluctance torque. This is due to the anisotropy (imbalance) between the inductance in the d and the q direction. Due to the superimposition of these two torque components, the optimum efficiency is not at a load angle of 90° as with SPMSMs, but rather with larger values. This additional angle, which can be assumed to be 10° for NORD motors, can be taken into account with this parameter. The smaller the angle, the smaller the reluctance component. The specific reluctance angle for the motor can be determined as follows: • Allows drives with constant load (> 0.5 M_N) to run in CFC mode (**P300 ≥ 1**) • Gradually increase the reluctance angle **P243** until the current **P719** reaches a minimum		

P244	Peak current PMSM		S	P
Setting range	0.1 … 1000.0 A			
Arrays	[-01] = Peak current PMSM	[-02] = Imax unsaturated Ld		
	[-03] = Imax unsaturated Lq	[-04] = Imin saturated Ld		
	[-05] = Imin saturated Lq			
Factory setting	Depending on the FI's nominal power			
Scope of application	NORDAC *ON+*			
Description	For PMSMs with non-linear induction characteristic curves, the linearity limits can be entered with parameter **P244 [-02] – [-05]**. For NORD PMSMs (IE4 and IE5⁺ motors) the necessary data are saved if the motor is selected in **P200**.			

P245	Power system stabilisation PMSM VFC	S	P
Setting range	5 … 250 %		
Factory setting	{ 25 }		
Description	"*Oscillation damping PMSM VFC*". In VFC open-loop mode, PMSM motors tend to oscillate due to insufficient intrinsic damping. With the aid of oscillation damping this tendency to oscillate is counteracted by electrical damping.		

P246	Mass Inertia	S	P
Setting range	0 ... 500 000.0 kg*cm²		
Factory setting	{ 31 000 }		
Description	The mass inertia of the drive system can be entered in this parameter. For most applications the default setting is sufficient. However, for highly dynamic systems the actual value should ideally be entered. The values for the motors can be obtained from the technical data. The portion of the external centrifugal mass (gear unit, machine) must be calculated or determined experimentally.		
Note	Parameter applies for ASM and PMSM.		

P247	Switch freq VFC PMSM	S	P
Setting range	1 ... 100 %		
Factory setting	{ 25 }		
Scope of application	NORDAC *ON+*		
Description	"*Switchover frequency VFC PMSM*". In order to provide a minimum amount of torque immediately in case of spontaneous load changes, in VFC mode the setpoint of I_d (magnetisation current) is controlled depending on the frequency (field increase mode)		
	The value of this additional field current is determined by parameter (**P210**). This reduces linearly to the value "zero", which is reached at the frequency which is governed by **P247**. In this case, 100 % corresponds to the nominal frequency from **P201**. 		

P280	Current mech. Brake	S
Setting range	0.02 … 0.4 A	
Arrays	[-01] = Initial start current	[-02] = Holding current
Factory setting	[-01] = { 0.18 }	[-02] = { 0.08 }
Description	When the brake is released, it is first activated with [-01] = "Initial start current". After that, the current drops to [-02] = "Holding current". This results in a shorter release time.	

P281	Voltage mechan.brake	S
Setting range	100 … 300 V	
Factory setting	{ 180 }	
Description	The parameter describes the nominal voltage of the brake coil.	

P282	Mode mechan.brake	S
Setting range	000 … 111 (bin)	
Factory setting	{ 000 }	
Description	This parameter determines the operating mode of the spring-loaded brake.	
Setting values	Bit	Meaning

0	Monitoring Coil	Coil resistance monitoring is active If the set current and voltage values **P280** and **P281** do not correspond to the measured data, the error message **E16.5** occurs.
1	Monitor react. time	Reaction time monitoring is active If no brake release is detected within the time set in **P114**, the error message **E16.6** occurs.
2	Auto release time	Automatic determination of release time active

5.1.4 Speed control

P300	Control method			P
Setting range	0 … 2			
Factory setting	{ 0 }			
Description	The control method for the motor is defined with this parameter. The following constraints must be observed: In comparison with setting {0}, setting {2} enables higher dynamics and control precision, however, it requires greater effort for parameterisation. Setting {1} operates with speed feedback from an encoder and therefore enables the highest possible quality of speed control and dynamics.			
Note	Commissioning information: (🕮 0 "Selecting the operating mode for motor control").			
Setting values	**Value**	**Meaning**		
	0	VFC open-loop	Speed control without encoder feedback	
	1	CFC closed-loop	Speed control with encoder feedback	
	2	CFC open-loop	Speed control without encoder feedback	

P301	Incremental encoder		
Setting range	0 … 27		
Arrays	[-01] = TTL	[-02] = HTL	[-03] = Sin/Cos
Factory setting	{ 6 }	{ 3 }	{ 3 }
Description	"*Encoder resolution*". Input of the pulse count per rotation of the connected encoder. If the direction of rotation of the encoder is not the same as the FI, (depending on installation and wiring), this can be taken into account by selecting the corresponding negative pulse numbers.		
Note	**P301** is also significant for position control via incremental encoders. If an incremental encoder is used for positioning **P604 = 1**, the setting of the pulse number is made here (see supplementary POSICON manual).		

Setting values	**Value**		**Value**	
	0	500 pulses	8	-500 pulses
	1	512 pulses	9	-512 pulses
	2	1000 pulses	10	-1000 pulses
	3	1024 pulses	11	-1024 pulses
	4	2000 pulses	12	-2000 pulses
	5	2048 pulses	13	-2048 pulses
	6	4096 pulses	14	-4096 pulses
	7	5000 pulses	15	-5000 pulses
			16	-8192 pulses
	17	8192 pulses		
	18	16 pulses	23	-16 pulses
	19	32 pulses	24	-32 pulses
	20	64 pulses	25	-64 pulses
	21	128 pulses	26	-128 pulses
	22	256 pulses	27	-256 pulses

P302	Type Univers. encoder			
Setting range	0 … 5			
Factory setting	{ 1 }			
Description	Via this parameter, the encoder type is selected.			
Note				
Setting values	Value	Value		
	0	UART		
	1	TTL		
	2	BiSS		
	3	SSI		
	4	BiSS inverted		
	5	SSI inverted		

P310	Speed controller P			P
Setting range	0 … 3200 %			
Factory setting	{ 100 }			
Description	P-component of the encoder (proportional amplification). Amplification factor, by which the speed difference between the setpoint and actual frequency is multiplied. A value of 100 % means that a speed difference of 10 % produces a setpoint of 10 %. Values that are too high can cause the output speed to oscillate.			

P311	Speed controller I			P
Setting range	0 … 800 % / ms			
Factory setting	{ 20 }			
Description	I-component of the encoder (Integration component). The integration component of the controller enables complete elimination of any control deviation. The value indicates how large the setpoint change is per ms. Values that are too small cause the controller to slow down (reset time is too long).			

P312	Torque curr. ctrl. P		S	P
Setting range	0 … 1000 %			
Factory setting	{ 400 }			
Description	Current controller for the torque current. The higher the current controller parameters are set, the more precisely the current setpoint is maintained. At low frequencies, excessively high values of **P312** generally result in high frequency oscillations. On the other hand, excessively high values of **P313** usually cause low frequency oscillations over the entire speed range If the value "Zero" is set in **P312** and **P313**, the torque current control is switched off. In this case, only the lead time for the motor model is used.			

P313	Torque curr. ctrl. I		S	P
Setting range	0 … 800 % / ms			
Factory setting	{ 50 }			
Description	I component of the torque current controller (see **P312** "Torque curr. ctrl. P").			

P314	Torq curr ctrl limit	S	P
Setting range	0 … 400 V		
Factory setting	{ 400 }		
Description	"*Torque curr. Ctrl. limit*". Determines the maximum voltage increase of the torque current controller. The higher the value, the greater the maximum effect that can be exercised by the torque current controller. Excessive values in **P314** can specifically lead to instability during transition to the field weakening range (see **P320**). The values for **P314** and **P317** should always be set approximately the same, so that the field and torque current controllers are balanced.		

P315	Field curr. ctrl. P	S	P
Setting range	0 … 1000 %		
Factory setting	{ 400 }		
Description	Current controller for the field current. The higher the current controller parameters are set, the more precisely the current setpoint is maintained. At low frequencies, excessively high values of **P315** generally result in high frequency oscillations. On the other hand, excessively high values of **P316** usually cause low frequency oscillations over the entire speed range The field current controller is switched off if the value "Zero" is entered in **P315** and **P316**. In this case, only the lead time for the motor model is used.		

P316	Field curr. ctrl. I	S	P
Setting range	0 … 800 % / ms		
Factory setting	{ 50 }		
Description	I component of the field current controller (see **P315** "Field current controller P").		

P317	Field curr ctrl lim	S	P
Setting range	0 … 400 V		
Factory setting	{ 400 }		
Description	"*Field curr. ctrl. limit*". Determines the maximum voltage increase of the field current controller. The higher the value, the greater the maximum effect of the field current controller. Excessive values in **P317** can specifically lead to instability during transition to the field weakening range (see **P320**). The values for **P314** and **P317** should always be set approximately the same, so that the field and torque current controllers are balanced.		

P318	P weak	S	P
Setting range	0 … 800 %		
Factory setting	{ 150 }		
Description	The field weakening controller reduces the field setpoint if the synchronous speed is exceeded. In the basic speed range, the field weakening controller has no function; for this reason, the field weakening controller only needs to be set if speeds above the nominal motor speed are set. Excessive values for **P318** / **P319** cause controller oscillations. The field is not weakened sufficiently if the values are too small, or during dynamic acceleration and/or delay times. The downstream current controller can no longer read the current setpoint.		

P319	I weak	S	P
Setting range	0 … 800 % / ms		
Factory setting	{ 20 }		
Description	Only affects the field weakening range, see **P318** "P weak"		

P320	Weak border	S	P
Setting range	0 … 110 %		
Factory setting	{ 100 }		
Description	The field weakening limit determines the speed /current at which the controller begins to weaken the field. At a set value of 100 % the controller begins to weaken the field at approximately the synchronous speed. If values much larger than the standard values have been set in **P314** and/or **P317**, the field weakening limit should be correspondingly reduced, so that the control range is actually available to the current controller.		

P321	Speed ctr. I brake off	S	P
Setting range	0 … 4		
Factory setting	{ 0 }		
Description	"*Speed control I brake off*". During the brake release time **P107** / **P114**, the I-component of the speed controller is increased. This leads to better load take-up, especially with vertical movements.		
Setting values	**Value**	**Value**	

0	P311 speed control I x 1		
1	P311 speed control I x 2	3	P311 speed control I x 8
2	P311 speed control I x 4	4	P311 speed control I x 16

P325	Function encoder	S	P
Setting range	0 … 5		
Arrays	[-01] = Universal	[-02] = HTL	
Factory setting (SK 31xP)	{ 1 }	{ 0 }	
Description	The speed list value supplied by an incremental encoder to the FI can be used for various functions in the FI.		
Setting values	**Value**	**Meaning**	

0	Off	
1	CFC closed-loop	"*Servo mode speed measurement*": The motor speed list value is used for speed control with encoder feedback. The ISD control cannot be switched off in this function.
2	Actual PID frequency	The speed list value of a system is used for speed control. This function can also be used for controlling a motor with a linear characteristic curve. It is also possible to use an incremental encoder which is not mounted directly onto the motor for speed control. **P413** … **P416** govern the control.
3	Frequency addition	The determined speed is added to the actual setpoint value.
4	Freq. subtraction	The determined speed is subtracted from the actual setpoint.
5	Maximum frequency	The maximum possible output frequency / speed is limited by the speed of the encoder.

Enter a formula here.

P326	Ratio encoder	S	
Setting range	0.01 … 100.00		
Arrays	[-01] = Universal	[-02] = HTL	
Factory setting	{ 1.00 }		
Description	"*Encoder speed ratio*". If the incremental encoder is not mounted directly onto the motor shaft, then the respectively correct ratio of motor speed to encoder speed must be set. $$P326 = \frac{\text{Motor speed}}{\text{Encoder speed}}$$		
Note	Not for P325, setting “CFC closed-loop” (servo mode speed measurement).		

P327	Speed slip error	P
Setting range	0 … 3000 rpm	
Arrays	[-01] = permissible deviation during operation (FI enabled)	[-02] = permissible values at a standstill in order to monitor the function / wear of a holding brake (FI ready for switch-on).
Factory setting	{ 0 }	
Description	"*Slip error speed control*". The limit value for a permitted maximum slip error can be set. If this limit value is reached, the FI switches off and displays error **E013.1** if the permissible deviation has been exceeded during operation. Error **E013.4** is displayed if the permissible deviation has been exceeded during standstill. Slip error monitoring functions with all control methods (**P300**).	

Relevant settings

Encoder type	Electrical connection	Parameter
TTL encoder	Encoder Interface (Terminal X13)	P325 = 0
HTL encoder	DIN3 (Terminal X11:23) …	P420 [-02] = 43
	DIN4 (Terminal X11:24) …	P420 [-04] = 44

Setting values	0 = OFF

P328	Speed slip delay	P
Setting range	0.0 ... 10.0 s	
Arrays	[-01] = permissible deviation during operation (FI enabled)	[-02] = permissible values at standstill (FI ready for switch-on)
Factory setting	{ 0.0 }	
Description	"*Speed slip delay*". If the permissible slip error defined in **P327** is exceeded, the error message **E013.1** is suppressed within the time limits which are set here if the permissible deviation has been exceeded during operation. Error **E013.4** is triggered if the permissible deviation has been exceeded during standstill.	
Setting values	0 = Off	

P330	Ident startrotor pos	S
Setting range	0 … 2	
Factory setting	{ 1 }	
Description	"*Ident startrotor pos*". Selection of the method for determination of the starting position of the rotor (initial value of the rotor position) of a PMSM (Permanent Magnet Synchronous Motor). The parameter is only relevant for the control method "CFC closed-loop" (**P300**, setting {1}).	

Setting values	**Value**	**Meaning**
	0	**Voltage controlled**: With the first start of the motor, a voltage indicator is memorised to ensure that the rotor of the motor is set to the rotor position "zero". This type of identifying starting position of the rotor can only be used if there is no counter-torque from the motor (e.g. flywheel drive) at frequency "zero". If this condition is fulfilled, this method of identifying the position of the rotor is very accurate (<1° electrical). This method is unsuitable for lifting equipment applications, as there is always a counter-torque. For operation without encoders: Up to the switch-over frequency **P331** the motor (with the nominal current memorised) is operated under voltage control. Once the switch-over frequency has been reached, the method for identifying the rotor position is switched over to the EMF method. If hysteresis (**P332**) is taken into into account, the frequency falls below the value in **P331**, the frequency inverter switches back from the EMF method to voltage controlled operation.
	1	**Test signal method**: The starting position of the rotor is determined with a test signal. If this method is also to be used at a standstill with the brake applied, a PMSM with sufficient anisotropy between the inductance of the d and q axes is required. The greater this anisotropy is, the greater the precision of the method. With parameter **P212** the voltage level of the test signal can be changed and the rotor position controller can be adjusted with parameter **P333**. For motors which are suitable for use with the test signal method, a rotor position accuracy of 5°…10° electrical can be achieved (depending on the motor and the anisotropy). The conditions for activating the test signal method can be selected with **P336**.

2	**Value from universal encoder,** *"Value from universal encoder"*: With this method, the starting position of the rotor is determined from the absolute position of a universal encoder (Hiperface, EnDat with Sin/Cos track, BISS with Sin/Cos track or SSI with Sin/Cos track). The universal encoder type is set in parameter **P604**. For this position information to be unique, it must be known (or determined) how this rotor position relates to the absolute position of the universal encoder. This is performed with the offset parameter **P334**. Motors should either be delivered with a rotor start position "zero" or the rotor starting position must be marked on the motor. If this value is not available, the offset value can also be determined with the settings {0} and {1} of parameter **P330**. For this, the drive unit is started with the setting {0} or {1} After the first start, the determined offset value is stated in the parameter **P334**. This value is volatile, i.e. it is only stored in the RAM. In order to save it in the EEEPROM, it must be briefly changed and then set back to the determined value. After this, fine tuning can be carried out with the motor running under no load. For this, the drive is operated in closed loop mode (**P300=1**) at as high a speed as possible below the field weakening point. From the starting point, the offset is gradually adjusted so that the value of the voltage component U_d (**P723**) is as close as possible to zero. A balance between the positive and negative direction of rotation should be sought. In general, the value "0" cannot be achieved, as the synchronous motor has a slight load due to the fan wheel at high speeds. The universal encoder should be located on the motor shaft. **Note:** If the UART encoder is used for speed control, rotor position coupling via the setting {2} is not possible. Fault **E19.1** is triggered.

P331	**Switch over freq.**	**S**	**P**
Setting range	5.0 ... 100.0 %		
Factory setting	{ 15.0 }		
Description	"*Switch over freq.*". Definition of the frequency above which, in operation without encoder, the control method is activated according to **P300** . In this case, 100 % corresponds to the nominal motor frequency from **P201**.		
Note	The parameter is only relevant for the control method "CFC open-loop" (**P300**, setting {2}).		

P332	**Hyst. Switchover Freq**	**S**	**P**
Setting range	0.1 ... 25.0 %		
Factory setting	{ 5.0 }		
Description	"*Hyst Switchover Freq*". Difference between the switch-on and switch-off point in order to prevent oscillation on transition of operation without encoder to the control method specified in **P330** (and vice versa).		

P333	**Flux feedb.fact.PMSM**	**S**	**P**
Setting range	5 ... 400 %		
Factory setting	{ 25 }		
Description	" *Flux feedback CFC open-loop*". This parameter is necessary for the position monitor in CFC open-loop mode. The higher the value which is selected, the lower the slip error from the rotor position monitor. However, higher values also limit the lower limit frequency of the position monitor. The larger the feedback amplification which is selected, the higher the limit frequency and the higher the values which must be set in P331 and P332. This conflict of objectives can therefore not be resolved simultaneously for both optimisation objectives.		
Note	The default value is selected so that it typically does not need to be adjusted for NORD IE5+ motors.		

P334	**Encoder offset PMSM**	**S**	
Setting range	-0,500 ... 0.500 rev		
Factory setting	{ 0,000 }		
Description	Evaluation of the zero track is necessary for closed loop operation of PMSM (Permanent Magnet Synchronous Motors) with incremental encoders. The zero pulse is then used for synchronisation of the rotor position. The value to be set for parameter **P334** (offset between zero pulse and actual rotor position "Zero") must be determined experimentally or included with the motor.		
Note	NORD motors are delivered so that the zero pulse of the encoder corresponds to the zero pole position of the motor. In case of deviation, this can be obtained from an adhesive label on the motor.		

P336	Mode Rotorpos ident	S
Setting range	0 ... 3	
Factory setting	{ 0 }	
Description	*"Mode Rotorpos ident"* The precise position of the rotor must be known in order to operate a PMSM. This can be determined by various methods.	
Note	Use of the parameter is only advisable if the test signal method is set (**P330**).	

Setting values

Value		Meaning
0	First enable	Identification of the PMSM rotor position is performed when the drive is enabled for the first time.
1	Supply voltage	Identification of the PMSM rotor position is performed when the supply voltage is applied for the first time.
2	Digital input/Bus input Bit	Identification of the PMSM rotor position is triggered with an external order by means of a binary bit (digital input **P420** or Bus-in bit **P480**, setting {79}, "rotor position identification"). Identification of the rotor position is only performed if the FI is in the “ready for switch-on” state and the rotor position is not known (see **P434**, **P481** setting {28}).
3	Each enable	Identification of the PMSM rotor position is performed on each enable.

P350	PLC functionality
Setting range	0 … 1
Factory setting	{ 0 }
Description	Activation of the integrated PLC

Setting values

Value		Meaning
0	Off	The PLC is not active, control of the FI is via IOs.
1	On	The PLC is active, control of the FI is via the PLC depending on **P351**

P351	PLC set val. select.
Setting range	0 … 3
Factory setting	{ 0 }
Description	Selection of the source for the control word (CTW) and the main setpoint (MSW) with active PLC functionality **P350 = {1}**). With the settings **P351 ={0}** and **{1}** the main setpoints are defined via **P553**, but the definition of the auxiliary setpoints remains unchanged via **P546**. This parameter is only adopted if the frequency inverter is in "Ready for switch-on" status.

Setting values

Value		Meaning
0	STW & HSW = PLC	The PLC provides the control word (CTW) and the main setpoint (MSW) Parameters **P509** and **P510 [-01]** have no function.
1	CTW = P509	The PLC provides the main setpoint (MSW) The control word source (CTW) corresponds to the setting in parameter **P509**.
2	MSW = P510[1]	The PLC provides the control word (CTW) The source for the main setpoint (MSV) corresponds to the setting in parameter **P510[-01]**.
3	CTW & MSW = P509/510	The source for the control word (CTW) and the main setpoint (MSW) corresponds to the setting in parameter **P509 / P510 [-01]**.

P355	PLC integer setpoint
Setting range	-32768 … 32767
Arrays	[-01] … [-10]
Factory setting	All Arrays: { 0 }
Description	Data can be exchanged with the PLC via this INT array. This data can be used by the appropriate process variables in the PLC.

P356	PLC long setpoint
Setting range	-2 147 483 648 … 2 147 483 647
Arrays	[-01] … [-05]
Factory setting	All Arrays: { 0 }
Description	Data can be exchanged with the PLC via this DINT array. This data can be used by the appropriate process variables in the PLC.

P360	PLC display value
Display range	- 2 147 483.648 … 2 147 483.647
Arrays	[-01] … [-05]
Description	Display of PLC data. By means of the relevant process variables, the parameter arrays can be written by the PLC. The values are not saved!

P370	PLC status	
Display range	0000 … FFFF (hex)	0000 0000 … 1111 1111 (bin)
Description	Display of the actual PLC status.	

Display values

Value (Bit)		Meaning
0	P350=1	**P350** has been set to the function “Activate internal PLC”.
1	PLC active	The internal PLC is active
2	Stop active	The PLC program is set to “Stop”
3	Debug active	Debugging of the PLC program is running.
4	PLC error	The PLC has an error. However, PLC user errors 23.xx are not displayed here.
5	PLC stopped	The PLC program has been stopped (single step or breakpoint)
6	Scope Memory in use	A function block uses the memory area for the oscilloscope function of the NORDCON software. The oscilloscope function cannot be used.

5.1.5 Control terminals

P410	Min. freq. a-in 1/2			P
Setting range	-400.0 ... 400.0 Hz			
Factory setting	{ 0.0 }			
Description	"*Minimum frequency auxiliary setpoints*". The minimum frequency that can act on the setpoint via the auxiliary setpoints. Auxiliary setpoints are all frequencies that are additionally delivered for further functions in the FI: • Actual frequency PID • Frequency addition • Frequency subtraction • Auxiliary setpoints via BUS • Process controller			

P411	Max. freq. a-in 1/2			P
Setting range	-400.0 ... 400.0 Hz			
Factory setting	{ 50.0 }			
Description	"*Maximum frequency auxiliary setpoints*". The maximum frequency that can act on the setpoint via the auxiliary setpoints. Auxiliary setpoints are all frequencies that are additionally delivered for further functions in the FI: • Actual frequency PID • Frequency addition • Frequency subtraction • Auxiliary setpoints via BUS • Process controller			

P412	Nom.val process ctrl		S	P
Setting range	-100 ... 100 %			
Factory setting	{ 5 }			
Description	"*Process controller setpoint*". Fixed specification of a setpoint for the process controller that will only be occasionally altered.			

P413	PID control P comp.		S	P
Setting range	0.0 ... 400.0 %			
Factory setting	{ 10.0 }			
Description	This parameter is only effective if the function *„"PID actual frequency"* is selected. The P-component of the PID controller determines the frequency jump if there is a control deviation based on the control difference. E.g.: At a setting of **P413 = 10 %** and a controller deviation of 50 %, 5 % is added to the actual setpoint.			

P414	PID control I comp.		S	P
Setting range	0.0 ... 3000.0 % / s			
Factory setting	{ 10.0 }			
Description	This parameter is only effective when the function *"PID actual frequency"* is selected. The I-component of the PID controller determines the frequency change depending on time.			

P415	PID control D comp.		S	P
Setting range	0 ... 400.0 % / ms			
Factory setting	{ 1.0 }			
Description	This parameter is only effective when the function *"PID current freq."* is selected. The D-component of the PID controller determines the frequency change depending on time.			

P416	Ramptime PI setpoint	S	P
Setting range	0.00 ... 99.99 sec		
Factory setting	{ 2.00 }		
Description	"*Ramptime PI setpoint*". This parameter is only effective when the function *"PID actual frequency"* is selected. Ramp for PI setpoint		

P420	Digital inputs	
Setting range	0 … 84	
Arrays	[-01] = Digital input 1	Digital input 1 (DIN1) integrated into the FI
	[-02] = Digital input 2	Digital input 2 (DIN2) integrated into the FI
	[-03] = Digital input 3	Digital input 3 (DIN3) integrated into the FI
	[-04] = Digital input 4	Digital input 4 (DIN4) integrated into the FI
	[-05] = Reserved	
	[-06] = Reserved	
	[-07] = Reserved	
	[-08] = Reserved	
Factory setting	{ 0 }	
Description	"*Digital input functions*". Up to 4 inputs which can be freely programmed with digital functions are available.	

Setting values

Value		Description	Signal
00	No function	Input switched off.	---
01	Enable right	The FI delivers an output signal with the rotation field "Right" if a positive setpoint is present. 0 → 1 Flank (P428 = 0)	High
02	Enable left	The FI delivers an output signal with the rotation field "Left" if a positive setpoint is present. 0 → 1 Flank (P428 = 0)	High
If the drive is to start up automatically when the mains is switched on (**P428 = 1**), a permanent High level for enabling must be provided (bridge between DIN 1 and the control voltage output). If the functions "Enable right" and "Enable left" are actuated simultaneously, the device is blocked. If the device is in fault status but the cause of the fault no longer exists, the error message is acknowledged with a 1 → 0 flank.			
03	Phase seq. reversal	Causes the rotation field to change direction (combined with enable "Right" or "Left").	High
04	Fixed frequency 1 [1)]	The frequency from P429 is added to the actual setpoint.	High
05	Fixed frequency 2 [1)]	The frequency from P430 is added to the actual setpoint.	High
06	Fixed frequency 3 [1)]	The frequency from P431 is added to the actual setpoint.	High
07	Fixed frequency 4 [1)]	The frequency from P432 is added to the actual setpoint.	High
08	Param. set switching	First bit of the parameter set switching; selection of the active parameter set 1…4 (P100).	High
09	Maintain the freq.	During the acceleration or deceleration phase, a "Low" level will cause the actual output frequency to be "maintained". A "High" level allows the ramp to continue.	Low
10	Voltage disable [2)]	The frequency inverter output voltage is switched off; the motor runs down freely.	Low
11	Quick stop [2)]	The FI reduces the frequency according to the quick stop time from P426.	Low

12	Fault acknowledgem. [2)]	Fault acknowledgement with an external signal. If this function is not programmed, a fault can also be acknowledged by a Low enable setting (P506).	0→1 Flank
13	PTC resistor input [2)]	Analogue evaluation of signal which is present. Switching threshold approx. 2.5 V, switch-off delay = 2 s, warning after 1 s.	Level
14	Remote control [2,3)]	With bus system control, Low level switches the control to control via control terminals.	High
15	Jog frequency [1)]	The fixed frequency value can be adjusted using the HIGHER/LOWER and ENTER keys (P113), if control is via the ControlBox or ParameterBox.	High
16	Motor potentiometer	As in setting 09, however, the frequency is not maintained below the minimum frequency P104 and above the maximum frequency P105.	Low
17	ParaSetSwitching 2	Second bit of the parameter set switching; selection of the active parameter set 1…4 (P100).	High
18	Watchdog [2)]	Input must see a High flank cyclically (P460), otherwise a shutdown will occur with error E012. Function starts with the 1st High flank.	0→1 Flank
21	Fixed frequency 5 [1)]	The frequency from P433 is added to the actual setpoint.	High
31	Inhibit turn right [2.4)]	Blocks the “Enable right/left” via a digital input or bus control. Does not depend on the actual direction of rotation of the motor (e.g. following negated setpoint).	Low
32	Inhibit turn left [2.4)]		Low
47	Motorpot. Freq. +	In combination with enable R/L, the output frequency can be continuously varied. To save a current value in **P113**, both inputs must be at a High voltage for 0.5 s. This value is then used as the next starting value for the same direction of rotation (Enable R/L) otherwise start at f_{MIN}. Values from other setpoint sources (e.g. fixed frequencies) are not taken into account.	High
48	Motorpot. Freq. -		High
50	Bit 0 fixedfreq.Array	“*Fixed frequency array*”, binary coded digital inputs to generate up to 32 fixed frequencies. **P465 [-01]... [-31]**	High
51	Bit 1 fixedfreq.Array		High
52	Bit 2 fixedfreq.Array		High
53	Bit 3 fixedfreq.Array		High
65	3-Wire-Direction (closing switch to reverse direction of rotation)	Alternative to enable R/L (01, 02), in which a permanently applied level is required. Here, only a control pulse is required to trigger the function. Control of the FI can therefore be performed entirely with keys. A pulse on the function "Phase seq. reversal" inverts the present direction of rotation. This function is reset with a "Stop signal" or by activating a key.	0→1 Flank
66	Bit 0 Freq-/Ramp.Arr	“*Frequency/ramp array*”, binary coded digital inputs to generate up to 32 fixed frequencies (**P465**).	
67	Bit 1 Freq-/Ramp.Arr		
68	Bit 2 Freq-/Ramp.Arr		
69	Bit 3 Freq-/Ramp.Arr		
71	Motorpot.F+ and Save	“*Motor potentiometer function frequency +/- with automatic saving*”. With this motor potentiometer function, a setpoint (sum) is set via the digital inputs and is simultaneously saved. With controller enabling R/L, this is then started up in the corresponding enable rotation direction. The frequency is retained on change of direction. Simultaneous activation of the +/- functions causes the frequency setpoint to be set to zero. The frequency setpoint can also be displayed in **P718** and pre-set in the operating status “Ready for switch-on”. A set minimum frequency **P104** is still effective. Other setpoint values, e.g. analogue or fixed frequencies, can be added or subtracted. Adjustment of the frequency setpoint is performed with the ramps from **P102 / 103**.	High
72	Motorpot.F- and Save		High

73	Inhibit right+quick [2,4)]	As for setting 31, but coupled to the "Quick stop²" function	Low
74	Inhibit left + quick [2,4)]	As for setting 32, but coupled to the “Quick stop” function.	Low
83	DO 1 man. set	Via the “BusIO In Bits” function, the digital output can be set directly via the BusIO or via the control word.	
84	DO 2 man. set		

1) If neither of the digital inputs is programmed for left or right enable, actuation of a fixed frequency or jog frequency enables the frequency inverter. The rotation field direction depends on the sign of the setpoint

2) Also effective for control via BUS (e.g. Ethernet, USS)

3) Function cannot be selected via BusIO In Bits

4) Notice! When using this function for end position monitoring, it must be ensured that the end position switch cannot be overrun, because as soon as the end position switch has been left, the blocking of the direction of rotation is automatically cancelled. The frequency inverter therefore accelerates again when the enable signal is applied.

P423	**Safety SS1 max. time**
Setting range	0.01 ... 320.00 s
Factory setting	{ 0.1 }
Description	“Safety SS1 max. time” is used to delay the output monitoring of the frequency inverter if the Safety Digital Input is parameterised to Quick Stop (**P424 = 2**). If the motor is still controlled after the set time, an error message is generated. The time to be set depends on the parameterised quick stop time, the brake reaction time and the flux delay. For asynchronous motors, the time to be set also depends on the DC run-on time.
Scope of Application	SK 3x1P with SK CU6-STO
Note	The set “Safety SS1 max. time” applies for all parameter sets. Be sure that the “Quick stop time” (**P426**) is matched for all parameter sets of the monitoring time. The parameter is only saved after entry and confirmation of the “Safety CRC” (**P499**). A parameter setting change is only applied after the external 24 V DC supply of the frequency inverter has been switched off and on again (24 V off → 60 s → 24 V on). Switching off the 400 V supply is not required for NORDAC *ON* or NORDAC *ON+*. If the safety functions are used, the parameters must be provided with password protection by use of “Change safety passw.” (**P498**). The “Safety SS1 max. time” (**P423**) is not changed by “Load factory setting” (**P523**). If the “Safety SS1 max. time” (**P423**) is to be changed to a default value, this must be carried out manually.

P424	**Safe Dig.input**
Setting range	0 … 2
Factory setting	{ 0 }
Scope of application	SK 3x1P with SK CU6-STO
Description	Assignment of a fail-safe stop function for the “Safety digital input” of the frequency inverter.
Note	The parameter is only saved after entry and confirmation of parameter **P499** (Safety CRC). A modification of the parameter settings is only applied after a Power Off –> 5-10 s –> Power On of the 24 V DC supply of the frequency inverter. Switching off the 400 V supply is not required here. If the safety functions are used, the parameters must be provided with a password **P489**. Parameter **P424** is not changed with the command **P523** “Load factory setting“. If parameter **P424** is to be changed to a default value, this must be carried out manually.
Setting values	**Value** / **Meaning**

0	No function	
1	Voltage disable	Output voltage is switched off, motor runs down to a standstill.
2	Quick stop	The FI reduces the frequency according to the quick stop time from P426.

P425	Function PTC input		
Setting range	0 … 1		
Factory setting	{ 1 }		
Scope of application	**SK 3xxP**		
Description	A connected thermistor is evaluated by the device. This function must be disabled if no thermistor is connected. Otherwise the device will enter a fault state with an overtemperature message (E2.0).		
Note	If monitoring is deactivated, the device no longer provides direct overtemperature protection for the motor.		
Setting values	**Value**	**Meaning**	
	0	Off	Thermistor input not monitored.
	1	On	Thermistor input monitoring active

P426	Quick stop time	P
Setting range	0 ... 320.00 s	
Factory setting	{ 0.10 }	
Description	Setting of the braking time for the quick stop function which can be triggered either via a digital input, the bus control, the keyboard or automatically in case of a fault. The quick stop time is the time for the linear frequency decrease from the set maximum frequency P105 to 0 Hz. If an actual setpoint <100 % is used, the quick stop time is reduced correspondingly.	

P427	Quick stop on Error	S	
Setting range	0 ... 3		
Factory setting	{ 0 }		
Description	"*Quick stop on Error*". Activation of automatic quick stop in case of an error. A quick stop can be triggered by error **E2.x**, **E7.0**, **E10.x**, **E12.8**, **E12.9** and **E19.0**.		
Setting values	**Value**		**Meaning**
	0	Off	Automatic quick stop in case of fault is deactivated
	1	In case of mains supply failure [1]	Automatic quick stop in case of mains supply failure.
	2	In case of faults	Automatic quick stop in case of fault
	3	Fault or mains failure [1]	Automatic quick stop in case of fault or mains failure

1) Quick stop in case of mains failure is excluded for DC supply (P538=4).

P428	Automatic starting	S
Setting range	0 … 1	
Factory setting	{ 0 }	
Description	**WARNING!** Danger of injury due to unexpected movements of the drive. Switch-on after an earth fault/short-circuit. Do **NOT** parameterise this parameter to “On” (**P428 = 1**), if “Automatic acknowled.” (**P506 = 6** “Always”) has been parameterised! Secure drive against movements. This parameter defines how the FI responds to a static enabling signal when the mains voltage is applied (mains voltage On). In the standard setting **P428 = 0** Off, the FI requires a flank to enable (signal change from Low → High) at the relevant digital input. **P428 = 1** “On” can be set if the FI must start immediately when the mains voltage is switched on. If the enable signal is permanently switched on, or equipped with a cable jumper, the FI starts up immediately.	
Note	The setting “On” (**P428 = 1**) can only be enabled if the frequency inverter has been parameterised to local control (**P509 = 0** or **P509 = 1**).	
Setting values	**Value** / **Meaning**	
	0 Off: The device expects a flank (signal change “low → high”) at the digital input which has been parametrised to “Enable” in order to start the drive. If the device is switched on with an active enable signal (mains voltage on), it immediately switches to “Switch-on inhibit”.	
	1 On: The device expects a signal level (“high”) at the digital input which has been parametrised to “Enable” in order to start the drive. **NOTICE! Risk of injury! Drive starts up immediately!**	

P429	Fixed frequency 1	P
Setting range	-400.0 … 400.0 Hz	
Factory setting	{ 0.0 }	
Description	Following actuation via a digital input and enabling of the device (right or left), the fixed frequency is used as a setpoint. A negative setting value will cause a phase sequence reversal (based on the *Enable rotation direction* **P420**). If several fixed frequencies are actuated simultaneously, the individual values are added with the correct sign. This also applies to combinations with the jog frequency **P113** or minimum frequency **P104**. If none of the digital inputs are programmed for enable (right or left), the simple fixed frequency signal results in an enable. A positive fixed frequency corresponds to a right enable, a negative to a left enable.	
Note	The frequency limits **P104 = f_{min}** or **P105 = f_{max}** cannot be overshot or undershot.	

P430	Fixed frequency 2	P
Setting range	-400.0 … 400.0 Hz	
Factory setting	{ 0.0 }	
Description	For a description of the function of the parameter, see **P429** “Fixed frequency 1”.	

P431	Fixed frequency 3	P
Setting range	-400.0 … 400.0 Hz	
Factory setting	{ 0.0 }	
Description	For a description of the function of the parameter, see **P429** “Fixed frequency 1”.	

P432	Fixed frequency 4	P
Setting range	-400.0 … 400.0 Hz	
Factory setting	{ 0.0 }	
Description	For a description of the function of the parameter, see **P429** “Fixed frequency 1”.	

P433	Fixed frequency 5	P
Setting range	-400.0 … 400.0 Hz	
Factory setting	{ 0.0 }	
Description	For a description of the function of the parameter, see **P429** “Fixed frequency 1”.	

P434	Digital out function	P
Setting range	0 … 53	
	[-01] = Digital out 1	Digital output 1 (DOUT1) integrated into the FI
	[-02] = Digital out 2	Digital output 2 (DOUT2) integrated into the FI
Scope of application	**[-01] … [-02]**	
Factory setting	[-01] = { 0 } [-02] = { 0 }	
Description	“*Digital output function*“. Up to 2 digital outputs are available which can be freely programmed with digital functions. These can be seen in the following table.	

Setting values

Value		Description	Signal
00	No function	Input switched off.	Low
01	External brake	For control of a mechanical brake on the motor via an external 24 V brake relay (max. 20 mA). The output switches at a programmed absolute minimum frequency (P505). For typical brakes, a setpoint delay of 0.2-0.3 s (see also P107/P114) should be programmed.	High
02	Inverter is working	Voltage applied to inverter output (U - V - W).	High
03	Current limit	Based on the nominal motor current setting in P203. This value can be adjusted with scaling P435.	High
04	Torque current limit	Based on motor data settings in P203 and P206. Signals a corresponding torque load on the motor. This value can be adjusted with scaling P435.	High
05	Frequency limit	Based on the nominal motor frequency setting in P201. This value can be adjusted by scaling P435.	High
06	Level with setpoint	Indicates that the FI has completed the frequency increase or decrease. Setpoint frequency = actual frequency! From a difference of 1 Hz → Setpoint not reached, contact opens.	High
07	Fault	General fault message, fault is active or not yet acknowledged. Fault: Contact opens, ready for operation: Contact closes.	Low
08	Warning	General warning. A limit value was reached that could result in a later shutdown of the device.	Low
09	Overcurrent warning	At least 130% of the nominal device current was supplied for 30 seconds.	Low

10	Mot.overtemp.warning	"*Motor overtemperature (Warning)*". The motor temperature is evaluated via the thermistor input or a digital input. → Motor is too hot. The warning is given immediately, overtemperature switch-off after 2 seconds.	Low
11	Torque current limit	"*Torque current limit/Current limit active (Warning)*". The limit value in P112 or P536 was reached. A negative value in P435 inverts the behaviour. Hysteresis = 10 %	Low
12	Value of P541	The output can be set using parameter P541 independently of the actual operating status of the FI.	High
13	Torq.curr. limit gen	Limit value in P112 was reached in the generator range. Hysteresis = 10 %	High
14	Effect. power limit	Limit value for the ratio of the stated mechanical power to the nominal power of the motor was reached.	High
15	Freq+current limit	Interlinking of the “Current limit” and “Frequency limit” states. The output switches when both limit values are exceeded.	High
16	Quick stop active	A quick stop (P427) has been triggered.	High
17	Quick stop+STO act.	A quick stop (P427) is triggered if STO “*Voltage disable*“ or “*Quick stop*“ are enabled.	High
18	Inverter ready	The device is ready for operation. After being enabled, it delivers an output signal.	High
19	Gen. torque limit	As for 13, however a limit value can be set via P435.	High
20	Reference	Reference point available / has been saved	[1]
21	End position	The specified position has been reached	[1]
22	Position	Position value in **P626** reached	[1]
23	Abs. pos.	Position value (amount) in **P626** reached (without consideration of prefix)	[1]
24	Abs. pos.array	A value set in **P613** has been reached or exceeded.	[1]
25	= Position	Comparison position reached, as for function 22, however with consideration of **P625**	[1]
26	= Abs. pos.	Comparison position value reached, as for function 23, however with consideration of **P625**	[1]
27	Flying saw synchron.	The slave drive has completed the starting phase of the “flying saw” function and is now synchronised with the master axis.	
28	Rotorpos PMSM ok	The PMSM rotor position is known.	High
29	Motor stopped	Speed less than P505	High
30	BusIO In Bit 0	Control by Bus In Bit 0 (P546 …)	High
31	BusIO In Bit 1	Control by Bus In Bit 1 (P546 …)	High
32	BusIO In Bit 2	Control by Bus In Bit 2 (P546 …)	High
33	BusIO In Bit 3	Control by Bus In Bit 3 (P546 …)	High
34	BusIO In Bit 4	Control by Bus In Bit 4 (P546 …)	High
35	BusIO In Bit 5	Control by Bus In Bit 5 (P546 …)	High
36	BusIO In Bit 6	Control by Bus In Bit 6 (P546 …)	High
37	BusIO In Bit 7	Control by Bus In Bit 7 (P546 …)	High
38	Value Bus Setpoint	Value from Bus setpoint (P546 ...)	High
39	STO inactive	The signal is low if STO or Safe Stop are active.	High
40	Output via PLC	The output is set by the integrated PLC	High
43	STO o. OUT2/3 inact.	Neither safe stop, voltage disable nor quick stop are active.	High
50	State digital In 1	A signal is present at digital input 1.	High
51	State digital In 2	A signal is present at digital input 2.	High
52	State digital In 3	A signal is present at digital input 3.	High
53	State digital In 4	A signal is present at digital input 4.	High

[1] For detailed information about output messages, please refer to 📖 Section 6.2 "Messages"

P435	Dig. out scaling		P
Setting range	-400 … 400%		
	[-01] = Digital output 1	Digital output 1 (DO1) integrated into the FI	
	[-02] = Digital output 2	Digital output 2 (DO2) integrated into the FI	
Factory setting	All { 100 }		
Description	"*Scaling of digital outputs*". Adjustment of the limiting values of the digital functions. For a negative value, the output function will be output negative. Reference to the following values: Current limit (P434 = 3) = x [%] · P203 "Nominal current" Torque current limit (P434 = 4) = x [%] · P203 · P206 (calculated nominal motor torque) Frequency limit (P434 = 5) = x [%] · P201 "Nominal frequency"		

P436	Dig. out. hysteresis		S	P
Setting range	1 … 100%			
	[-01] = Digital output 1	Digital output 1 (DO1) integrated into the FI		
	[-02] = Digital output 2	Digital output 2 (DO2) integrated into the FI		
Factory setting	All { 10 }			
Description	*"Digital output hysteresis"* Difference between switch-on and switch-off point to prevent oscillation of the output signal.			

P460	Watchdog time	S
Setting range	-250.0 ... 250.0 s	
Factory setting	{ 10.0 }	
Setting values	**Value** / **Meaning**	
	0.1 ... 250.0	The time interval between the expected watchdog signals (programmable function of the digital inputs **P420**). If this time interval elapses without an impulse being registered, switch-off and error message **E012** are actuated.
	0.0	**Customer error:** As soon as a High-Low flank or a Low signal is registered on a digital input (Function 18), the FI switches off with error message **E012**.
	-0.1 … -250.0	**Rotor run watchdog:** In this setting the rotor run watchdog is active. The time is defined by the set value. There is no watchdog message when the FI is switched off. After each enable, a pulse must first come before the watchdog is activated.

P464	Fixed frequency mode	S
Setting range	0 … 1	
Factory setting	{ 0 }	
Description	This parameter determines the form in which fixed frequencies are to be processed.	
Note	The highest active fixed frequency is added to the setpoint value of the motor potentiometer if functions 71 or 72 are selected for two digital inputs.	
Setting values	**Value** / **Meaning**	
	0 Add to main setvalue	Fixed frequencies and the fixed frequency array are added to each other. That means, they are added together, or added to an analogue setpoint to which limits are assigned according to **P104** and **P105**.
	1 Equal main setvalue	Fixed frequencies are not added - neither together, nor to main analogue setpoints. If for example, a fixed frequency is switched to an existing analogue setpoint, the analogue setpoint will no longer be considered. Programmed frequency addition or subtraction to one of the analogue inputs or bus setpoints is still possible and valid, as is the addition to the setpoint of a motor potentiometer function (function of digital inputs: 71/72). If several fixed frequencies are selected simultaneously, the frequency with the highest value has priority (example: **20** > 10 or **20** > -30).

P465	Fixed freq. Array			
Setting range	-400.0 … 400.0 Hz			
Arrays	[-01] = Fixed frequency array 1			
	[-02] = Fixed frequency array 2			
	…			
	[-31] = Fixed frequency array 31			
Factory setting	{ 0.0 }			
Description	In the array levels, up to 31 different fixed frequencies can be set, which in turn can be encoded for the functions 50… 54 in binary code for the digital inputs.			

P466	Min.freq. proc.ctrl.		S	P
Setting range	0.0 … 400.0 Hz			
Factory setting	{ 0.0 }			
Description	"*Minimum frequency process control*". With the aid of the minimum process controller frequency the control ratio can also be kept to a minimum ratio, even with a master value of "zero", in order to enable adjustment of the compensator.			

P475	Delay on/off switch		S	
Setting range	-30,000 ... 30,000 s			
Arrays	[-01] = Digital input 1	Digital input 1 (DI1) integrated into the FI		
	[-02] = Digital input 2	Digital input 2 (DI2) integrated into the FI		
	[-03] = Digital input 3	Digital input 3 (DI3) integrated into the FI		
	[-04] = Digital input 4	Digital input 4 (DI4) integrated into the FI		
Factory setting	All { 0,000 }			
Description	"*Digital function switch on/off delay*". Adjustable switch on/off delay for the digital inputs. Use as a switch-on filter or simple process control is possible.			
Setting values	**Value**	**Meaning**		
	Positive values	Switch-on delayed		
	Negative values	Switch-off delayed		

P480	Funct. BusIO In Bits		S	
Setting range	0 … 82			
Arrays	[-01] = BusIO In Bit 0	In Bit 0 … 3 via bus		
	[-02] = BusIO In Bit 1			
	[-03] = BusIO In Bit 2			
	[-04] = BusIO In Bit 3			
	[-05] = BusIO In Bit 4	In Bit 4 … 7 via bus		
	[-06] = BusIO In Bit 5			
	[-07] = BusIO In Bit 6			
	[-08] = BusIO In Bit 7			
	[-09] = Flag 1	See "Use of markers" at the end of the description of parameter P481		
	[-10] = Flag 2			
	[-11] = Bit8 bus controlword	Assignment of a function for Bit 8 or 9 of the control word		
	[-12] = Bit9 bus controlword			
Factory setting	[-01] … [-12] = { 0 }			
Description	"*Bus IO In Bits function*". The BusIO In Bits are perceived as digital inputs P420. They can be set to the same functions. In order to use this function, one of the bus setpoints P546 must be set to "BusIO In Bits 0-7". The required function must then be assigned to the relevant bit.			
Note	For the possible functions of the Bus In Bits, please refer to the table of digital input functions. Function 14 "Remote control" is not possible.			

P481	Funct-BusIO Out Bits		S
Setting range	0 … 53		
Arrays	[-01] = BusIO Out Bit 0	Out Bit 0 … 3 via Bus.	
	[-02] = BusIO Out Bit 1		
	[-03] = BusIO Out Bit 2		
	[-04] = BusIO Out Bit 3		
	[-05] = BusIO Out Bit 4	Out Bit 4 … 5 via Bus.	
	[-06] = BusIO Out Bit 5		
	[-07] = BusIO Out Bit 6	Out Bit 6 … 7 via Bus.	
	[-08] = BusIO Out Bit 7		
	[-09] = Marker 1	See "Use of markers" at the end of the description of parameter **P481**.	
	[-10] = Marker 2		
	[-11] = Bit10 Bus status word	Assignment of a function for Bit 10 or 13 of the status word.	
	[-12] = Bit13 Bus status word		
Factory setting	All { 0 }		
Description	"*Bus IO Out Bits function* ". The bus I/O Out bits are perceived as digital outputs **P434**. They can be set to the same functions. In order to use this function, one of the bus actual values **P543** must be set to "Bus I/O In Bits 0-7". The required function must then be assigned to the relevant bit.		
Note	The functions for the Bus Out Bits can be found in the table of functions for the digital outputs.		

P482	Norm. BusIO Out Bits		S
Setting range	-400 … 400%		
Arrays	[-01] = BusIO Out Bit 0	Out Bit 0 … 3 via Bus	
	[-02] = BusIO Out Bit 1		
	[-03] = BusIO Out Bit 2		
	[-04] = BusIO Out Bit 3		
	[-05] = BusIO Out Bit 4	Out Bit 4 … 5 via Bus	
	[-06] = BusIO Out Bit 5		
	[-07] = BusIO Out Bit 6	Out Bit 6 … 7 via Bus	
	[-08] = BusIO Out Bit 7		
	[-09] = Marker 1	See "Use of markers" at the end of the description of parameter P481.	
	[-10] = Marker 2		
	[-11] = Bit 10 Bus status word	Bit 10 … 13 of the status word.	
	[-12] = Bit 13 Bus status word		
Factory setting	All { 100 }		
Description	*"Normalisation of Bus IO Out Bits".* Adjustment of the limit values of the Bus Out Bits. For a negative value, the output function will be output negative. Reference to the following values: Current limit (**P481 = 3**) = x [%] · **P203** "Nominal current" Torque current limit (P**481 = 4**) = x [%] · **P203** · **P206** (calculated nominal motor torque) Frequency limit (**P481 = 5**) = x [%] · **P201** "Nominal frequency"		

P483	Hyst. BusIO Out Bits		S
Setting range	1 … 100%		
Arrays	[-01] = BusIO Out Bit 0	Out Bit 0 … 3 via Bus	
	[-02] = BusIO Out Bit 1		
	[-03] = BusIO Out Bit 2		
	[-04] = BusIO Out Bit 3		
	[-05] = BusIO Out Bit 4	Out Bit 4 … 5 via Bus.	
	[-06] = BusIO Out Bit 5		
	[-07] = BusIO Out Bit 6	Out Bit 6 … 7 via Bus.	
	[-08] = BusIO Out Bit 7		
	[-09] = Marker 1	See "Use of flags" at the end of the description of parameter **P481**.	
	[-10] = Marker 2		
	[-11] = Bit 10 Bus status word	Bit 10 … 13 of the status word.	
	[-12] = Bit 13 Bus status word		
Factory setting	All { 10 }		
Description	"*Hysteresis Bus IO Out Bits*". Difference between switch-on and switch-off point to prevent oscillation of the output signal.		

5.1.6 Additional parameters

P501	Inverter name
Setting range	A … Z (char)
Arrays	[-01] … [-20]
Factory setting	{ 0 }
Description	Free input of a designation (name) for the device (max. 20 characters). With this, the frequency inverter can be uniquely identified for setting with NORDCON software or within a network.

P504	Pulse frequency	S
Setting range	16.4 kHz	
Factory setting	{ 6.0 }	
Description	The internal pulse frequency for controlling the power unit can be changed with this parameter. A higher setting value reduces motor noise, but leads to increased EMC emissions and reduction of the possible motor torque.	
Note	The best possible degree of interference suppression for the device is achieved by using the default value and taking the wiring directives into consideration.	
	Raising the pulse frequency leads to a reduction of the possible output current, depending on the time (I^2t curve). When the temperature warning limit **C001** is reached, the pulse frequency is gradually lowered to the default value (see also **P537**). If the inverter temperature drops by a sufficient amount, the pulse frequency is increased to the original value.	
	The pulse frequency must not change if a sine filter is used. Otherwise, “Module errors” (**E4.0**) can be triggered. See setting {16.2 } and {16.3}.	

Setting values

Value		Meaning
min. … 16.0	Pulse frequency min.… 16.0 kHz	The value which is set is used as the standard pulse frequency. With increasing overload the frequency inverter automatically gradually reduces the pulse frequency to the default value.
16.1	Automatic setting of the maximum possible pulse frequency	The frequency inverter continuously determines and automatically sets the highest possible pulse frequency.
16.2	Pulse frequency 6 kHz	Fixed pulse frequency setting. This value remains constant even in case of overload (suitable for operation with a sine filter). **NB:** With these settings, short circuits at the output which occur before enabling may possibly not be detected correctly.
16.3	Pulse frequency 8 kHz	
16.4	Automatic load adjustment	The pulse frequency is automatically adjusted between a minimum value (highest load reserve) and a maximum value (lowest load reserve) depending on the load. During an acceleration phase and if high power is required (≥ rated power) the minimum value is set. With constant speed and a power requirement ≤ 80 % rated power, the high pulse frequency is set.

P505	Absolute mini. freq.	S	P
Setting range	0.0 … 10.0 Hz		
Factory setting	{ 2 }		
Description	“*Absolute minimum frequency*”. Specifies the frequency value that cannot be undershot by the FI. If the setpoint becomes smaller than the absolute minimum frequency, the FI switches off or changes to 0.0 Hz. At the absolute minimum frequency, braking control **P434** and the setpoint delay **P107** are executed. If the setting value “Zero” is selected, the brake relay or the digital output, which is assigned the function { 1 } in **P434**, does not switch during reversing. When controlling lift equipment without speed feedback, this value should be set to a minimum of 2 Hz. With 2 Hz and above, the current control of the FI operates and a connected motor can supply sufficient torque.		
Note	Output frequencies < 4.5 Hz result in current limitation .		

P506	Automatic acknowled.	S
Setting range	0 … 7	
Factory setting	{ 0 }	
Description	*"Automatic fault acknowledgement"* In addition to manual fault acknowledgement, automatic acknowledgement can also be selected.	
Note	Automatic fault acknowledgement is performed three seconds after the error can be acknowledged.	
	NOTICE! This parameter must not be set to 6 “Always” if **P428** is set to “On”. Otherwise, after an active fault (e.g. earth fault/short circuit), the device continually switches on again. This would result in destruction of the device and could possibly endanger the system.	

Setting values

Value	Meaning	
0	**No automatic** fault acknowledgement	When using the control terminals to control the FI, the error message is acknowledged by removing the enabling signal.
1 … 5	**Number** of permissible automatic fault acknowledgements within one mains-on cycle. After mains off and switch on again, the full amount is available again.	
6	**Always**, a fault message will always be acknowledged automatically if the cause of the error is no longer present, see note.	
7	**Quit disable**, acknowledgement is only possible using the OK / ENTER key or by switching off the mains. No acknowledgement is implemented by removing the enable!	

P509	Control word source
Setting range	0 ... 8
Factory setting	{ 8 }
Description	Selection of the interface via which the frequency inverter receives its control word (for enabling, direction of rotation, etc.).
Note	Note P510!
	For parameterisation via the bus: Set P509 and if necessary P899 to the relevant bus system.

Setting values

Value		Meaning
0	Contr.term. or keyb.	Control is via the optional control display (SK TU5-CTR) (if P510 = 0) or via BUS I/O Bits.
1	Contr. terminal only	Control is via the digital inputs or via the BUS I/O Bits.
2	USS / Modbus	The control word is expected via the RS 485 interface. The frequency inverter automatically detects whether this is a USS protocol or a Modbus protocol.
8	Ethernet	The control word is received via the Ethernet-based interface, which was selected in **P899** (📖 see BU 0820).

P510	Source Setpoints	S
Setting range	0 oder 1 oder 2 oder 8	
Arrays	Selection of the setpoint source.	
	[-01] = Source main setpoint [-02] = Source 2nd setpoint	
Factory setting	all { 0 }	
Description	Selection of the interface, from which the frequency inverter receives its setpoints.	

Setting values

Value		Meaning
0	Auto (= P509)	The setpoint source corresponds to the control word (**P509**).
1	Contr. terminal only	Digital inputs control the frequency, including fixed frequencies.
2	USS / Modbus	The setpoint is expected via the RS485 interface.
8	Ethernet	The setpoint is received via the Ethernet-based interface, which was selected in **P899** (📖 see BU 0820).

P511	USS baud rate	S
Setting range	0 … 8	
Factory setting	{ 3 }	
Description	Setting of the transfer rate (transfer speed) via the RS485 interface. The same baud rate must be set for all bus participants.	
Note	For communication via Modbus RTU (available for SK 540E and higher) a transfer rate of maximum 38400 Baud must be set.	

Setting values

Value	Meaning	Value	Meaning
0	4800 Baud	4	57600 Baud
1	9600 Baud	5	115200 Baud
2	19200 Baud	6	187500 Baud
3	38400 Baud		

P512	USS address
Setting range	0 … 30
Factory setting	{ 0 }
Description	Setting of the bus address of the frequency inverter for USS communication.

P513	Telegram time-out	S
Setting range	-0.1... 100.0 s	
Arrays	[-01] = USS / Modbus; [-02] = Reserved; [-03] = Reserved; [-04] = Ethernet	
Factory setting	{ 0.0 }	
Description	Monitoring function of the active bus interface. Following receipt of a valid telegram, the next telegram must arrive within the set period. If not, the FI reports an error and switches off with the error message E010 "Bus Timeout". A communication failure during remote control with NORDCON shuts down the frequency inverter without triggering an error.	

Setting values

Value		Meaning
-0.1	No error	Even if communication between the bus interface and the FI is interrupted, the FI continues to operate without change.
0	Off	Monitoring is switched off.
0.1	… 100.0	Setting of telegram downtime

P516	Skip frequency 1	S	P
Setting range	0.0 … 400.0 Hz		
Factory setting	{ 0.0 }		
Description	The output frequency around the frequency in the range between **+P517** and **-P517** set here is not displayed. This range is transmitted with the set deceleration and acceleration ramp; it cannot be continuously supplied to the output.		
Note	Frequencies below the absolute minimum frequency should not be set.		
Setting values	0.0 Skip frequency inactive		

P517	Skip freq. area 1	S	P
Setting range	0.0 … 50.0 Hz		
Factory setting	{ 2.0 }		
Description	Skip range for "Skip freq. area 1" **P516**. This frequency value is added and subtracted from the skip frequency. Skip range 1: (**P516 - P517**) ... (**P516**) … (**P516 + P517**)		

P518	Skip frequency 2	S	P
Setting range	0.0 … 400.0 Hz		
Factory setting	{ 0.0 }		
Description	The output frequency around the set frequency in the range between **+P519** and **-P519** set here is not displayed. This range is transmitted with the set deceleration and acceleration ramp; it cannot be continuously supplied to the output.		
Note	Frequencies below the absolute minimum frequency should not be set.		
Setting values	0.0 Skip frequency inactive		

P519	Skip range 2	S	P
Setting range	0.0 … 50.0 Hz		
Factory setting	{ 2.0 }		
Description	Skip range for "Skip frequency 2" **P518**. This frequency value is added to and subtracted from the skip frequency. Skip range 2: (**P518 - P519**) … (**P518**) ... (**P518 + P519**)		

P520	Flying start	S	P
Setting range	0 … 4		
Factory setting	{ 0 }		
Description	This function is required to connect the FI to motors which are already rotating, e.g. for fan drives.		
Note	For physical reasons, flying start only operates above 1/10 of the nominal motor frequency **P201**, however not below 10 Hz.		
	Motor frequencies >100 Hz are only picked up in speed controlled mode (**P300 = 1**).		

	Example 1	Example 2
P201	50 Hz	200 Hz
f = 1/10* P201	F = 5 Hz	F = 20 Hz
Result f_{Fang} =	The flying start functions above f_{Fang}=10Hz.	The flying start functions above f_{Fang}=20Hz.

PMSM: The catch function automatically determines the direction of rotation. Therefore, if function 2 is set, the device behaves identically to function 1. If function 4 is set, the device behaves identically to function 3.

PMSM: In CFC closed loop mode, flying start can only be executed if the rotor position is known in relation to the incremental encoder. For this purpose, the motor cannot initially rotate when it is switched on for the first time after a "mains on" of the FI.
This restriction does not apply if the zero track of the incremental encoder is used.

PMSM: The flying start does not function if fixed pulse frequencies (setting 16.2 and 16.3) are used in **P504**.

Setting values

Value		Meaning
0	Switched off	No flying start
1	Both directions	The FI searches for a speed in both directions.
2	In the setpoint direction	Searches only in the direction of the present setpoint value.
3	Both directions after failure	As for 1, however only after mains failure or fault.
4	Setpoint direction after failure	As for 2, however only after mains failure or fault.

P521	Flying start Resolution	S	P
Setting range	0.02 … 2.50 Hz		
Factory setting	{ 0.05 }		
Description	"*Flying start resolution*". The flying start circuit search increment size can be adjusted using this parameter. Values that are too large affect accuracy and cause the FI to cut out with an overcurrent message. If the values are too small, the search time is greatly extended.		

P522	Flying start offset	S	P
Setting range	-10.0 … 10.0 Hz		
Factory setting	{ 0.0 }		
Description	"*Flying start offset*". A frequency value that can be added to the frequency value found, e.g. to remain in the motor range and so avoid the generator range and therefore the chopper range.		

P523	Factory setting
Setting range	0 ... 4
Factory setting	{ 0 }
Description	With the selection and activation of the relevant value, the selected parameter range is set to the factory setting. Once this setting is made, the parameter value automatically changes back to 0.
Note	With the setting *"Load factory settings"* the safety-relevant parameters **P423**, **P424**, **P499** are not reset. These must be reset manually.
Setting values	

Value		Meaning
0	No change	Does not change the parameterisation.
1	Load factory setting	"Load factory setting". The entire parameterisation of the FI is reset to the factory setting. All originally parameterised data are lost.
2	Fact.setng.w.out bus	*"Load factory setting without bus".* All parameters of the FI, with the *exception* of the USS and Ethernet parameters are reset to the factory setting.
3	Fact set w/o motor	*"Load factory setting without motor parameter".* All parameters of the frequency inverter, with the *exception* of the motor data, are reset to the factory setting.
4	Fact.set only Ethern	*"Load factory settings, only Ethernet parameters".* Only the FI parameters for the Ethernet settings are reset to the factory setting

P525	Load monitoring max						S	P
Setting range	1 ... 400 % / 401							
Arrays	Selection of up to 3 auxiliary values:							
	[-01] =	Auxiliary value 1	[-02] =	Auxiliary value 2	[-03] =	Auxiliary value 3		
Factory setting	All { 401 }							
Description	"*Load monitoring maximum value*". Setting of the upper limit of load monitoring. Up to 3 values can be specified. Prefixes are not taken into account, only the integer values are processed (motor / generator torque, right/left rotation). The array elements **[-01]**, **[-02]** and **[-03]** of parameters **P525 … P527**, or the entries which are made there always belong together.							
Note	Setting **401 = Off** → Monitoring is not performed.							

P526	Load monitoring min.				S	P
Setting range	0 / 1 ... 400 %					
Arrays	Selection of up to 3 auxiliary values:					
	[-01] =	Auxiliary value 1	[-02] =	Auxiliary value 2	[-03] =	Auxiliary value 3
Factory setting	All { 0 }					
Description	*"Load monitoring, minimum value"* Setting of the lower limit value of load monitoring. Up to 3 values can be specified. Prefixes are not taken into account, only the integer values are processed (motor / generator torque, right/left rotation). The array elements **[-01]**, **[-02]** and **[-03]** of parameters **P525 … P527**, or the entries which are made there always belong together.					
Note	Setting **0 = Off** → Monitoring is not performed.					

P527	Load control freq.				S	P
Setting range	0.0 ... 400.0 Hz					
Arrays	Selection of up to 3 auxiliary values:					
	[-01] =	Auxiliary value 1	[-02] =	Auxiliary value 2	[-03] =	Auxiliary value 3
Factory setting	All { 25.0 }					
Description	"*Load control frequency*" Definition of up to 3 frequency points, which define the monitoring range for load control. The auxiliary frequency values do not need to be entered in order of size. Prefixes are not taken into account, only the integer values are processed (motor / generator torque, right/left rotation). The array elements **[-01]**, **[-02]** and **[-03]** of parameters **P525 … P527**, or the entries which are made there always belong together.					

P528	Load control delay	S	P
Setting range	0.10 ... 320.00		
Factory setting	{ 2.00 }		
Description	"*Load control delay*". Parameter **P528** defines the delay time for which an error message "**E12.5**" is suppressed on infringement of the defined monitoring range **P525 … P527**. A warning **C12.5** is triggered after half of this time has elapsed. According to the selected control mode **P529** an error message can also be generally suppressed.		

P529	Mode load control	S	P
Setting range	0 … 3		
Factory setting	{ 0 }		
Description	Specifies the response on infringement of the monitoring range (**P525 … P527**).		
Setting values	**Value**	**Meaning**	
	0 Fault and warning	Infringement of the monitoring range produces a warning "**E12.5**" after the elapse of the time defined in parameter **P528**. A warning **C12.5** is triggered after half of this time has elapsed.	
	1 Warning	After the elapse of half of the time defined in **P528** infringement of the monitoring range produces a warning **C12.5**.	
	2 Error and warning, constant travel	"*Fault and warning during constant travel*". As for setting{0} however monitoring is inactive during acceleration phases.	
	3 Warning during constant travel	"*Warning only during constant travel*". As for setting {1} however monitoring is inactive during acceleration phases	

P533	Factor I^2t Motor	S	
Setting range	50 … 150 %		
Factory setting	{ 100 }		
Description	Weighting of motor current for I^2t motor monitoring (**P535**). Larger factors permit larger currents.		

P534	Torque disconn. limit		S	P
Setting range	0 ... 400 % / 401			
Arrays	[-01] = Motor switch-off limit	[-02] = Generator switch-off limit		
Factory setting	All { 401 }			
Description	"*Torque switch-off limit*". Setting for a maximum permissible torque limit. A warning (**C12.1** or **C12.2**) is given above 80% of the set limit. The drive shuts down at 100% of the set limit value. An error message (**E12.1** or **E12.2**) is given.			
Note	Setting **401 = Off** → the function is disabled.			

P535	I^2t motor
Setting range	0 … 24
Factory setting	{ 0 }
Description	The motor temperature is calculated depending on the output current, the time and the output frequency (cooling). If the temperature limit value is reached, then switch-off occurs with error message **E2.1**. Possible positive or negative ambient conditions are not taken into account. Eight characteristic curves with trigger times of < 60 s, 120 s and 240 s are available for the function I^2t motor. The triggering times are based on classes 5, 10 and 20 for semiconductor switching devices. The recommended setting for standard applications is **P535 = 5**. All characteristic curves run from 0 Hz to half of the nominal frequency **P201**. The full nominal current is available from above half of the nominal frequency.
Note	Switch-off classes 10 and 20 are provided for applications with heavy starting. When using these switch-off classes, it must be ensured that the FI has a sufficiently high overload capacity.
	Disable monitoring for multiple motor operation.
	0 = Off → Monitoring is not performed.
	When switching on for the first time, there may be a delay of a few milliseconds

Switch-off class 5, 60 s at (1.5 x I_N x P533)		Switch-off class 10, 120 s at (1.5 x I_N x P533)		Switch-off class 20, 240 s at (1.5 x I_N x P533)	
I_N at 0 Hz	**P535**	**I_N at 0 Hz**	**P535**	**I_N at 0 Hz**	**P535**
100%	1	100%	9	100%	17
90%	2	90%	10	90%	18
80%	3	80%	11	80%	19
70%	4	70%	12	70%	20
60%	**5**	60%	13	60%	21
50%	6	50%	14	50%	22
40%	7	40%	15	40%	23
30%	8	30%	16	30%	24

P536	Current limit	S
Setting range	1 ... 2.6	
Factory setting	{ 2.0 }	
Description	The output current is limited to the rated current of the frequency inverter (see technical data) taking into account the factor which is set in **P536**. When the limit value is reached, the FI reduces the actual output frequency.	
Note	Setting **2.6 = Off** → The parameter is disabled.	

P537	Pulse Disconnection	S	
Setting range	10 ... 200 % / 201		
Factory setting	{ 150 }		
Description	This function prevents rapid shutdown of the FI according to the load. With the pulse switch-off enabled, the output current is limited to the set value. This limitation is implemented by briefly switching off individual output stage transistors; the actual output frequency remains unchanged.		
Note	The value set here can be undershot by a smaller value in **P536**. For smaller output frequencies (< 4.5 Hz) or higher pulse frequencies (> 6 kHz or 8 kHz, P504), pulse switch-off by power reduction can be undershot.		
	If the function is disabled and a high pulse frequency is selected in parameter **P504**, the frequency inverter automatically reduces the pulse frequency when the power limits are reached. If the load on the inverter is reduced, the pulse frequency increases back to the original value.		
Setting values	**Value**	**Meaning**	
	10 ... 200 %	Limit value in relation to nominal FI current	
	201	The function is so to speak disabled; the FI supplies the maximum possible current. However, at the current limit the pulse switch off can still be active.	

P539	Check output voltage	S	P
Setting range	0 ... 3		
Factory setting	{ 0 }		
Description	The output current at the U-V-W terminals is monitored and checked for plausibility. In case of error, the error message **E016** is output.		
Note	This function can be used as an additional protective function for lifting applications, but is not permissible on its own as protection for persons.		
Setting values	**Value**	**Meaning**	
	0 Off	Monitoring is not performed.	
	1 Motor Phases only	The output current is measured and checked for symmetry. If an asymmetry is present, the FI switches off and outputs error message **E016**.	
	2 Magnetisation only	At the moment the FI is switched on, the level of the excitation current (field current) is checked. If insufficient excitation current is present, the FI switches off with the error message **E016**. A motor brake is not released in this phase.	
	3 Motor Phas.+Magnet.	Monitoring according to settings {1} and {2}.	

P540	Mode phase sequence	S	P
Setting range	0 ... 7		
Factory setting	{ 0 }		
Description	For safety reasons, this parameter can be used to prevent a rotation direction reversal and therefore prevent an incorrect rotation direction.		
Note	This function does not operate with active position control (P600 ≠ 0).		

Setting values

Value		Meaning
0	No limitation	No limitation of direction of rotation
1	Disable phaseseq.key	The rotation direction key on the ControlBox, e.g. SK PAR-3H, is disabled.
2	To the right only [1)]	Only the "right" field of rotation is possible. Selection of the “incorrect” rotation direction results in the output of the minimum frequency **P104** with the field of rotation R.
3	To the left only [1)]	Only the “left” direction is possible. Selection of the “incorrect” rotation direction results in the output of the minimum frequency **P104** with the field of rotation L.
4	Enabl. Direct. only	Rotation direction is only possible according to the enable signal, otherwise 0 Hz is output.
5	Right Orient. Contr. [1)]	*"Right orientation controlled"* Only Right direction is possible. Selection of the “incorrect” rotation direction leads to the FI switching off (control block). If necessary, an adequately large setpoint value (>fmin) must be observed.
6	Left Orient. Contr. [1)]	*"Left orientation controlled“*. Only Left direction is possible. Selection of the “incorrect” rotation direction leads to the FI switching off (control block). If necessary, an adequately large setpoint value (>fmin) must be observed.
7	Enab. Direct. Contr.	*"Enable direction controlled"* Rotation direction is only possible according to the enable signal, otherwise the FI is switched off.

1) Applies to control via control terminals and keyboard. In addition, the rotation direction key of the ControlBox, e.g. SK PAR-3H, is blocked.

P541	Set digital out	S
Setting range	0000 … 0xFF (hex)	
Arrays	[-01] = Set digital out	[-02] = Set Bus OUT Bit
Factory setting	[-01] = { 0 }	[-02] = { 0 }
Description	“*Set digital out*”. This function provides the option of controlling the digital outputs independently of the frequency inverter status. This function can either be used manually or in combination with a bus control.	
Note	The setting is not saved in the EEPROM and is lost when the frequency inverter is switched off!	

Setting values

[-01] = Set digital out		[-02] = Set Bus IO Out Bits	
1	Digital out 1	Bit 0	[1] Bit 0
2	Digital out 2	Bit 1	[2] Bit 0
		Bit 2	[4] Bit 0
		Bit 3	[8] Bit 0
		Bit 4	[16] Bit 0
		Bit 5	[32] Bit 0
		Bit 6	[64] Bit 0
		Bit 7	[128] Bit 0

P543	Bus actual value			S	P
Setting range	0 … 57				
Arrays	[-01] = Actual bus value 1	[-02] = Actual bus value 2	[-03] = Actual bus value 3		
	[-04] = Actual bus value 4	[-05] = Actual bus value 5			
Factory setting	[-01] = { 1 }	[-02] = { 4 }	[-03] = { 9 }	[-04] = { 0 }	[-05] = { 0 }
Description	Setting of the return values for bus control.				
Setting values	**Value / Meaning**				

0	Off	14	Setp. pos.HighWord [1]
1	Actual frequency	15	Cur.pos.Inc.HighWord [1]
2	Actual speed	16	Set.pos.Inc.HighWord [1]
3	Current	19	Freq. Master Value
4	Torque current	20	Set Freq. After Ramp
5	State digital-IO	21	Act. Freq. w/o Slip
6	Current pos.LowWord [1]	22	Speed encoder [1]
7	Setpoint pos.LowWord [1]	23	Act. freq. With slip
8	Set point frequency	24	Lead.act.freq.+slip
9	Error code	53	Actual value 1 PLC
10	Curr.pos.Inc.LowWord [1]	54	Actual value 2 PLC
11	Setp.pos.Inc.LowWord [1]	55	Actual value 3 PLC
12	BusIO Out Bits 0-7	56	Actual value 4 PLC
13	Current pos.HighWord [1]	57	Actual value 5 PLC

[1] Only for NORDAC *ON+*

P546	Funct. Bus set point			S	P
Setting range	0 … 57				
Arrays	[-01] = Bus set point 1	[-02] = Bus set point 2	[-03] = Bus set point 3		
	[-04] = Bus set point 4	[-05] = Bus set point 5			
Factory setting	[-01] = { 1 }	All other { 0 }			
Description	Assignment of a function to a bus set point value.				
Setting values	**Value**				

0	Off	14	Cur.val process ctrl
1	Setpoint frequency	15	Nom.val process ctrl
2	Torque current limit (P112)	16	Add. process control
3	PID current freq.	17	BusI/O In Bits 0…7
4	Frequency addition	19	Set relays (as P541)
5	Freq. subtraction	46	PI process controller, “Torque”
6	Current limit (P536)	48	Motor temperature
7	Maximum frequency (P105)	49	Ramp time (acceleration and deceleration)
8	PID current freq. limited	53	d-correction, F process
9	PID current freq. monitored	54	d-correction Torque
10	Servo mode Torque	55	d-correction, F+ Torque
11	Torque precontrol (P214)	56	Acceleration time
13	Multiplication	57	Deceleration time

P551	Drive profile		S	
Setting range	0 … 3			
Factory setting	{ 0 }			
Description	Activation of a process data profile.			
Setting values	**Value**	**Meaning**		

0	USS	No specific drive profile.
1	CANopen DS402	CANopen drive profile according to DS402.
2	Reserve	
3	Nord-Custom	Drive profile with freely assignable bits. **Note:** The free bits are set via parameters **P480 / P481**

P553	PLC set values		
Setting range	0 … 57		
Arrays	[-01] = PLC setpoint 1	[-02] = PLC setpoint 2	[-03] = PLC setpoint 3
	[-04] = PLC setpoint 4	[-05] = PLC setpoint 5	
Factory setting	All { 0 }		
Description	Assignment of functions for the various PLC control bits.		
Note	Condition: **P350 = 1** and **P351 = 0** or **1**.		

Setting values

Value	Meaning	Value	Meaning
0	Off	14	Cur.val process ctrl
1	Setpoint frequency	15	Nom.val process ctrl
2	Torque current limit (P112)	16	Add. process control
3	PID current freq.	17	BusI/O In Bits 0…7
4	Frequency addition	19	Set relays (as P541)
5	Freq. subtraction	46	PI process controller, “Torque”
6	Current limit (P536)	48	Motor temperature
7	Maximum frequency (P105)	49	Ramp time (acceleration and deceleration)
8	PID current freq. limited	53	d-correction, F process
9	PID current freq. monitored	54	d-correction Torque
10	Servo mode Torque	55	d-correction, F+ Torque
11	Torque precontrol (P214)	56	Acceleration time
13	Multiplication	57	Deceleration time

P554	Min. chopper Chop.	S
Setting range	65 … 102 %	
Factory setting	{ 65 }	
Description	"*Minimum chopper threshold*". Adjustment of the switching threshold of the brake chopper.	
Note	An increase in this setting leads to a faster overvoltage FI switch off.	
	For applications where pulsating energy is returned (crank drives) the braking resistor power dissipation can be minimised by increasing this setting.	
	In case of an FI error the brake chopper is generally disabled.	

Setting values

Value	Meaning
65 ... 100	Brake chopper switching threshold.
101	In case of an FI error the brake chopper is always disabled. Monitoring is also active if the FI is not enabled. Chopper activation at 65%, e.g. in the event of an increase in the link circuit voltage due to a mains fault.
102	Chopper always switched on, except for active chopper overcurrent (error **E003.4**).

P555	P-limit chopper		S
Setting range	5 … 100 %		
Factory setting	{ 100 }		
Description	"*Chopper power limit*". With this parameter it is possible to program a manual (peak) power limit for the braking resistor. The switch-on delay (modulation level) for the chopper can only rise to a certain maximum specified limit. Once this value has been reached, irrespective of the level of the link circuit voltage, the inverter switches off the current to the resistor. The result would be an overvoltage switch-off of the FI.		
	The correct percentage value is calculated as follows: $k[\%] = \frac{R * P_{\max BW}}{U_{\max}^{2}} * 100\%$		
	R =	Resistance of the braking resistor	
	P_{maxBW} =	Momentary peak power of the braking resistor	
	U_{max} =	FI chopper switching threshold	
		3~ 400 V	⇒ 1000 V DC

P556	Braking resistor	S
Setting range	1 ... 400 Ω	
Factory setting	{ 120 }	
Description	Value of the braking resistor for calculation of the maximum brake power in order to protect the resistor.	
Note	Once the maximum continuous output **P557** including overload (200 % für 60 s) is reached, an I^2t limit error **E003.1** is triggered. For further details see **P737**.	

P557	Brake resistor type	S
Setting range	0.00 ... 20 kW	
Factory setting	{ 0.00 }	
Description	Continuous power (nominal power) of the resistor, to display the actual utilisation in **P737**. For a correctly calculated value, the correct value must be entered into **P556** and **P557**.	
Setting values	0.00 Monitoring disabled	

P558	Flux delay		S	P
Setting range	0, 1, 2... 5000 ms			
Factory setting	{ 1 }			
Description	ASM	The ISD control can only function correctly if there is a magnetic field in the motor. For this reason, a DC current is applied before starting the motor to provide excitation of the stator winding. The duration depends on the size of the motor and is automatically set in the factory setting of the FI. For time-critical applications the flux delay can be set or disabled.		
	PMSM	When used with PMSM, the dwell time can be set via this parameter during rotor position identification using the dwell method. Total dwell duration = 2.5 x P558 [ms]		
Note	Setting values that are too low can reduce the dynamics and starting torque.			
Setting values	**Value**	**Meaning**		
	0	Switched off		
	1	Automatic calculation		
	2 … 5000	Time set in [ms]		

P559	DC Run-on time	S	P
Setting range	0.00 ... 30.00 sec		
Factory setting	{ 0.50 }		
Description	After a stop signal and elapse of the brake ramp, direct current is applied to the motor for a short time. This should completely stop the drive. Depending on the inertia, the time for which the current is applied can be set in this parameter. The current level depends on the previous braking procedure (current vector control) or the static boost (linear characteristic).		
Note	This function is not possible in closed-loop mode with PMSM!		

P560	Parameter, Saving mode	S	
Setting range	0 … 2		
Factory setting	{ 1 }		
Description	"*Parameter saving mode*".		
Note	If BUS communication is used to implement parameter changes, it must be ensured that the maximum number of write cycles to the EEPROM (100,000 x) is not exceeded.		

Setting values

Value		Meaning
0	Only in RAM	Changes to the parameter settings are not written to the EEPROM. All saved settings which were made before changing the saving mode are retained, even if the FI is disconnected from the mains.
1	RAM and EEPROM	All parameter changes are automatically written to the EEPROM and remain stored there even if the FI is disconnected from the mains supply.
2	OFF	Saving in RAM and EEPROM not possible. (No parameter changes are adopted)

P583	Motor phase sequence	S	P
Setting range	0 ... 2		
Factory setting	{ 0 }		
Description	The motor phase control sequence (U – V – W) can be changed with this parameter. This enables the direction of rotation of the motor to be changed without changing the motor connections.		
Note	If there is a voltage on the output terminals (U – V – W) (e.g. on enabling) the parameter setting or the parameter set may be changed by setting parameter **P583**. Otherwise the frequency inverter switches off with error message **E016.2**.		

Setting values

Value		Meaning
0	Normal	No change
1	Inverted	*"Invert motor phase sequence"* The direction of rotation of the motor is changed. The counting direction of the encoder for speed detection (if present) remains unchanged.
2	Inverted by encoder	As for setting {1}, however in addition the counting direction of the encoder is changed.

5.1.7 Information

P700	Actual operating status	
Display range	0 … 2990	
Arrays	[-01] = Current fault	Indicates the currently active (unacknowledged) error.
	[-02] = Actual warning	Indicates a present warning message.
	[-03] = Reason FI blocked	Indicates the reason for active switch-on inhibit.
	[-04] = Extended error (DS402)	Displays the currently active error according to DS402 terminology.
Description	Messages (coded) on the actual operating status of the frequency inverter such as faults, warnings or the cause of a switch-on inhibit (see chapter 0 "Error messages" on page 114).	
Note	Display of bus-level error messages is in decimal integer format. The displayed value must be divided by 10 in order to correspond with the correct format. Example: Display: 20 → Error number: **2.0**	

P701	Last fault
Display range	0.0 … 999.9
Arrays	[-01] … [-10]
Description	"*Last fault 1 … 10*". This parameter stores the last 10 faults .

P702	Freq. last error	S
Display range	-400.0 … 400.0 Hz	
Arrays	[-01] … [-10]	
Description	"Frequency l*ast error 1 … 10*". This parameter stores the output frequency that was being delivered at the time the fault occurred. The values of the last 10 errors are stored.	

P703	Current last error	S
Display range	0.0 ... 500 A	
Arrays	[-01] … [-10]	
Description	"*Current last error 1 … 10*". This parameter stores the output current that was being delivered at the time the fault occurred. The values of the last 10 errors are stored.	

P704	Volt. last error	S
Display range	0... 500 V AC	
Arrays	[-01] … [-10]	
Description	"*Last voltage error 1 … 10*". This parameter stores the output voltage that was being delivered at the time the fault occurred. The values of the last 10 errors are stored.	

P705	Dc.lnk volt. last er.	S
Display range	0 ... 1000 V DC	
Arrays	[-01] … [-10]	
Description	"*Link circuit voltage last error 1 … 10*". This parameter stores the link circuit voltage that was being delivered at the time the error occurred. The values of the last 10 errors are stored.	

P706	P set last error	S
Display range	0 ... 3	
Arrays	[-01] … [-10]	
Description	"*Parameter set last error 1 … 10*". This parameter stores the parameter set code that was active when the error occurred. Data for the previous 10 faults are stored.	

P707	Software-Version	
Display range	0.0 … 999.0	
Arrays	[-01] = IO Version [-02] = IO Revision [-03] = IO Special version [-04] = RG Version [-05] = RG Revision [-06] = RG Special version [-07] = IO Boot version [-08] = RG Boot version [-09] = Update file version	Version number (e.g.: V1.0) Revision number (e.g.: R1) Special version of hardware/software (e.g. 0.0). The value “0” means “Standard version”.
Description	Display of software version (firmware version) of device	

P708	State of digital in.	
Display range	0000 0000 … 0000 1111 (bin)	0000 … 000F (hex)
Description	Display of switching status of the digital inputs	

	Bits 15-12	Bits 11-8	Bits 7-4	Bit 3-0	
Minimum value	0000 **0**	0000 **0**	0000 **0**	0000 **0**	Binary **hex**
Maximum value	0000 **0**	0000 **0**	0000 **0**	1111 **F**	Binary **hex**

Display values	**Value (Bit)**	**Meaning**
	1 — Digital input 1	Switching status of digital input 1
	2 — Digital input 2	Switching status of digital input 2
	4 — Digital input 3	Switching status of digital input 3
	8 — Digital input 4	Switching status of digital input 4

P711	State of digital out	
Display range	0000 0000 … 0000 0011 (bin)	0000 ... 0003 (hex)
Description	"*State of digital outputs*". Displays the status of the digital outputs in hexadecimal code.	

	Bits 15-12	Bits 11-8	Bits 7-4	Bit 3-0	
Minimum value	0000 **0**	0000 **0**	0000 **0**	0000 **0**	Binary **hex**
Maximum value	0000 **0**	0000 **0**	0000 **0**	0011 **3**	Binary **hex**

Setting values	**Value (Bit)**	**Meaning**
	0 — Digital output 1	Switching state Digital output 1 (DO1)
	1 — Digital output 2	Switching state Digital output 2 (DO2)

P712	Energy consumption
Display range	0.00 ... 19 999 999.99 kWh
Description	Displays the energy consumption (cumulative energy consumption over the life of the FI).

P713	Braking resistor energy	
Display range	0.00 ... 19 999 999.99 kWh	
Description	"*Energy output via braking resistor*". Displays the energy consumption of the braking resistor (cumulative energy consumption over the life of the device).	

P714	Operating time	
Display range	0.00 ... 19999999.99 h	
Description	Duration of the device's operational readiness and availability of mains voltage (cumulative value over the service life of the device).	

P715	Running time	
Display range	0.00 ... 19999999.99 h	
Description	Period of time during which the device was enabled and delivered power at the output (cumulative value over the service life of the device).	

P716	Actual frequency	
Display range	-400.0 ... 400.0 Hz	
Description	Displays the actual output frequency.	

P717	Actual speed	
Display range	-9999 ... 9999 rpm	
Description	Displays the actual motor speed calculated by the FI.	

P718	Current set freq.	
Display range	-400.0... 400.0 Hz	
Arrays	[-01] =	Actual setpoint frequency from the setpoint source
	[-02] =	Actual setpoint frequency after processing in the FI status machine
	[-03] =	Actual setpoint frequency after frequency ramp
Description	Displays the frequency specified by the setpoint.	

P719	Actual current	
Display range	0.0... 500.0 A	
Description	Displays the actual output current.	

P720	Act. torque current	
Display range	-500.0 ... 500.0 A	
Description	Displays the actual calculated torque-developing output current (active current). Basis for calculation is the motor data **P201... P209**. • Negative values = generator • Positive values = motor	

P721	Actual field current	
Display range	-500.0... 500.0 A	
Description	Displays the actual calculated field current (reactive current). The basis for calculation are the motor data **P201...**. **P209**.	

P722	Actual voltage	
Display range	0 ... 500 V	
Description	Displays the actual AC voltage supplied by the FI output.	

P723	Voltage -d	S
Display range	-500 ... 500 V	
Description	"*Actual voltage component Ud*". Displays the actual field voltage component.	

P724	Voltage -q	S
Display range	-500 ... 500 V	
Description	"*Actual voltage component Uq*". Displays the actual torque voltage component.	

P725	Present cos phi
Display range	0.00 ... 1.00
Description	Displays the actual calculated cos φ of the drive.

P726	Apparent power
Display range	0.00 ... 300.00 kVA
Description	Displays the actual calculated apparent power. Basis for calculation is the motor data **P201 ... P209**.

P727	Mechanical Power
Display range	-99.99 ... 99.99 kW
Description	Displays the actual calculated effective power of the motor. Basis for calculation is the motor data **P201 ... P209**.

P728	Input voltage
Display range	0 ... 1000 V
Description	"*Mains voltage*". Displays the actual mains voltage at the FI input. This is directly determined from the amount of the intermediate circuit voltage

P729	Torque
Display range	-400 ... 400 %
Description	Displays the actual calculated torque. Basis for calculation is the motor data **P201 ... P209**.

P730	Field
Display range	0 ... 100 %
Description	Displays the actual field in the motor calculated by the inverter. Basis for calculation is the motor data **P201 ... P209**.

P731	Parameter set			
Display range	0 … 3			
Description	Displays the actual operating parameter set.			
Display values	**Value**	**Meaning**	**Value**	**Meaning**
	0	Parameter set 1	2	Parameter set 3
	1	Parameter set 2	3	Parameter set 4

P732	Phase U current	S
Display range	0.0... 500.0 A	
Description	Displays the actual U phase current.	
Note	This value can deviate from the value in **P719** due to the measurement procedure used, even with symmetrical output currents.	

P733	Phase V current	S
Display range	0.0... 500.0 A	
Description	Displays the actual V phase current.	
Note	This value can deviate from the value in **P719** due to the measurement procedure used, even with symmetrical output currents.	

P734	Phase W current	S
Display range	0.0... 500.0 A	
Description	Displays the actual W phase current.	
Note	This value can deviate from the value in **P719** due to the measurement procedure used, even with symmetrical output currents.	

P735	Speed encoder	S
Display range	-9999 … 9999 rpm	
Arrays	[-01] = Universal	[-02] = HTL
Scope of application	**[-01], [-02] SK 31xP and higher**	
Description	Displays the actual speed supplied by the encoder. P301 / P605 must be set, depending on the encoder which is used.	

P736	Link voltage
Display range	0 … 1000 V
Description	"*Link voltage*". Displays the actual link circuit voltage.

P737	Usage rate brakeres.
Display range	0 … 1000%
Description	"*Actual braking resistor usage rate*". In generator mode, this parameter provides information about the actual usage rate of the braking resistor (on condition that **P556** and **P557** are parameterised) or the actual modulation rate of the brake chopper (on condition that **P557 = 0**).

P738	Usage rate motor	
Display range	0 … 1000 %	
Arrays	[-01] = relative to I_{Nenn}	[-02] = relative to I^2t
Description	"*Actual usage rate of motor*". Displays the actual motor usage. Basis for the calculation is the motor data **P203** and the current which is actually consumed.	

P739	Temperature	
Display range	-150 ... 150 °C	
Arrays	[-01] = Heatsink	Actual temperature of the heat sink This value is used for overtemperature switch-off **E001.0**
	[-02] = Ambient dc-link	Actual temperature of the interior of the power section of the inverter. This value is the basis for overtemperature switch-off **E001.1.**
	[-03] = Reserved	
	[-04] = Microcontroller	Actual temperature of the microprocessor in the control section of the inverter. This value is the basis for overtemperature switch-off **E001.1.**
Description	Displays the actual temperature values at various measuring points.	

P740	PZD bus in		S
Display range	0000 … FFFF (hex)		
Arrays	[-01] = Control word	Control word	
	[-02] = Set value1 … [-06] = Setvalue 5	Set value data from main set value **P509**	
	[-07] = Res. stat.InBit **P480**	The displayed value depicts all Bus In Bit sources linked with an “OR”.	
	[-08] = Parameter data In 1 … [-12] = Parameter data In 5	Data during parameter transfer: Order label (AK), Parameter number (PNU), Index (IND), Parameter value (PWE 1/2)	
	[-13] = Control Word PLC	Control word, source PLC	
	[-14] = Setvalue 1 PLC … [-18] = Setvalue 5 PLC	Setvalue data from the PLC.	
	[-19] = Main set value	Main set value from the PLC	
	[-20] = Control byte 1 PLC	The first byte of the auxiliary control word with defined functionalities for IO control via PLC. 01h Fixed frequency 1 02h Fixed frequency 2 04h Fixed frequency 3 08h Fixed frequency 4 10h Fixed frequency 5 20h Jog frequency 40h Maintain the frequency with motor potentiometer	
	[-21] = Control byte 2 PLC	The second byte of the auxiliary control word with defined functionalities for IO control via PLC. 01h Fixed frequency array Bit 0 02h Fixed frequency array Bit 1 04h Fixed frequency array Bit 2 08h Fixed frequency array Bit 3 10h Fixed frequency array Bit 4 20h Motor potentiometer function activated 40h Increase motor potentiometer frequency 80h Reduce motor potentiometer frequency	
	[-22] = Res. controlword FI	*"Resulting control word"* – Control word for the frequency inverter which is formed from variable control words (depending on P551).	
Description	This parameter provides information about the actual control word and the setpoints that are transferred via the bus systems.		
Note	For display, a Bus system must be selected in P509 Scaling: 📖 8.5 "Scaling of setpoint/actual values "		

P741	PZD bus out		S
Display range	0000 … FFFF (hex)		
Arrays	[-01] = Status word bus	Status word corresponding to selection in P551	
	[-02] = Bus actual value 1 … … [-06] = Bus actual value 5	Actual values according to P543	
	[-07] = Res.stat.OutBit P481	The displayed value depicts all Bus OUT Bit sources linked with an "*OR*".	
	[-08] = Parameter data Out 1 … … [-12] = Parameter data Out 5	Data during parameter transfer.	
	[-13] = Status word PLC	Status word via PLC	
	[-14] = Actual value 1 PLC … … [-18] = Actual value 5 PLC	Actual value via PLC	
	[-19] = Res. status word FI	*"*Resulting *status word"* – Status word from the frequency inverter	
Description	This parameter provides information about the actual status word and the actual values that are transferred via the bus systems.		
Note	Scaling: 🕮 8.5 "Scaling of setpoint/actual values "		

P742	Data base version	S
Display range	0 ... 9999	
Description	Displays the internal database version of the FI.	

P743	Inverter type
Display range	0.00 ... 250.00 kW
Description	Displays the rated power of the frequency inverter.

P744	Configuration	
Display range	0000 … FFFF (hex)	
Arrays	[-01] = Device version	Display of the device version
	[-02] = CU6 extension	Displays customer unit (SK CU6-…)
	[-03] = Additional interfaces	Displays communication interfaces
	[-04] = Functionalities	Displays device functions
Description	Displays the configuration of the device.	

Display values

Value	Meaning
Array [-01] - device version	
0512	Basic
0513	Advanced
0514	PNT
0515	EIP
0516	ECT

Array [-02] – CU6 extension	
0000	No extension
0001	STO
0002	Reserved
0003	Reserved
0004	Reserved
0005	Reserved
0006	Reserved

Array [-03] Additional interfaces	
Bit 0	Interface for IOE present
Bit 1	TTL encoder interface
Bit 2	HTL encoder functionality
Bit 3	Diagnostic interface
Bit 4	External 24 V supply
Bit 5	CU6 interface present

Array [-04] Functionalities	
Bit 0	POSICON functionality (PLC)
Bit 1	PLC functionality
Bit 2	Operation of a PMSM possible (PMSM)
Bit 3	Operation of a reluctance motor possible (SRM)
Bit 4	Delta Sigma current measurement
Bit 5	Encoder extension
Bit 6	Internal brake

P745	**Module version**	
Display range	-3276.8 … 3276.7	
Arrays	[-01] = CU6 version	[-05] = XU6 revision
	[-02] = CU6 revision	[-06] = XU6 special version
	[-03] = CU6 special version	[-07] = XU6 stack version 1
	[-04] = XU6 version	[-08] = XU6 stack version 2
Scope of application	**[-01] … [-08] SK 3x1P and higher**	
Description	Software version for optional hardware extensions. Have this data available in case of technical queries.	

P746	**Option Status**	**S**
Display range	0000 … FFFF (hex)	
Scope of application	**[-01] SK 3x1P**	
Description	Displays the actual status of the optional hardware extensions. 0 = Not ready 1 = Standby	

P747	**Inverter Volt Range**		
Display range	0 … 3		
Description	"*Inverter voltage range*". Indicates the mains voltage range for which this device is specified.		
Display values	0 = 100 V.. 200 V	1 = 200 V.. 240 V	2 = 380 V.. 480 V
	3 = 400 V.. 500 V		

P750	Error statistics	S
Display range	0 ... 9999	
Arrays	[-01] … [-25]	
Description	Display of the error messages which have occurred during operation (**P714**).	
Note	Depending on the frequency of the errors, the entries in the arrays are displayed in descending order. Therefore Array [-01] shows the error message which has occurred most frequently.	

P751	Counter statistics	S
Display range	0 ... 9999	
Arrays	[-01] … [-25]	
Description	Display of the frequency with which the errors according to **P750** have occurred.	
Note	The arrays of parameters **P750** and **P751** are directly related. Example: In **P751 [-01]**, the number of error messages according to **P750 [-01]** are displayed.	

P780	Device id
Display range	0 … 9 and A … Z (char)
Arrays	[-01] = … [-12]
Description	Display of the device's serial number (12-digit)
Note	• Display via NORDCON: as a contiguous serial number of the device • Display via bus: ASCII code (decimal). Each array must be read out separately.

P799	Op.-time last error
Display range	0.00 … 19 999 999.99 h
Arrays	[-01] … [-10]
Description	"*Operating time, last fault*". If a fault occurs, a time stamp is set on the basis of the operating hours counter **P714** and saved in **P799**. Array [-01]. [10] corresponds to the last faults 1 ... 10.

6 Operating status messages

In case of deviations from the normal operating status, a message is output. There are:

- Error messages: Faults cause the device to switch off.
- Warning messages: A limit value has been reached. The device will continue to run. If the cause for the warning persists, the device enters the fault state.
- Inhibit notification (switch-on block): External influences prevent starting.

The messages are stored in the information parameter **(P700)**.

6.1 Display of messages

LED indicators

The device status is indicated by an externally visible “device status” LED (📖 3.2 "Diagnostic LED ").

SimpleBox Display

The SimpleBox displays an error with its number and the prefix "E". In addition, the present fault can be displayed in array element [**-01**] of parameter (**P700)**. The last error messages are stored in parameter (**P701**). Further information about the frequency inverter status at the moment of the fault can be obtained from parameters (**P702**) to (**P706**) / (**P799**)

If the cause of the error is no longer present, the error display in the SimpleBox flashes and the error can be acknowledged with the Enter key.

In contrast, warning messages are prefixed with "C" ("**Cxxx**") and cannot be acknowledged. They disappear automatically when the reason for them is no longer present or the frequency inverter has switched to the "Error" state. Display of the message is suppressed if the warning appears during parameterisation.

The present warning message can be displayed in detail at any time in array element [**-02**] of parameter (**P700**).

The reason for an existing disabled switch on cannot be displayed with the SimpleBox.

ParameterBox display

The ParameterBox displays the messages in plain text.

6.2 Messages

In the following tables you will find a list of possible errors, a description of the cause and instructions for troubleshooting. Under “Further notes” you will find solution approaches related to parameterisation.

Error messages

Coding		ERROR TEXT	Cause • Remedy
Group	Number		
E001	**1.0**	**Inverter overtemp.**	Temperature monitoring of the inverter Temperature range has been exceeded or undershot. • Reduce or increase ambient temperature • Check fan or cabinet ventilation • Check the device for dirt Further notes: • see (**P739)** for temperature display
E001	**1.1**	**Intern. inverter temp**	Temperature monitoring of the inverter Temperature range has been exceeded or undershot. • Reduce or increase ambient temperature • Check fan or cabinet ventilation • Check the device for dirt Further notes: • see (**P739**) for temperature display
E002	**2.0**	**Motor overtemp.PTC**	Motor temperature sensor (PTC resistor), the separate PTC resistor input or KTY / PT1000 have triggered at the analogue input (P400 = 48) • Reduce motor load • Increase motor speed • Install external motor fan or check the function Further notes: • Check parameter setting (**P425**)
E002	**2.1**	**Motor overtemp.I²t**	The inverter has detected an impermissible motor temperature (motor I^2t). • Reduce motor load • Increase motor speed • Repeat stator resistance measurement 5.1.3 "Motor data"
E002	**2.2**	**Overtemp. DIN**	The digital input function **P420 / P480 {13}** *"PTC resistor input"* has triggered. The digital input is "low". • Check connection and thermostat
E003	**3.0**	**Overcurrent I²t lim.**	The current limit (I^2t) has been exceeded (e.g more than 1.5x the rated current for 60 s). • Reduce motor load • Check system for blockage or overload • Check rotary encoder settings (resolution, defect, connection) Further notes: • Adjust the current limit by changing the pulse frequency (**P504**).
E003	**3.1**	**Overcurrent chopper**	The current limit (I^2t) of the brake chopper has been exceeded (e.g more than 1.5 x rated current for 60 s). • Avoid overcurrent in braking resistor • Check braking resistor values (**P555**, **P556**, **P557** and **P554**, if available)

E003	**3.2**	**Overcurrent IGBT**	The drive is running above its possible power (125% overcurrent for 50 ms). • Reduce motor load • Check the available inverter power via derating tables (e.g. increased pulse frequency)
E003	**3.3**	**Overcurrent IGBT fast**	The drive is running above its possible power (200% overcurrent). • Reduce motor load • Check available inverter power via derating tables (e.g. increased pulse frequency)
E003	**3.4**	**Overcurrent chopper**	Brake chopper current too high • Avoid overcurrent in braking resistor
E003	**3.7**	**Power limit input**	Input current too high. Continuous overload at FI Input. Shutdown for 150% overload within 60 s. • Reduce motor load • Check system for blockage or overload Further notes: • Shortening of the shutdown time due to – Higher loads – Frequent overloads • If the mains voltage is in the lower tolerance range, the input current increases
E004	**4.0**	**Module overcurrent**	Module error • Short circuit or earth fault at the FI output (motor cable or motor) • Check optional braking resistor Further notes: • The error also occurs if: – Size of breaking resistor is wrong – Motor cable too long • Do not disconnect (**P537**)! • **The error may significantly reduce the service life of the device or even destroy it**
E004	**4.1**	**Overcurrent measurem.**	Pulse switch-off (**P537**) has been reached three times within 50 ms. • Reduce motor load • Check system for blockage or overload Further notes: • Error message is only possible if (**P112**) and (**P536**) are switched off • Check motor data settings on the device (**P201** … **P209**) and check motor dimensioning • Check ramp times (**P102/P103**)
E004	**4.5**	**Overcurr.brake rect.**	Holding brake malfunction at the motor • Check holding brake, e.g. for mechanical blocking • Check brake rectifier • Check connections and cables on both sides

E005	**5.0**	**Overvoltage Ud**	DC link voltage is too high. → The drive is overloaded during the braking process. → The braking resistor itself or connections and cables to the braking resistor are defective. • Check dimensioning of the braking resistor Further notes: • Extend deceleration time (**P103**) • Extend quick stop time (**P426**) • Speed fluctuation (for example due to high inertia loads) → if necessary set the <U/f characteristic curve (**P211, P212**) • Set switch-off mode (**P108**) with delay (not permissible for lifting equipment)
E005	**5.1**	**Mains overvoltage**	Mains voltage is too high. • Check if the device is suitable for electrical connection to the supply network
E006	**6.0**	**Charging error**	DC link voltage is too low. • Check if the device is suitable for electrical connection to the supply network (see 7 "Technical data")
E006	**6.1**	**Mains low voltage**	Mains voltage is too low. • Check if the device is suitable for electrical connection to the supply network (see 7 "Technical data")
E007	**7.0**	**Mains Phase Failure**	Error at mains connection side • Check all mains phases for availability (see technical data 7 "Technical data") • Mains is asymmetrical
E007	**7.1**	**Phasefailure dc-link**	Mains phase error • Check all mains phases for availability (see technical data 7 "Technical data")
E008	**8.0**	**Parameter loss** (maximum EEPROM value exceeded)	Error in EEPROM data • Software version of the stored data set not compatible with the software version of the FI **Note**: Faulty parameters are automatically reloaded (factory setting). • EMC interferences (see also **E020**)
E008	**8.1**	**Inverter ID error**	• EEPROM faulty
E008	**8.2**	**Extern. EEPROM error**	• Check ControlBox for correct position • ControlBox EEPROM defective (**P550 = 1**)
E008	**8.4**	**Internal EEPROM error** (Database version incorrect)	The configuration of the frequency inverter was not correctly identified. • Switch the mains voltage off and on again.
E008	**8.7**	**EEPROM copy differs**	The configuration of the frequency inverter was not correctly identified. • Switch the mains voltage off and on again
E010	**10.3**	**Bus time-out**	Bus module telegram time-out by **(P513)** • Timeout triggered by parameter **(P513**.
E010	**10.4**	**Init-error option**	Bus module initialisation failure • Restart the frequency inverter (switch the power supply off and on again) • DIP switch of a connected I/O extension defective

E010	**10.5**	**System error option**	• External bus module • netX & control system controller software not compatible
E010	**10.6**	**Ethernet cable**	• Ethernet cable not connected or connection defective
E010	**10.7**	**System error option**	System error bus module • Further details can be found in the respective additional bus instructions I/O extension: • Incorrect measurement of the input voltage or undefined provision of the output voltage due to error in reference voltage generation • Short circuit at analogue output
E010	**10.8**	**System bus error**	• Error between bus interface and frequency inverter
E010	**10.9**	**Module missingP120**	The module stated in parameter **(P120)** is not present. • Check connections and cables on both sides
E012	**12.0**	**External watchdog**	Time monitoring of digital inputs A digital input has been set to the watchdog function. • Check the digital inputs Further notes: • Check setting **P420** • Check setting **P460**
E012	**12.1**	**Limit moto./Customer**	The drive switch-off limit has triggered. • Reduce motor load • Check system for blockage or overload Further notes: • Check settings **P534 [-01]**
E012	**12.2**	**Limit gen.**	The machine drives the motor and puts it into generator operation. The generator switch-off limit has triggered. • Reduce (generator) motor load • Check system for overload Further notes: • Check settings **P534 [-02]**
E012	**12.3**	**Torque limit**	A parameterised limit value for the torque has been reached. • Limitation of the setpoint source has switched off.
E012	**12.4**	**Current limit**	Limitation of the setpoint source has switched off.
E012	**12.5**	**Load monitor**	Switch-off due to overshooting or undershooting of permissible load torques (**P525 … P529**) for the time set in (**P528**). • Adjust load Further notes: • Change limit values (**P525 … P527**) • Increase delay time (**P528**) • Change monitoring mode (**P529**)

E013	**13.0**	**Encoder error**	No signal from encoder • Check connections and cables on both sides • Check mechanical installation of encoder Further notes: • Check encoder type and parameterisation • Check voltage supply • Check cable routing (EMC) • After reaching a slip error the encoder does not deliver pulses (Example: the motor shaft is at a standstill)
E013	**13.1**	**Speed slip error**	The difference between measured and calculated speed has exceeded a limit value. • Check mechanical installation of encoder • Check system for blockage or overload Further notes: • Check limit values (**P327**) and (**P328**) • Increase acceleration times The inverter is in derating mode. The current required for acceleration is not available (see FAQ).
E013	**13.2**	**Disconnect. control**	The slip error switch-off monitoring has triggered. The motor could not follow the setpoint. • Check system for blockage or overload Further notes: • Check motor data (**P201** … **P209**) • Check motor circuit • Check encoder settings (**P300**) and following in servo mode • Increase value for torque current limit in (**P112**) • Increase value for current limit in (**P536**) • Check deceleration time (**P103**) and extend if necessary
E013	**13.3**	**Slipfault encoder**	Incorrect direction of rotation • Check connections
E013	**13.5**	**Fly.saw acceleration** **(Only for NORDAC *ON*+)**	Acceleration time too low Error message for POSICON → 🕮 Manual BU 0810
E013	**13.6**	**Fly.saw wrong value** **(Only for NORDAC *ON*+)**	Way and speed prefixes do not match Error message for POSICON → 🕮 Manual BU 0810
E013	**13.8**	**Limit switch right** **(Only for NORDAC *ON*+)**	Error message for POSICON → 🕮 Manual BU 0810
E013	**13.9**	**Limit switch left** **(Only for NORDAC *ON*+)**	Error message for POSICON → 🕮 Manual BU 0810
E014	**14.2**	**Reference pnt. error** **(Only for NORDAC ON+)**	An error has occurred while reading the reference point. • Restart device
E014	**14.4**	**Abs.encoder error** **(Only for NORDAC ON+)**	An error has occurred while reading the absolute encoder position.
E014	**14.5**	**Pos diff.<> Speed** **(Only for NORDAC ON+)**	
E014	**14.6**	**Diff.betw.Abs.& Inc.** **(Only for NORDAC ON+)**	
E014	**14.7**	**Max pos overshoot** **(Only for NORDAC ON+)**	
E014	**14.8**	**Min pos undershoot** **(Only for NORDAC ON+)**	

E016	**16.0**	**Motor phase failure**	A motor phase is not connected. • Check connections and cables on both sides • Check the motor Further notes: • Check (**P539**)
E016	**16.1**	**Magn. current watch**	Required exciting current not achieved at moment of switch-on. • Check connections and cables on both sides • Check the motor Further notes: • Check (**P539**) • Check motor data (**P201** … **P209**)
E016	**16.2**	**Change phase direct.**	The motor phase sequence (U – V – W) has been changed during operation (enable). Further notes: • Check parameter values in (**P583**) • Has parameter set (**P100**) been switched over?
E016	**16.5**	**Incorrect brake data**	Current/voltage ratio of mechanical brake is incorrect. • Compare the brake data with P280 and P281.
E016	**16.6**	**Incorrect brake actuation time**	Mechanical brake actuation times does not match P107 and P114. • Check the settings of P280 and P281. • Check brake mechanics (anchor plate, air gap).
E017	**17.0**	**Change assembly grp.**	The customer unit (SK CU6-…) is not recognised by the frequency inverter. • EMC faults • Check cable shielding and earthing terminals of electrical components
E018	**18.0**	**Safety circuit**	The Safe Pulse Block safety circuit has triggered during release.
E018	**18.5**	**Safety SS1**	The parameterised trigger time (**P423**) of the SS1-t functionality has expired. STO is triggered as the inverter still sends output pulses. This error cannot be acknowledged. Restart the frequency inverter (Power Off → 120 s → Power On).
E018	**18.6**	**Safety system**	Safety function error: This error cannot be acknowledged.
E019	**19.0**	**Parameter ident.**	Automatic identification of the connected motor has failed. • Check connections and cables on both sides • Check the motor Further notes: • Check motor data (**P201** … **P209**)
E019	**19.1**	**Rotor position**	Incorrect result for motor position identification by test signal method.
E022	**22.0**	**No PLC program**	The PLC has been started but there is no PLC program in the device. • Load PLC program into the device
E022	**22.1**	**Checksum PLC progr.**	The checksum check via the PLC program produced an error. • Restart device (power ON) • Reload the PLC program
E022	**22.2**	**PLC jump illegal**	A jump command points to an invalid address.

E022	**22.3**	**PLC stack fault**	More than 7 bracket levels were opened during the run time of the program. • Check the program for run time errors
E022	**22.4**	**PLC max cycl.reached**	The stated maximum cycle time for the PLC program was exceeded. • Adjust cycle time • Check program
E022	**22.5**	**PLC unknown comm.**	A command code in the program cannot be executed because it is not known. • Program error, behaviour as for Error 22.1 • Version of the PLC and the NORDCON version do not match
E022	**22.6**	**PLC write access**	The program content has been changed while the PLC program was running.
E022	**22.9**	**PLC fault**	Group error
E023	**23.0 … 23.7**	**PLC user fault 1 … 8**	Error in the PLC program sequence. Triggered by writing the process variable "ErrorFlags".
E024	**24.0 … 24.7**	**PLC user fault 9 … 16**	Error in the PLC program sequence. Triggered by writing the process variable "ErrorFlags".
E025	**25.0**	**Hiperface monitoring**	An error has been detected in the absolute encoder / incremental encoder via Hiperface monitoring.
E025	**25.1**	**Communication error**	A communication error has been detected while monitoring the encoders. • If no encoder has been installed, select setting { 1 } TTL for P302
E025	**25.2**	**No encoder detected**	No encoder has been detected. • Check cable connection to encoder
E025	**25.3**	**Resolution not possible**	The parameterised encoder resolution is not possible with the connected encoder. • Check parameterisation P300, P301
E025	**25.4**	**Encoder error**	An internal error has occurred in the encoder.
E025	**25.5**	**Parameter error**	2 different encoder types are set. Only one multiturn encoder is allowed to be set in the P604 parameter sets. • Check parameters
E090	**90.0**	**System error**	Unknown error code from sub system. The FI has received an error code from an external unknown module. FI update required. The new, extended error code can be read from **P700 [-04]** . This allows the error to be distinguished. • Restart device
E110	**110.0**	**Safety checksum**	An incorrect checksum has been detected for P499. • Restart device
E110	**110.1**	**Safety checksum**	The value for P499 has been changed. • Restart device
E110	**110.2**	**Safety param.passw.**	Safety requires parameter password. • Set a safety password in P498

Warnings

Coding		ERROR TEXT	Cause • Remedy
Group	Number		
C001	**1.0**	**Inverter overtemp.**	Temperature monitoring of the inverter Temperature range has been exceeded or undershot. • Reduce or increase ambient temperature • Check fan or cabinet ventilation • Check the device for dirt Further notes: • see **P739** for temperature display
C002	**2.0**	**Motor overtemp. PTC**	Warning from the motor temperature sensor (trigger limit reached) • Reduce motor load • Increase motor speed • Install external motor fan or check the function Further notes: • Check parameter setting **P425**
C002	**2.1**	**Motor overtemp. I2t**	The inverter has detected an impermissible motor temperature (motor I^2t). • Reduce motor load • Increase motor speed • Repeat stator resistance measurement 5.1.3 "Motor data"
C002	**2.2**	**Ext resistor temp.**	Temperature sensor (e.g. braking resistor) has been triggered. The digital input is “low”. • Check connection and temperature sensor
C003	**3.0**	**Overcurrent I^2t lim.**	The current limit (I^2t) has been exceeded (e.g more than 1.3 x rated current for 60 s). • Reduce motor load • Check system for blockage or overload • Check rotary encoder settings (resolution, defect, connection) Further notes: • Adjust the current limit by changing the pulse frequency (**P504**).
C003	**3.1**	**Overcurrent chopper**	The current limit (I^2t) of the brake chopper has been exceeded (e.g more than 1.3 x rated current for 60 s). • Avoid overcurrent in braking resistor Further notes: • Check braking resistor values (**P555, P556, P557** and **P554**, if available)
C003	**3.5**	**Torque limit**	The limit value of the torque generating current (parameterised, mechanical load limit) has been reached. • Check system for blockage or overload Further notes: • Check value in **P112**.

C003	**3.6**	**Current limit**	The limit value of the FI output current (parameterised FI load limit) has been reached. • Check system for blockage or overload Further notes: • Check **P536**
C003	**3.7**	**Real power**	Input current too high. Drive is running at the load limit. • Reduce motor load • Check system for blockage or overload Further notes: • Shortening of the shutdown time due to - Higher loads - Frequent overloads • If the mains voltage is in the lower tolerance range, the input current increases
C004	**4.1**	**Overcurrent measurem.**	The pulse disconnection (**P537**) has been achieved. • Reduce motor load • Check system for blockage or overload Further notes: • Error message is only possible if (**P112**) and (**P536**) are switched off • Check motor data settings on the device (**P201 … P209**) and check motor dimensioning • Check ramp times (**P102/P103**)
C008	**8.0**	**Parameter loss**	One of the cyclically saved messages such as operating hours or enabling time could not be saved successfully. The warning expires as soon as saving can be successfully performed again.
C012	**12.1**	**Limit moto./Customer**	The motor switch-off limit is reached. • Reduce motor load • Check system for blockage or overload Further notes: • Check settings **P534 [-01]**
C012	**12.2**	**Limit gen.**	The machine drives the motor and puts it into generator operation. Warning: 80% of the generator switch-off limit have been reached. • Reduce (generator) motor load • Check system for overload Further notes: • Check settings **P534 [-02]**
C012	**12.3**	**Torque limit**	- -
C012	**12.5**	**Load monitor**	Overshooting or undershooting of permissible load torques (**P525 … P529**) for half of the time set in (**P528**). • Adjust load Further notes: • Change limit values (**P525 … P527**) • Increase delay time (**P528**) • Change monitoring mode (**P529**)
C025	**25.4**	**Universal encoder warning**	The universal encoder issues a warning to the FI

Switch-on blocks

Coding		ERROR TEXT	Cause • Remedy
Group	Number		
I0	**0.1**	**Volt. blocked by IO**	The input which is parameterised with the “Voltage disable” function (**P420/P480**) is not set (“Low”). • Set input (“High”) • Check connections and cables on both sides Further notes: • Check parameterisation of digital functions (**P420**/ **P480**)
I0	**0.2**	**Quick stop by IO**	The input which is parameterised with the “Quick stop” function (**P420/P480**) is not set (“Low”). • Set input (“High”) • Check connections and cables on both sides Further notes: • Check parameterisation of digital functions (**P420**/ **P480**)
I0	**0.3**	**Volt. blocked by Bus**	If “Source control word” (**P509**) is not 0 or 1, Bit 1 is not set in the control word (“Low”). Further notes: • Set Bit 1 to “High“ in the control word
I0	**0.4**	**Quick stop by Bus**	If “Source control word” (**P509**) is not 0 or 1, Bit 2 is not set in the control word (“Low”). Further notes: • Set Bit 2 to “High“ in the control word
I0	**0.5**	**Enable at start**	Enable signal was already applied during the initialisation phase of the frequency inverter (mains or control voltage "ON"). Or the frequency inverter switches from the “Fault” or “Switch-on inhibit” state to the “Ready” state although the enable is still active. • Deactivate enable signal Further notes: • Activate “Automatic starting“ (**P428**) NOTICE! Risk of injury! Drive starts up immediately! • Check enable signals – Digital inputs (**P420**) – BUS IO In (**P480**) – Control word (**P740**)
I0	**0.6**	**Volt. blocked by PLC**	Information message for PLC → see supplementary manual BU 0550
I0	**0.7**	**Quickstop by PLC**	Information message for PLC → see supplementary manual BU 0550
I000	**0.8**	**Right dir. locked**	Switch-on inhibit with inverter shut-off activated by: • **P540** or by “Block enable right” (**P420 = 31**, **73**) The frequency inverter switches to "Ready to switch-on" status.
I000	**0.9**	**Left dir. locked**	Switch-on inhibit with inverter shut-off activated by: • **P540** or by “Block enable left” (**P420 = 32, 74**) The frequency inverter switches to "Ready to switch-on" status.
I6	**6.0**	**Charging error**	Charging relay not energised, because: • Mains / link voltage too low • Mains voltage failure

I018[1)]	**18.0**	Reserved	Information message for “Safe Stop” → function, see supplementary manual

6.3 FAQ operational problems

Fault	Possible cause	Remedy
Device will not start (all LEDs off)	• No mains voltage or wrong mains voltage	• Check connections and supply cables • Check switches / fuses
Device does not react to enabling	• Control elements not connected • Incorrect control word source setting • Right and left enable signals present simultaneously • Enable signal present before device ready for operation (device expecting a 0 → 1 edge)	• Reset enable • Change over **P428** if necessary: "0" = device expecting a 0→1 edge for enable / "1" = device reacts to "Level" → ***Danger:*** *Drive can start up independently!* • Check control connections • Check **P509**
Motor will not start in spite of enable being present	• Motor cables not connected • Brake not ventilating • No setpoint specified • Incorrect setpoint source setting	• Check connections and supply cables • Check control elements • Check **P510**
Device switches off without error message when load increases (increased mechanical load / speed)	• Mains phase missing	• Check connections and supply cables • Check switches / fuses
Motor rotates in the wrong direction	• Motor cable: U-V-W incorrectly connected	• Motor cable: Change 2 phases • Alternative: – Check motor phase sequence (**P583**) – Change Enable right/left functions (**P420**) – Change control word Bit 11/12 (for bus control)
Motor not reaching required speed	• Maximum frequency parameter setting too low	• Check **P105**
Motor speed does not correspond to the setpoint specification	• Setpoint specification via BUS IO Bit is not correct	• Check **P465** • Check **P509 / P510** • Check **P546** • **P104/ P105** Check “Min./ max. –frequency”
Motor generating a considerable amount of noise (at the current limit) and "OFF" signal is implemented at slow speed with little or no control, possibly with error message 3.0	• Tracks A and B swapped round by encoder (for speed feedback) • Incorrect encoder resolution setting • Encoder power supply missing • Encoder faulty	• Check encoder connections • Check **P300, P301** • Monitor via **P735** • Check encoder

7 Technical data

7.1 General Data Frequency inverter

Function	Specification
Output frequency	0.0 … 400.0 Hz
Pulse frequency	3.0 … 16.0 kHz, factory setting = 6 kHz Power reduction > 6 kHz for 400 V devices
Typical overload capacity	150% for 60 s, 200% for 15 s, 250% for 1.5 s
Frequency inverter efficiency	> 95% according to size
Energy efficiency	IE2 🕮 7.2 "Technical data for determining the energy efficiency level "
Insulation resistance	> 5 MΩ
Operating / ambient temperature	Size 1: -30 °C … +40 °C (S1 - 100% ED), -30 °C … +50 °C (S3 - 70% ED) Size 2: -30 °C … +50 °C (S1 - 100% ED), -30 °C … +50 °C (S3 - 50% ED motor-mounted, S3 – 60% ED wall-mounted) Size 3:-30 °C … +40 °C (S1 - 100% ED), -30 °C … +50 °C (S3 - 70% ED) Detailed information (including UL values) on individual device types and operating modes: 🕮 1.7 "Standards and approvals"
Storage and transport temperature	-30°C … +60°C
Long-term storage temperature	< 50 °C
Protection class	IP55 (without painting), IP66 (with painting)
Max. installation altitude above sea level	*up to 1000 m* No power reduction, overvoltage category 3 *1000...2000 m:* 1% / 100 m power reduction, overvoltage category 3 *2000...4000 m:* 1% / 100 m power reduction, overvoltage category 2, external overvoltage protection required at mains input
Ambient conditions	*Transport (IEC 60721-3-2:)* Mechanical: 2M1 *Operation (IEC 60721-3-3):* 3K3
Environmental protection	*Energy-saving function* 🕮 8.4 "Options for optimising the energy efficiency", see **P219** *EMC* 🕮 8.1 "Electromagnetic compatibility (EMC)" *RoHS* 🕮 1.7 "Standards and approvals"
Protective measures against	Overtemperature of the frequency inverter Short-circuit, earth fault Overvoltage and undervoltage Overload
Motor temperature monitoring	I^2t motor, PTC/bimetallic switch
Regulation and control	Sensorless current vector control (ISD), linear V/f characteristic curve, VFC open-loop, CFC open-loop, CFC closed-loop
Waiting period between two mains switch-on cycles	60 s for all devices in normal operating cycle
Interfaces	*Standard* RS485 (USS) (for parameterisation units only) RS232 (single slave) *Option* Bluetooth via NORDAC ACCESS BT
Electrical isolation	Control terminals
Electrical connection	*Power unit* 🕮 2.5 "Electrical Connection"

7.2 Technical data for determining the energy efficiency level

The following tables relate to the provisions of the Ecodesign EU Regulation 2019/1781.

Information

Calculation basis for the energy efficiency level

The energy efficiency specifications come from calculations according to **DIN EN 61800** *"Adjustable speed electrical power drive systems – Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications – Energy efficiency indicators for power drive systems and motor starters"*.

Simplifications are included in the calculation methods of the standard!

Manufact	FI type	Rel. losses [1] (rel. motor stator frequency / rel. torque-producing current)								Standby [2]	Standby [2] (UKCA)	IE rating
		90/100	90/50	50/100	50/50	50/25	0/100	0/50	0/25			
Getriebebau NORD GmbH & Co. KG	NORDAC *ON* SK 3xxP-	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[W]	[%]	
	360-340	6,1	5,3	5,6	5,1	5,1	5,3	5,0	5,0	4,6	1,24	IE2
	450-340	5,6	4,8	5,0	4,6	4,5	4,7	4,4	4,4	4,8	1,07	IE2
	370-340	6,0	5,4	5,7	5,3	5,2	5,5	5,2	5,1	5,6	1,52	IE2
	750-340	4,1	3,5	3,8	3,4	3,3	3,6	3,3	3,3	5,7	0,75	IE2
	950-340	3,9	3,0	3,5	2,9	2,7	3,3	2,8	2,6	5,2	0,55	IE2
	111-340	3,0	2,5	3,0	2,5	2,3	2,9	2,4	2,3	5,4	0,49	IE2
	151-340	2,9	2,3	2,8	2,3	2,1	2,7	2,2	2,0	5,4	0,36	IE2
	221-340	3,1	2,2	2,7	2,1	1,9	2,5	2,0	1,8	5,4	0,24	IE2
	301-340	2,8	2,2	2,7	2,1	1,9	2,6	2,1	1,9	5,4	0,18	IE2

1) Power losses in % of the rated apparent output power

2) Standby losses in % of the rated output power

Manuf	FI type	Output power	Indicative output power	Rated output current	Max. operating temperature	Rated input frequency	Rated input voltage range
Getriebebau NORD GmbH & Co. KG	NORDAC *ON* SK 3xxP-	[kVA]	[kW]	[A]	[°C]	[Hz]	[V]
	360-340	0,7	0,37	1,1	40	50	380 V – 480 V
	450-340	0,8	0,45	1,3	40	50	380 V – 480 V
	370-340	0,7	0,37	1,1	40	50	380 V – 480 V
	750-340	1,3	0,75	2,0	40	50	380 V – 480 V
	950-340	1,5	0,95	2,3	40	50	380 V – 480 V
	111-340	1,7	1,10	2,6	40	50	380 V – 480 V
	151-340	2,3	1,50	3,5	40	50	380 V – 480 V
	221-340	3,3	2,20	5,0	40	50	380 V – 480 V
	301-340	4,4	3,00	6,7	40	50	380 V – 480 V

7.2.1 Electrical data 3~400 V

7.2.1.1 NORDAC *ON*, size 1

Device type		SK 300P–360	SK 300P–450
With STO		–	–
Nominal power	400 V	0.37 kW	0.45 kW
	480 V	0.5 hp	0.6 hp
Mains voltage	**400 V**	EN: 3 AC 400 V -20% … 480 V +10%, 47 … 63 Hz UL: 3 AC 380Y/220...480Y/277 V -20%/+10% 47-63 Hz	
Input current	rms [1]	1.5 A FLA 1.1 A	1.7 A FLA 1.7 A
Output current	rms [1]	1.2 A FLA 1.1 A	1.5 A FLA 1.3 A
	I_{SC} = 10 kA	Fuses (AC) (maximum values)	
RK5	480 V	30 A	30 A
CB	480 V	30 A	30 A

1) Note the derating curve (🕮 Section 8.2 "Reduced output power")

7.2.1.2 NORDAC *ON*, size 2

Device type		SK 30xP–370	SK 30xP–750	SK 30xP–950
Nominal power	400 V	0.37 kW	0.75 kW	0.95 kW
	480 V	0.5 hp	1.0 hp	1.25 hp
Mains voltage	**400 V**	EN: 3 AC 400 V -20% … 480 V +10%, 47 … 63 Hz UL: 3 AC 380Y/220...480Y/277 V -20%/+10% 47-63 Hz		
Input current	rms [1]	1.1 A FLA 1.1 A	2.1 A FLA 2.1 A	2.6 A FLA 2.6 A
Output current	rms [1]	1.2 A FLA 1.1 A	2.2 A FLA 2.0 A	2.7 A FLA 2.4 A
	I_{SC} = 10 kA	Fuses (AC) (maximum values)		
RK5	480 V	30 A	30 A	30 A
CB	480 V	30 A	30 A	30 A

1) Note the derating curve (🕮 Section 8.2 "Reduced output power")

7.2.1.3 NORDAC *ON*+, size 2

Device type		SK 31xP–370	SK 31xP–750	SK 30xP–950
Nominal power	400 V	0.37 kW	0.75 kW	0.95 kW
	480 V	0.5 hp	1.0 hp	1.25 hp
Mains voltage	**400 V**	EN: 3 AC 400 V -20% … 480 V +10%, 47 … 63 Hz UL: 3 AC 380Y/220...480Y/277 V -20%/+10% 47-63 Hz		
Input current	rms [1]	1.1 A FLA 1.1 A	2.1 A FLA 2.1 A	2.6 A FLA 2.6 A
Output current	rms [1]	1.2 A FLA 1.1 A	2.2 A FLA 2.0 A	2.7 A FLA 2.4 A
	I_{SC} = 10 kA	Fuses (AC) (maximum values)		
RK5	480 V	30 A	30 A	30 A
CB	480 V	30 A	30 A	30 A

1) Note the derating curve (🕮 Section 8.2 "Reduced output power")

7.2.1.4 NORDAC *ON*+, size 3

Device type		SK 3xxP–111	SK 3xxP–151	SK 3xxP–221	SK 3xxP–301
Nominal power	400 V	1.1 kW	1.5 kW	2.2 kW	3.0 KW
	480 V	1.5 hp	2.0 hp	3.0 hp	4.0 hp
Mains voltage	**400 V**	EN: 3 AC 400 V -20% … 480 V +10%, 47 … 63 Hz UL: 3 AC 380Y/220...480Y/277 V -20%/+10% 47-63 Hz			
Input current	rms [1]	2.8 A FLA 2.1 A	3.6 A FLA 2.8 A	4.8 A FLA 3.6 A	6.4 A FLA 4.8 A
Output current	rms [1]	3.0 A FLA 2.7 A	3.8 A FLA 3.4 A	5.2 A FLA 4.6 A	7.2 A FLA 6.4 A
	I_{SC} = 10 kA	Fuses (AC) (maximum values)			
RK5 [2]	480 V	tbd	tbd	tbd	tbd
CB[2]	480 V	tbd	tbd	tbd	tbd

1) Note the derating curve (📖 Section 8.2 "Reduced output power")

2) Values are under clarification. Please consult NORD.

8 Additional information

8.1 Electromagnetic compatibility (EMC)

8.1.1 General Provisions

As of July 2007, all electrical equipment which has an intrinsic, independent function and which is sold as an individual unit for end users, must comply with Directive 2004/108/EEC (formerly Directive EEC/89/336). There are three different ways for manufacturers to indicate compliance with this directive:

1. *EU Declaration of Conformity*

   This is a declaration from the manufacturer, stating that the requirements in the applicable European standards for the electrical environment of the equipment have been met. Only those standards which are published in the Official Journal of the European Community may be cited in the manufacturer's declaration.

2. *Technical documentation*

   Technical documentation can be produced which describes the EMC characteristics of the device. This documentation must be authorised by one of the "Responsible bodies" named by the responsible European government. This makes it possible to use standards which are still in preparation.

3. *EU Type test certificate*

   This method only applies to radio transmitter equipment.

The devices only have an intrinsic function when they are connected to other equipment (e.g. to a motor). The base units cannot therefore carry the CE mark that would confirm compliance with the EMC directive. Precise details are therefore given below about the EMC behaviour of this product, based on the proviso that it is installed according to the guidelines and instructions described in this documentation.

The manufacturer can certify that his equipment meets the requirements of the EMC directive in the relevant environment with regard to their EMC behaviour in power drives. The relevant limit values correspond to the basic standards EN 61000-6-2 and EN 61000-6-4 for interference immunity and interference emissions.

8.1.2 EMC evaluation

Two standards must be observed when evaluating electromagnetic compatibility.

1. ***EN 55011 (environmental standard)***

   In this standard, the limit values are defined in dependence on the basic environment in which the product is operated. A distinction is made between two environments, where the ***first environment*** describes the non-industrial ***living and business area*** without its own high-voltage or medium-voltage distribution transformers. The ***second environment*** defines ***industrial areas***, which are not connected to the public low-voltage network, but have their own high-voltage or medium-voltage distribution transformers. The limit values are subdivided into ***classes A1, A2 and B***.

2. ***EN 61800-3 (product standard)***

   In this standard, the limit values are defined in dependence on the usage area of the product. The limit values are subdivided into ***categories C1, C2, C3 and C4***, where class C4 basically only applies to drive systems with higher voltage (≥ 1000 V AC) or higher current (≥ 400 A). However, class C4 can also apply to the individual device if it is incorporated in complex systems.

The same limit values apply to both standards. However, the standards differ with regard to an application that is extended in the product standard. The operator decides which of the two standards applies, whereby the environmental standard typically applies in the event of a fault remedy.

The main connection between the two standards is explained as follows:

Category according to EN 61800-3	C1	C2	C3
Limit value class according to EN 55011	B	A1	A2
Operation permissible in First environment (living environment)	X	X [1)]	-
Second environment (industrial environment)	X	X [1)]	X [1)]
Note required in accordance with EN 61800-3	-	[2)]	[3)]
Distribution channel	Generally available	Limited availability	
EMC expertise	No requirements	Installation and commissioning by EMC expert	

1) Device used neither as a plug-in device nor in moving equipment

2) “The drive system can cause high-frequency interference in a living environment that may make interference suppression measures necessary.”

3) “The drive system is not intended for use in a public low-voltage network that feeds residential areas.”

Table 3: EMC comparison between EN 61800-3 and EN 55011

8.1.3 EMC of device

NOTICE

EMC interference to the environment

This device produces high-frequency interference, which may make additional suppression measures necessary in domestic environments (📖 8.1 "Electromagnetic compatibility (EMC)").

The use of shielded motor cables is essential in order to maintain the specified radio interference suppression level.

The device is exclusively intended for commercial use. It is therefore not subject to the requirements of the standard EN 61000-3-2 for radiation of harmonics.

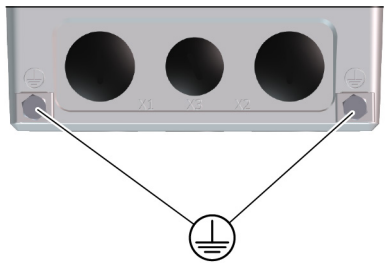
The limit value classes are only achieved if

- the wiring is EMC-compliant
- the length of shielded motor cable does not exceed the permissible limits
- The standard pulse frequency (P504) is used

The motor cable shield must be connected on both sides.

Device version **Max. motor cable length, shielded**	**Conducted emissions 150 kHz - 30 MHz**	
	Class C2	**Class C1**
Standard configuration for operation on TN/TT networks (active integrated mains filter)	5 m	-

The PE contacts of the connection cables (e.g. mains and motor cable) are connected to each other in the device. For fault-free operation we recommend a further connection between the PE of the device and the PE of the system construction. Two screw terminals are available on the device.



EMC overview of standards that are used in accordance with EN 61800-3 as checking and measuring procedures:		
Interference emission		
Cable-related emission (interference voltage)	EN 55011	C2
		-
Radiated emission (interference field strength)	EN 55011	C2
		C3 (size 2)
Interference immunity EN 61000-6-1, EN 61000-6-2		
ESD, discharge of static electricity	EN 61000-4-2	6 kV (CD), 8 kV (AD)
EMF, high frequency electro-magnetic fields	EN 61000-4-3	10 V/m; 80 – 1000 MHz
Burst on control cables	EN 61000-4-4	1 kV
Burst on mains and motor cables	EN 61000-4-4	2 kV
Surge (phase-phase / phase-ground)	EN 61000-4-5	1 kV / 2 kV
Cable-led interference due to high frequency fields	EN 61000-4-6	10 V, 0.15 – 80 MHz
Voltage fluctuations and drops	EN 61000-2-1	+10 %, -15 %; 90 %
Voltage asymmetries and frequency changes	EN 61000-2-4	3 %; 2 %

Table 4: Overview according to product standard EN 61800-3

8.1.4 Declarations of Conformity

GETRIEBEBAU NORD
Member of the NORD DRIVESYSTEMS Group

NORD DRIVESYSTEMS

Getriebebau NORD GmbH & Co. KG
Getriebebau-Nord-Str. 1 . 22941 Bargteheide, Germany . Fon +49(0)4532 289 - 0 . Fax +49(0)4532 289 - 2253 . info@nord.com

C310001_0921

EU Declaration of Conformity

In the meaning of the EU directives 2014/35/EU Annex IV, 2014/30/EU Annex II, 2009/125/EG Annex IV and 2011/65/EU Annex VI

Getriebebau NORD GmbH & Co. KG as manufacturer in sole responsibility hereby declares, that the variable speed drives of the product series NORDAC ON

- **SK 300P-xxx-340-.-.-...**
  (xxx= 120, 180, 250, 360, 370, 550, 450, 750, 950, 111, 151, 191, 221, 301)
  also in these functional variants:
  SK 301P-... , SK 302P-... , SK 310P-... , SK 311P-... , SK 312P-...

  and the further options/accessories:
  SK PAR-3. , SK CSX-3. , SK BRI6-... , SK TIE5-BT-STICK

comply with the following regulations:

Low Voltage Directive	**2014/35/EU**	OJ. L 96 of 29.3.2014, p. 357–374
EMC Directive	**2014/30/EU**	OJ. L 96 of 29.3.2014, p. 79–106
Ecodesign Directive	**2009/125/EG**	OJ. L 285 of 31.10.2009, p. 10–35
Regulation (EU) Ecodesign	**2019/1781**	OJ. L 272 of 25.10.2019, p. 74–94
RoHS Directive	**2011/65/EU**	OJ. L 174 of 1.7.2011, p. 88–11
Delegated Directive (EU)	**2015/863**	OJ. L 137 of 4.6.2015, p. 10–12

Applied standards:

EN 61800-5-1:2007+A1:2017	EN 61800-3:2018	EN 61800-9-1:2017
EN 60529:1991+A1:2000+A2:2013+AC:2016	EN 63000:2018	EN 61800-9-2:2017

It is necessary to notice the data in the operating manual to meet the regulations of the EMC-Directive. Specially take care about correct EMC installation and cabling, differences in the field of applications and if necessary original accessories.

First marking was carried out in 2021.

Bargteheide, 04.03.2021

U. Küchenmeister
Managing Director

pp F. Wiedemann
Head of Inverter Division

NORD GEAR LIMITED

Member of the NORD DRIVESYSTEMS GROUP

NORD Gear Limited
11 Barton Lane, Abingdon, Oxfordshire, United Kingdom OX14 3NB | Tel. No.: +44 1235 534404 | Email: GB-Sales@nord.com

DoC number C352000_EN

Declaration of Conformity

NORD Gear Limited hereby declares under sole responsibility that the product series as originally delivered:

SK 300P-xxx-340-.-.-...
(xxx = 120, 180, 250, 360, 370, 450, 550, 750, 950, 111, 151, 191, 221, 301)
also in these functional variants:
SK 301P-..., SK 302P-..., SK 310P-..., SK 311P-..., SK 312P-...

and further options/accessories:
SK PAR-3., SK CSX-3., SK BRI6-..., SK TIE5-BT-STICK

complies with the following statutory requirements and carries the UKCA marking accordingly:	and conforms with the following designated standards:
Electrical Equipment (Safety) Regulations S.I. 2016/1101 (as amended)	EN 61800-5-1:2007+A1:2017 EN 61800-9-1:2017 EN 61800-9-2:2017 EN 60529:1991+A1:2000+A2:2013+AC:2016
Electromagnetic Compatibility Regulations S.I. 2016/1091 (as amended)	EN 61800-3:2004+A1:2012+AC:2014
Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations S.I. 2012/3032 (as amended)	BS EN IEC 63000:2018

According to the EMC directive, the listed devices are not independently operable products, they are intended for installation in machines. Compliance to the directive requires the correct installation of the product, it is necessary to take notice of the data and safety instructions in the installation and operating manual. Specifically take care regarding the correct EMC installation and cabling requirements.

Abingdon, 08.12.2021

Andrew Stephenson
Managing Director

8.2 Reduced output power

The frequency inverters are designed for special overload situations. For example, 1.5x overcurrent can be used for 60 s. For approx. 3.5 s, 2x overcurrent is possible. A reduction of the overload capacity or its duration must be considered for the following circumstances:

- Output frequencies < 4.5 Hz and DC voltage (stationary pointer)
- Pulse frequencies greater than the nominal pulse frequency (P504)
- Increased mains voltages > 400 V
- Increased heat sink temperature

The following characteristic curves can be used to obtain the corresponding current/power limit.

8.2.1 Derating depending on the pulse frequency

This illustration shows how the output current must be reduced, depending on the pulse frequency in order to avoid excessive heat dissipation in the frequency inverter. Reductions starts at 6 kHz.

With the applicable rated current of Figure 2, a differentiation must be made between wall-mounted and motor-mounted inverters. In case of wall-mounting, the graph below applies and the inverter rated current may be taken as IN.

For a motor-mounted frequency inverter, the internal temperature of 90 °C is decisive and must not be exceeded. The graph in Figure 2 only serves as a reference point where IN corresponds to the rated motor current.

The diagram shows the possible current load capacity for continuous operation.

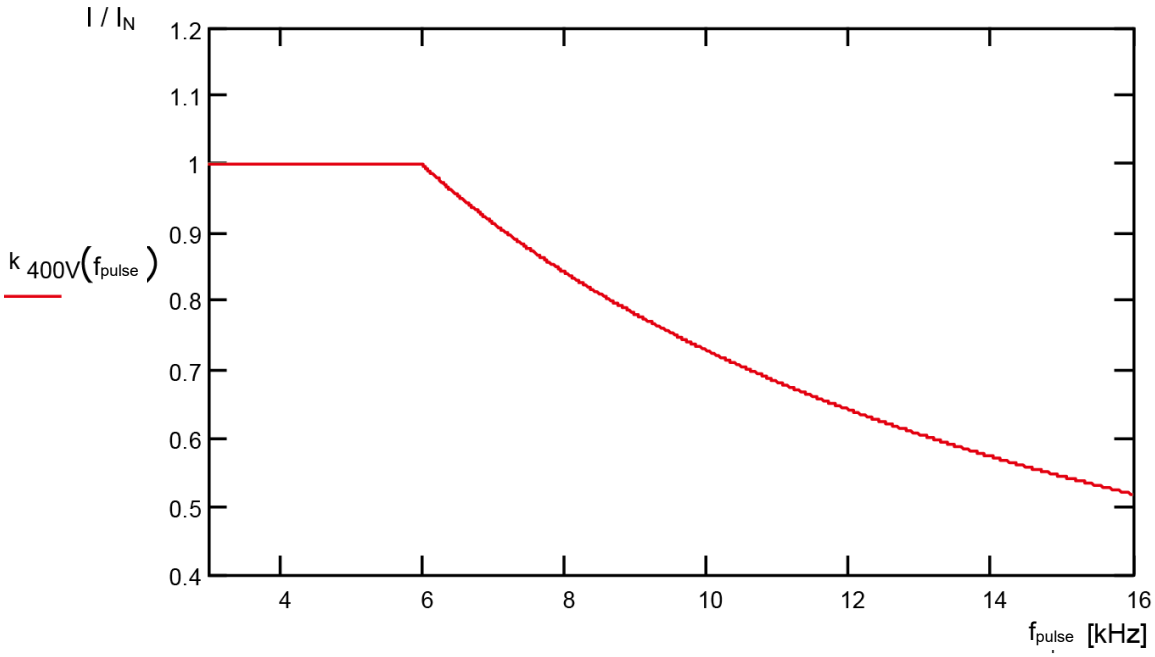


Figure 2: Heat losses due to pulse frequency

8.2.2 Reduced overcurrent due to the time

Depending on the duration of an overload, the possible overload capacity changes. Some values are highlighted in these tables. If one of these limit values is reached, the frequency inverter must have sufficient time (at low load or without load) to regenerate.

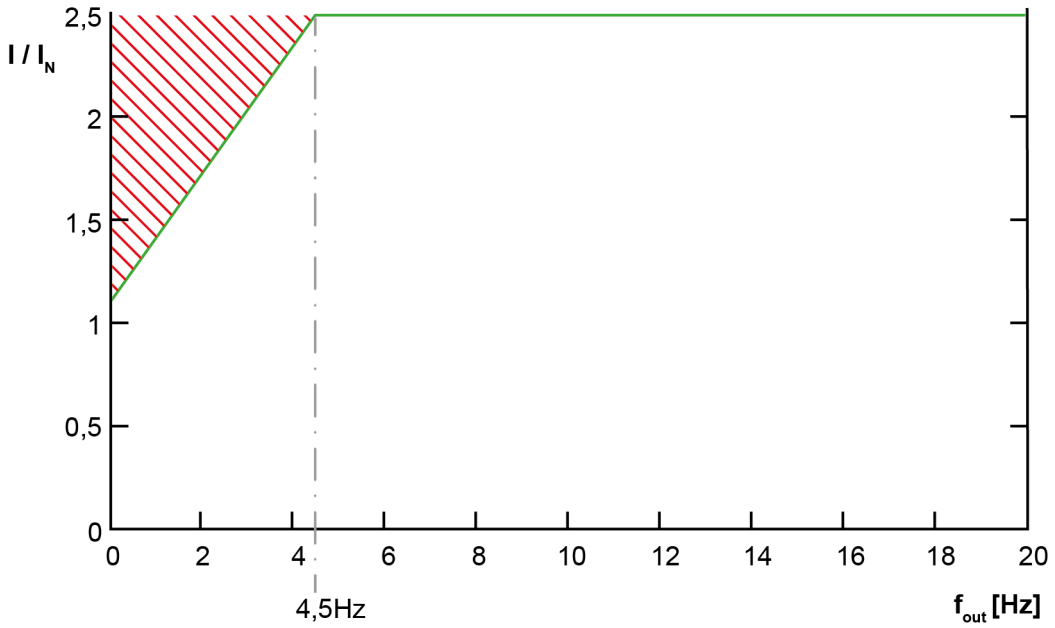
If operation is repeatedly carried out in the overload range at short intervals, the limit values stated in the tables are reduced.

400 V devices: Reduced overload capability (approx.) due to pulse frequency (P504) and time						
Pulse frequency [kHz]	Time [s]					
	> 600	60	30	20	2.5	1.5
3...6	110%	150%	165%	180%	215%	250%
8	105%	135%	150%	165%	190%	220%
10	95%	120%	135%	145%	175%	200%
12	85%	105%	120%	130%	150%	175%
14	70%	90%	100%	110%	130%	150%
16	60%	75%	85%	95%	110%	130%

Table 5: Overcurrent depending on the time

8.2.3 Reduced overcurrent due to output frequency

To protect the power unit at low output frequencies (< 4.5 Hz), monitoring is provided to determine the temperature of the IGBTs (*insulated-gate bipolar transistor*) due to high current. A pulse disconnection (P537) with variable limit is introduced so that no current can be accepted above the limit shown in the diagram. At standstill with 6 kHz pulse frequency, no current can thus be accepted above 1.1x the nominal current.



The resulting upper limit values for the pulse disconnection for the various pulse frequencies can be found in the following tables. The adjustable value (0.1 ... 1.9) that can be set in parameter P537 is in any case limited to the value specified in the tables depending on the pulse frequency. Values below the limit can be adjusted as required.

400 V devices: Reduced overload capability (approx.) due to pulse frequency (P504) and output frequency							
Pulse frequency [kHz]	Output frequency f_{out} [Hz]						
	4.5	3.0	2.0	1.5	1.0	0.5	0
3...6	200%	170%	150%	140%	130%	120%	110%
8	165%	140%	123%	115%	107%	99%	90%
10	150%	127%	112%	105%	97%	90%	82%
12	130%	110%	97%	91%	84%	78%	71%
14	115%	97%	86%	80%	74%	69%	63%
16	100%	85%	75%	70%	65%	60%	55%

Table 6: Overcurrent depending on pulse and output frequency

8.2.4 Reduced output current due to low voltage

The frequency inverters are thermally designed with regard to the rated output currents. For lower low voltages larger currents cannot be used in order to keep the output power constant. For mains voltages above 400 V the permissible output current is reduced inversely proportional to the mains voltage in order to compensate for switching losses.

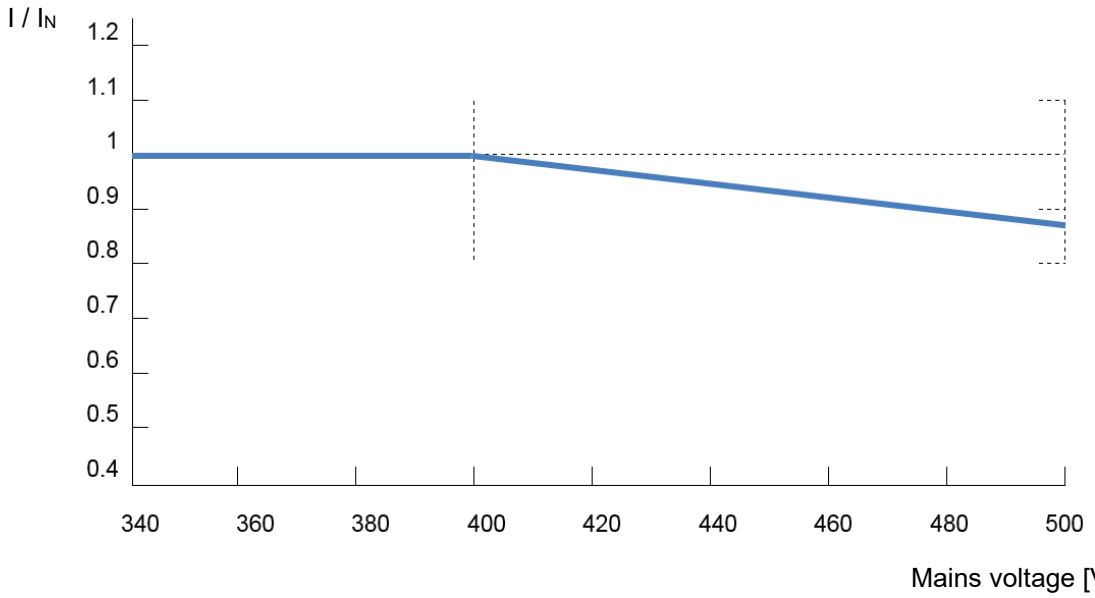


Figure 3: Reduced output current due to low voltage

8.2.5 Reduced output current due to the heat sink temperature

The temperature of the heat sink in included in the calculation of the reduction of output current, so that at low heat sink temperatures, a higher load capacity can be permitted, especially for higher pulse frequencies. At high heat sink temperatures, the reduction is increased correspondingly. The ambient temperature and the ventilation conditions for the device can therefore be optimally exploited.

8.3 Operation on the FI circuit breaker

For devices with an active mains filter (standard configuration for TN- / TT networks) leakage currents of ≤ 16 mA are to be expected. These are designed for operation with leakage current circuit breakers for the protection of persons.

For devices with an inactive mains filter (special configuration for TN networks) leakage currents of ≤ 30 mA are to be expected. These are not suitable for operation with leakage current circuit breakers for the protection of persons.

Only all-current sensitive FI circuit breakers (type B or B+) must be used.

(🕮 Section 2.5.5.1 "Mains connection")

(🕮 See also document TI 800_000000003.)

8.4 Options for optimising the energy efficiency

⚠ WARNING

Unexpected movement due to overload

In case of overload of the drive there is a risk that the motor will "break down" (sudden loss of torque). An overload may be caused e.g. by inadequate dimensioning of the drive unit or by the occurrence of sudden peak loads. Sudden peak loads may be of a mechanical origin (e.g. blockage) or may be caused by extremely steep acceleration ramps (P102, P103, P426).

Depending on the type of application, "breakdown" of the motor may cause unexpected movement (e.g. dropping of loads by lifting equipment).

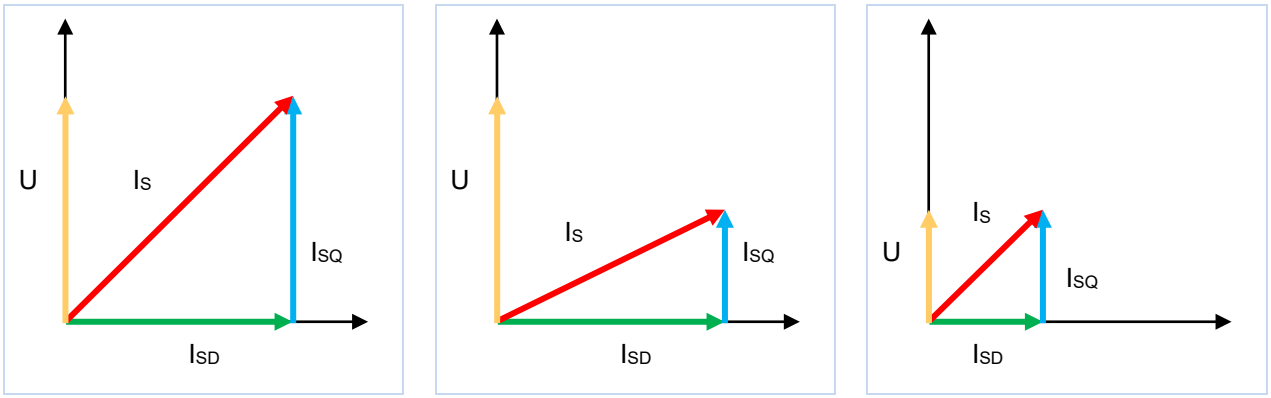
To prevent any risk, the following must be observed:

- For lifting equipment applications or applications with frequent large load changes, parameter P219 must remain in the factory setting (100 %).
- Do not inadequately dimension the drive unit, provide adequate overload reserves.
- If necessary, provide fall protection (e.g. for lifting equipment) or equivalent protective measures.

NORD frequency inverters have a low power consumption and are therefore highly efficient. In addition, with the aid of "Automatic flux optimisation" (Parameter (P219)) the inverter provides a possibility for increasing the overall efficiency of the drive in certain applications (in particular applications with partial load).

According to the torque required, the magnetisation current through the frequency inverter or the motor torque is reduced to the level which is required for the momentary drive power. The resulting considerable reduction in power consumption, as well as the optimisation of the cos φ factor of the motor rating in the partial load range contributes to creating optimum conditions both with regard to energy consumption and mains characteristics.

A parameterisation which is different from the factory setting (Factory setting = 100%) is only permissible for applications which do not require rapid torque changes. (For details, see Parameter (P219))



I_S = Motor current vector (line current)
I_{SD} = Magnetisation current vector (magnetisation current)
I_{SQ} = Load current vector (load current)

Figure 4: Energy efficiency due to automatic flux optimisation

8.5 Scaling of setpoint/actual values

The following tables contain details for the standardisation of typical setpoints and actual values. These details relate to parameters (P543), (P546), (P740) or (P741).

Indices that contain a "$_{No}$" represent the scaled setpoint or actual value in the tables.

8.5.1 Setpoints

Setpoint {function} Abbreviation [Unit]	Reference value 100%	Value range	Scaling of setpoints
Setpoint frequency {01} f_{SP} [Hz]	Maximum frequency (P105)	±100%	$f_{SP\ No} = \frac{16384 * f_{FSPT}}{P105}$
Torque current limit {02} p_{TL} [%]	Torque current limit (P112)	0…100%	$p_{TL\ No} = \frac{16384 * p_{TL}}{P112}$
Actual PID frequency {03} $f_{A\ PID}$ [Hz]	Maximum frequency auxiliary setpoints (P411)	±200%	$f_{A\ PID\ No} = \frac{16384 * f_{A\ PID}}{P411}$
Frequency addition {04} f_{Add} [Hz]	Maximum frequency auxiliary setpoints (P411)	±200%	$f_{Add\ No} = \frac{16384 * f_{Add}}{P411}$
Frequency subtraction {05} f_{Sub} [Hz]	Maximum frequency auxiliary setpoints (P411)	±200%	$f_{Sub\ No} = \frac{16384 * f_{Sub}}{P411}$
Current limit {06} p_{CL} [%]	Current limit frequency inverter (P536)	0…100%	$p_{CL\ No} = \frac{16384 * p_{CL}}{P536}$
Maximum frequency {07} f_{Max} [Hz]	Maximum frequency auxiliary setpoints (P411)	±200%	$f_{Max\ No} = \frac{16384 * f_{Max}}{P411}$
Actual PID frequency limited {08} $f_{AL\ PID}$ [Hz]	Maximum frequency auxiliary setpoints (P411)	±200%	$f_{AL\ PID\ No} = \frac{16384 * f_{AL\ PID}}{P411}$
Actual PID frequency monitored {09} $f_{AM\ PID}$ [Hz]	Maximum frequency auxiliary setpoints (P411)	±200%	$f_{AM\ PID\ No} = \frac{16384 * f_{AM\ PID}}{P411}$
Servo mode torque {10} [1] I_{TS} [A]	Torque current limit $I_{q\ max}$	±100%	$I_{TS\ No} = \frac{16384 * I_{TS}}{\sqrt{((P203)^2-(P209)^2) * P112)}}$
Servo mode torque {10} [2] p_{TS} [%]	Torque current limit (P112)	±100%	$p_{TS\ No} = \frac{16384 * p_{TS}}{P112}$
Torque precontrol {11} p_{TP} [%]	Torque precontrol (P214)	±100%	$p_{TP\ No} = \frac{16384 * p_{TP}}{P214}$
Actual value process controller {14} AV_{PC}	*Application-specific (REF)* [3]	±200%	$AV_{PC\ No} = \frac{16384 * AV_{PC}}{REF}$
Process controller setpoint {15} SP_{PC}	*Application-specific (REF)* [3]	±200%	$SP_{PC\ No} = \frac{16384 * SP_{PC}}{REF}$
Process controller precontrol {16} $f_{Add\ PC}$ [Hz]	Maximum frequency auxiliary setpoints (P411)	±200%	$f_{Add\ PC\ No} = \frac{16384 * f_{Add\ PC}}{P411}$
Curve control {18} $f_{AV\ CTC}$ [Hz]	Maximum frequency auxiliary setpoints (P411)	±200%	$f_{AV\ CTC\ No} = \frac{16384 * f_{AV\ CTC}}{P411}$

Setpoint {function} Abbreviation [Unit]	Reference value 100%	Value range	Scaling of setpoints
Process controller torque setpoint {46} 1) I_{SP} [A]	Torque current limit $I_{q\,max}$	±100%	$I_{SP\,No} = \frac{16384 * I_{SP}}{\sqrt{((P203)^2-(P209)^2) * P112)}}$
Setpoint torque process controller {46} 2) p_{SP} [%]	Torque current limit (P112)	±100%	$p_{SP\,N} = \frac{16384 * p_{SP}}{P112}$
Motor temperature {48} T_{Mot} [°C]	100 °C	±200%	$T_{Mot\,No} = \frac{16384 * T_{Mot}}{100\,°C}$
Ramp time {49} t_{Ramp} [s]	Acceleration time (P102)	0…200%	For acceleration: $t_{Ramp\,Acc\,No} = \frac{16384 * t_{Ramp}}{P102}$
	Deceleration time (P103)	0…200%	For deceleration: $t_{Ramp\,Decel\,No} = \frac{16384 * t_{Ramp}}{P103}$
Acceleration time {56} t_{Acc} [s]	Acceleration time (P102)	0…200%	$t_{Acc\,No} = \frac{16384 * t_{Acc}}{P102}$
Deceleration time {57} t_{Decel} [s]	Deceleration time (P103)	0…200%	$t_{Decel\,No} = \frac{16384 * t_{Decel}}{P103}$

1) When entering P112, the mathematical percentage sign must be taken into account: 80% = 80 / 100 = 0.8

2) Alternative representation

3) The process controller can be used to control process variables such as torques or speeds. The reference REF is set to the specific application and represents the physical quantity that is to stand for 100%. The reference REF must be selected the same for both setpoints and actual values of the process controller.

Table 7: Scaling of setpoints

8.5.2 Actual values

Actual values {function} Abbreviation [Unit]	Reference value 100%	Scaling of setpoints
Actual frequency {01} f_A [Hz]	Maximum frequency (P105)	$f_{A\,N} = \frac{f_{A\,No} * P105}{16384}$
Actual speed {02} n_A [rpm]	Nominal speed (P202)	$n_A = \frac{n_{A\,No} * P202}{16384}$
Current {03} I_N [A]	Nominal current (P203)	$I_N = \frac{I_{N\,No} * P203}{16384}$
Torque current {04} I_{TC} [A]	Torque current limit $I_{q\,max}$ 1)	$I_{TC} = \frac{I_{TC\,No} * \sqrt{((P203)^2-(P209)^2) * P112)}}{16384}$
Torque current {04} 2) p_{TC} [%]	Torque current limit (P112)	$p_{TC} = \frac{p_{TC\,No} * P112}{16384}$
Setpoint frequency {8} f_{SP} [Hz]	Maximum frequency (P105)	$f_{SP} = \frac{f_{SP\,No} * P105}{16384}$
Freq. Master Value {19} $f_{SP\,M}$ [Hz]	Maximum frequency (P105)	$f_{SP\,M} = \frac{f_{SP\,M\,No} * P105}{16384}$
Setpoint frequency after ramp master value {20} $f_{STPT\,MR}$ [Hz]	Maximum frequency (P105)	$f_{SP\,MR} = \frac{f_{SP\,MR\,No} * P105}{16384}$

Actual values {function} Abbreviation [Unit]	Reference value 100%	Scaling of setpoints
Actual frequency without slip master value {21} $f_{A\ MoS}$ [Hz]	Maximum frequency (P105)	$f_{A\ MoS} = \frac{f_{A\ MoS\ No} * P105}{16384}$
Speed encoder {22} n_{AE} [rpm]	Synchronous nominal motor speed	$n_{AE} = \frac{n_{AE\ No} * P201 * 60\ s}{16384 * p_M}$ With number of poles pairs of motor: [3] $p_M = \frac{floor * P201 * 60\ s}{P202}$
Actual frequency with slip {23} $f_{A\ wS}$ [Hz]	Maximum frequency (P105)	$f_{A\ wS} = \frac{f_{A\ wS\ No} * P105}{16384}$
Actual frequency with slip master value {24} $f_{A\ MwS}$ [Hz]	Maximum frequency (P105)	$f_{A\ MwS} = \frac{f_{A\ MwS\ No} * P105}{16384}$

1) When entering P112, the mathematical percentage sign must be taken into account: 80% = 80 / 100 = 0.8

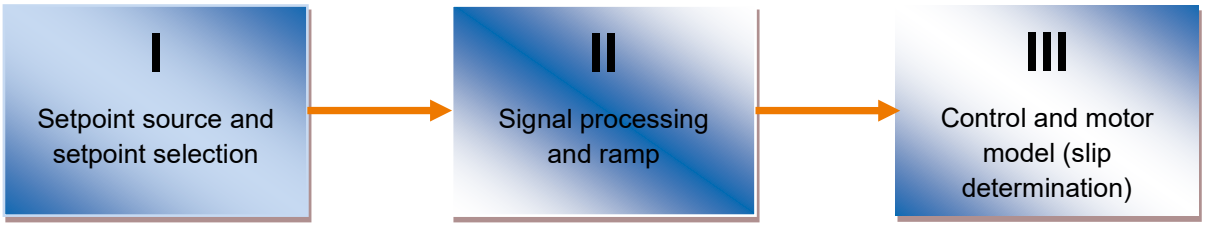
2) Alternative representation

3) Floor = mathematically rounding down

Table 8: Scaling of actual values

8.6 Definition of set and actual value processing (frequencies)

The frequencies used in parameter P543 are processed in various ways according to the following table.



Func.	Name	Meaning	Output to ...			Without left/right	With slip
			I	II	III		
8	Set point frequency	Set point frequency from setpoint source	X				
1	Actual frequency	Set point frequency before motor model		X			
23	Act. freq. With slip	Actual frequency on the motor			X		X
19	Freq. Master Value	Set point frequency from setpoint source Master value (freed from enable direction)	X			X	
20	Set Freq. After Ramp	Set point frequency before motor model Master value (freed from enable direction)		X		X	
24	Lead.act.freq.+slip	Actual frequency on the motor Master value (freed from enable direction)			X	X	X
21	Act. Freq. w/o Slip	Actual frequency without slip Master value			X		

Table 9: Set and actual value processing in the frequency inverter

9 Maintenance and servicing information

9.1 Service notes

Our technical support is available in case of technical queries.

If you contact our technical support, please have the precise device type (name plate/display), accessories and/or options, the software version used (P707) and the series number (name plate) at hand.

The device must be sent to the following address if it needs repairing:

Interroll Software & Electronics GmbH
Im Südpark 183
4030 Linz
Austria

Please remove all non-original parts from the device.

No guarantee is given for any attached parts such as power cables, switches or external displays.

Please back up the parameter settings before sending in the device.

Information

Please note the reason for sending in the component / device and specify a contact for any queries that we might have.

Unless otherwise agreed, the device is reset to the factory settings after inspection or repair.

Information

In order to rule out the possibility that the cause of a device fault is due to an optional module, the connected optional modules should also be returned in case of a fault.

Contacts (Phone)

Technical support	During normal business hours	+43 664 507 1416

9.2 Disposal

NORD products are made of high-quality components and valuable materials. Therefore, have faulty or defective appliances checked to see if they can be repaired and reused.

If repair and reuse is not possible, observe the following disposal notes.

9.2.1 Disposal according to German law

- The components are marked with the crossed-out waste bin according to the “Electrical and Electronic Equipment Directive – ElektroG3” (dated 20 May 2021, valid from 1 January 2022).

  The appliances must therefore not be disposed of as unsorted municipal waste, but must be collected separately and handed to a WEEE (Waste of Electrical and Electronic Equipment) registered collection point.

- The components do not contain any electrochemical cells, batteries or accumulators, which must be separated and disposed of separately.
- In Germany, NORD components can be handed in at the headquarters of Getriebebau NORD GmbH & Co. KG.

WEEE Reg. No.	**Name of the manufacturer / authorised representative**	**Category**	**Appliance type**
DE12890892	Getriebebau NORD GmbH & Co. KG	Appliances where at least one of the outer dimensions exceeds 50 cm (large appliances)	Large appliances for exclusive use in other than private households
		Appliances where none of the outer dimensions exceeds 50 cm (small appliances)	Small appliances for exclusive use in other than private households

- Contact: **Fehler! Linkreferenz ungültig.**

9.2.2 Disposal outside of Germany

Outside Germany, please contact the local subsidiaries or distributors of the NORD DRIVESYSTEM Group.

9.3 Abbreviations

ASM	Asynchronous machine, asynchronous motor	**GND**	Ground, common reference potential
AOUT	Analogue output	**I/O**	In / Out (Input / Output)
CFC	Current Flux Control (current-controlled, field-oriented control)	**ISD**	Field current (current vector control)
DI (DIN) **DigIn**	Digital input	**LED**	Light-emitting Diode
DS (LED)	Status LED (device status)	**MB**	Motor brake
DO (DOUT) **DigOut**	Digital output	**PLC**	Programmable logic controller
I/O	Input / Output	**PE**	Protective earth
EEPROM	Non-volatile memory	**S**	Supervisor parameter, P003
EMC	Electromagnetic compatibility	**SW**	Software version, P707
FI switch	Leakage current circuit breaker	**TI**	Technical information / data sheet (Data sheet for NORD accessories)
FI	Frequency inverters	**VFC**	Current Flux Control (current-controlled, field-oriented control)

Key word index

AT

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