INTELLIGENT DRIVESYSTEMS, WORLDWIDE SERVICES

BU 0240 – en-US

NORDAC *FLEX* (SK 200E ... SK 235E)

Brief instructions for Frequency Inverters

NORD® DRIVESYSTEMS

Documentation

Title:	**BU 0240**	
Order No.:	**6072403**	
Series:	SK 200E	
Device series:	SK 200E, SK 210E, SK 220E, SK 230E, SK 205E, SK 215E, SK 225E, SK 235E	
Device models:	*SK 2xxE-250-112-O ... SK 2xxE-750-112-O*	0.25 – 0.75 kW, 1~ 100-120 V, Out: 230 V
	SK 2xxE-250-123-A ... SK 2xxE-111-123-A	0.25 – 1.1 kW, 1~ 200-240 V
	SK 2xxE-250-323-A ... SK 2xxE-112-323-A	0.25 – 11.0 kW, 3~ 200-240 V [1)]
	SK 2xxE-550-340-A ... SK 2xxE-222-340-A	0.55 – 22.0 kW, 3~ 380-500 V [2)]

1) Size 4 (5.5 – 11.0 kW) only in version SK 2x0E
2) Size 4 (11.0 – 22.0 kW) only in version SK 2x0E

Version list

Title, Date	Order number	Device software version	Remarks
BU 0240, June 2010	**6072403** / 2210	V 1.2 R0	First version based on BU 0200 DE / 1310
BU 0240, June 2014	**6072403** / 2314	V 1.4 R3	Revised version based on BU 0200 DE / 2314
BU 0240, March 2016	**6072403** / 1216	V 2.1 R0	Revised version based on BU 0200 DE / 1216
BU 0240, December 2017	**6072403** / 5117	V 2.1 R3	Revised version based on BU 0200 DE / 5117
BU 0240, July 2018	**6072403** / 3118	V 2.1 R4	Revised version based on BU 0200 DE / 3118
BU 0240, December 2020	**6072403** / 4920	V 2.2 R1	Revised version based on BU 0200 DE / 4920

Table 1: Version List BU0240

Validity

The following brief instructions are based on the main instructions (see version list) of the relevant inverter series, which are also pertinent to commissioning. These brief instructions summarize the information which is required for the basic commissioning of a standard drive technology application. Detailed information, especially with regard to parameters, options and special functions can be obtained from the latest versions of the main instructions for the variable frequency drive as well as any supplementary instructions for field bus options (e.g. PROFIBUS DP) or inverter functionalities (e.g.: PLC).

Copyright notice

Publisher

Getriebebau NORD GmbH & Co. KG
Getriebebau-Nord-Strasse 1 • 22941 Bargteheide, Germany • http://www.nord.com/
Tel. +49 (4532) 2890 • Fax +49 (4532) 289-2253

Member of the NORD DRIVESYSTEMS Group

Table of Contents

List of illustrations

List of tables

1 General

1.1 Overview

This manual describes two very similar basic versions of the SK 200E product family (NORDAC FLEX).

Wherever the *SK 2xxE* is mentioned below, this refers to information that applies to all devices in this family.

If the information applies exclusively to versions SK 205E/SK 215E/SK 225E/SK 235E, this is apparent from the designation *SK 2x5E*.

If the information only applies to versions SK 200E/SK 210E/SK 220E/SK 230E, this is recognizable from the designation *SK 2x0E*.

Basic properties

- High starting torque and precise motor speed control setting by means of sensorless current vector control
- Can be installed directly on, or close to the motor.
- Permissible ambient temperature -25°C to 50°C (please refer to the technical data)
- Integrated EMC line filter for limit curve class A/category C2 or C3 (not with 115 V devices)
- Automatic measurement of the stator resistance and determination of precise motor data
- Programmable direct current braking
- Built-in brake chopper for 4-quadrant operation, optional braking resistors (internal/external)
- Separate temperature sensor input (TF+/TF-)
- Evaluation of an incremental encoder via digital inputs possible
- NORD system bus for linking modular additional modules
- Four separate parameter sets that can be changed over online
- 8x DIP switches for minimal configuration
- LEDs for diagnosis (SK 2x5E incl. DI/DO signal statuses)
- RS232/485 interface via RJ12 plug
- Plug-in data memory (EEPROM)
- ***Integrated "POSICON" positioning control*** (🕮 BU 0210)
- CANopen absolute value encoder evaluation via the NORD system bus
- Operation of *three-phase current* ***as****ynchronous* ***m****otors* (ASM) and ***P****ermanent-****M****agnet* ***S****ynchronous* ***M****otors* (PMSM)
- Integrated PLC (🕮 BU 0550)

Differences between the individual versions (SK 200E/SK 205E/… SK 235E) are summarized in the following table and will be described in this manual.

Additional characteristics, sizes 1 ... 3

Feature	200E	205E	210E	215E	220E	225E	230E	235E
Integrated 24 V power supply unit	x		x		x		x	
Optionally available 24 V power supply unit		x		x		x		x
Number of digital inputs (DIN)	4	4	3	3	4	4	3	3
Number of digital outputs (DO)	2	1	2	1	2	1	2	1
Number of analog inputs (AIN)	2		2		1		1	
Additional 2 potentiometers for minimal configuration		x		x		x		x
Electromechanical brake control		x		x		x		x
Safe pulse block (STO/SS1) (📖BU0230)			x	x			x	x
AS interface (4I/4O)					x	x	x	x

Table 2: Additional characteristics, size 1 ... 3

Additional characteristics, size 4

Feature	200E	210E	220E	230E
Integrated 24 V power supply unit	x	x	x	x
Number of digital inputs (DIN)	4	3	4	3
Number of digital outputs (DO)	2	2	2	2
Number of analog inputs (AIN)	2	2	1	1
Additional 2 potentiometers for minimal configuration	x	x	x	x
Electromechanical brake control	x	x	x	x
Safe pulse block (STO/SS1) (📖BU0230)		x		x
AS interface (4I/4O)			x	x

Table 3: Additional characteristics, size 4

1.2 Delivery

Check the device **immediately** after delivery/unpacking for transport damage such as deformation or loose parts.

If there is any damage, contact the carrier immediately and carry out a thorough assessment.

Important! This also applies even if the packaging is undamaged.

1.3 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 in 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 housing or missing cover (e.g. blind plugs for cable inlets). Otherwise, there is risk of serious or fatal injuries caused by electric shock or bursting electrical components such as powerful electrolytic capacitors.

Unauthorized removal of covers, improper use, incorrect installation or operation brings about the risk of serious personal injury or material damage.

There may be live, bare, moving or rotating parts or hot surfaces during operation and depending on the degree of protection of the devices.

The device operates at dangerous voltages. Dangerous voltage may be present at the supply lines, terminal strips and PCBs of all connecting terminals (e.g. power input, motor connection) even if the device is not working or the motor is not rotating (e.g. caused by electronic disable, jamming of the drive or a short circuit at the output terminals).

The device is not equipped with a main power switch and therefore is always live when connected to the power supply. Therefore voltages may also be present in a connected motor at standstill.

Even if the drive unit has been disconnected from the line supply, a connected motor may rotate and possibly generate a dangerous voltages.

If you come into contact with dangerous voltages such as these, there is risk of 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 results in risk of damage or destruction of the device.

The fact that the status LED or other indicators are not illuminated does not indicate that the device has been disconnected from the power grid and is de-energized.

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

Touching parts such as this can result in local burns to the body parts concerned (cooling times and clearance from neighboring components must be adhered to).

All work on the device such as transportation, installation, commissioning and maintenance must be carried out by qualified experts (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 high-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.

When working on the device, make sure that no foreign bodies, loose parts, moisture or dust enter or remain in the device (risk of short circuit, fire and corrosion).

Additional information can be found in this documentation.

2. Qualified experts

For the purposes of these basic safety instructions, qualified personnel are persons who are familiar with the assembly, installation, commissioning and operation of this product and who have the relevant qualifications for their work.

Furthermore, the device and the associated accessories may only be installed and started up by qualified electricians. Electricians are persons who, because of their technical training and experience, have sufficient knowledge with regard to

- Switching on, switching off, isolating, grounding and marking power circuits and devices,
- Proper maintenance and use of protective devices in accordance with defined safety standards.

3. Correct purpose of use – general

Variable Frequency Drives 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). These motors must be suitable for operation with variable frequency drives. Other loads must not be connected to the devices.

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

Please refer to the nameplate and in the documentation for technical data and information about connection conditions, which must be complied with.

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

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

a. Supplement: Intended use within the European Union

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

b. Supplement: Intended use outside the European Union

Adhere to local and national regulations regarding the installation and commissioning of the device (see also "a) Supplement: Intended use within the European Union").

4. Phases of life

Transport, storage

Follow the instructions in the manual regarding transport, storage and correct handling.

Comply with the permissible mechanical and climatic ambient conditions (see Technical Data in the device manual).

If necessary, use suitable and adequately dimensioned means of transport (e.g. lifting gear, cable guides).

Installation and assembly

Installation and cooling of the device must be carried out according to regulations in the corresponding documentation. Comply with the permissible mechanical and climatic ambient conditions (see Technical Data in the device manual).

Protect the device against inadmissible loads. In particular, prevent component deformation and/or modification of insulation distances. Avoid touching electronic components and contacts.

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 de-energized and at least 5 minutes have elapsed since line power has been disconnected! (Due to charged capacitors, the device may continue to carry hazardous voltages for up to 5 minutes after line power has been disconnected). Before starting work it is essential to check by measurement that all contacts of the power plug connectors or terminals are de-energized.

Establish the electrical installation as per applicable regulations (e.g. cable cross-section, fuses, protective conductor connection). Please refer to the documentation or manual for the device for further instructions.

Information regarding EMC-compliant installation such as shielding, grounding, setup of filters and routing of cables can be found in the documentation for the device and in Technical Information TI 80-0011. CE-marked devices must also comply with these instructions. The manufacturer of the system or machine is responsible for compliance with the limit values specified in EMC regulations.

In case of a fault, insufficient grounding may cause an electric shock with possibly fatal consequences if the device is touched.

The device may only be operated with effective ground connections which comply with local regulations for large leakage currents (> 3.5 mA). Please refer to Technical Information TI 80-0019 for detailed information regarding connections and operating conditions.

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

Disconnect all poles of all power connections (e.g. power supply) at all times.

Setup, troubleshooting and commissioning

Comply with applicable national accident prevention regulations when working on live devices (e.g. BGV A3, formerly VBG 4).

The device's voltage supply may start up the device directly or indirectly, or touching electrically conducting components may cause an electric shock with possible fatal consequences.

Parameterize and configure the devices in such a way that does not cause any hazards.

Under certain setting conditions the device or the motor connected to it may start automatically when line power is switched on. A machine that 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 line power, secure the danger area by warning and removing all persons from the danger area.

Operation

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

Keep all covers closed during operation.

Under certain setting conditions the device or the motor connected to it may start automatically when line power is switched on. A machine that 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 line power, secure the danger area by warning and removing all persons from the danger area.

The device produces operation-related 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 adjusting the pulse frequency. However, this might result in derating (lower output) of the device.

Maintenance, repair and decommissioning

Installation, maintenance and repair work must not be carried out unless the device has been de-energized and at least 5 minutes have elapsed since line power has been disconnected! (Due to charged capacitors, the device may continue to carry hazardous voltages for up to 5 minutes after line power has been disconnected). Before starting work it is essential to check by measurement that all contacts of the power plug connectors or terminals are de-energized.

Please refer to the device manual for further information.

Disposal

Do not dispose of the product and its parts and accessories as domestic waste. At the end of its life, dispose of the product properly according to the local regulations for industrial waste. In particular, please note that 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). When it comes to high-power electrolytic capacitors, there is also a risk of explosion with the associated risk of injury.

5. Potentially explosive environment (ATEX, EAC Ex)

In order to operate or carry out installation work in potentially explosive environments (ATEX, EAC Ex), the device must be approved and the relevant requirements and instructions in the device manual must be complied with.

Failure to comply can result in the ignition of an explosive atmosphere and fatal injuries.

- Only persons who are qualified, i.e. trained and authorized for all assembly, service, commissioning and operation activities in connection with explosive environments may work with the devices described here (including the motors, geared motors, any accessories and all connection equipment).
- Explosive concentrations of dust may cause explosions if ignited by hot or sparking objects. Such explosions may cause serious or fatal injuries to persons or severe material damage.
- The device must comply with the specifications of the ***"Planning Guideline for Operating and Installation Instructions B1091"*** B1091-1.
- Only original parts which are approved for the device and for operation in an explosive environment (ATEX zone 22 3D, EAC Ex) must be used.
- **Repairs may only be carried out by Getriebebau NORD GmbH & Co. KG.**

1.4 Warnings and hazard information

Under certain circumstances, hazardous situations may occur in association with the variable frequency drive. Clear warnings and hazard information can be found in a suitable place on the product and in the relevant documentation to draw your attention explicitly to possible hazardous situations.

1.4.1 Warnings and hazard information on the product

The following warnings and hazard information are used on the product.

Symbol	Supplement to symbol [1)]	Meaning
	DANGER Device is live > 5 min after disconnecting line voltage	**Danger** **Electric shock** The device contains powerful capacitors. Because of this, there may still be hazardous voltage for more than 5 minutes after disconnecting the main power supply. Before starting work on the device, check that all power contacts are de-energized 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. • Risk 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 through tools or the like, or direct contact) with PCBs and their components.

1) Text is written in English.

Table 4: Warnings and hazard information on the product

1.4.2 Warnings and hazard information in the document

The warnings and hazard information in this document are located at the beginning of the section which describes the actions which may result in the corresponding hazards.

The warnings and hazard information are classified as follows according to the ensuing risk as well as the probability and severity of the resulting injuries.

DANGER	Indicates an immediate danger which may result in death or serious injury.
WARNING	Indicates a possibly dangerous situation which may result in death or serious injury.
CAUTION	Indicates a possibly dangerous situation which may result in slight or minor injuries.
NOTICE	Indicates a possibly harmful situation which may cause damage to the product or the environment.

1.5 Standards and approvals

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

Approval	Directive		Applicable standards	Certificates	Label
CE *(European Union)*	Low Voltage	2014/35/EU	EN 61800-5-1 EN 60529 EN 61800-3 EN 50581	C310700, C310401	CE
	EMC	2014/30/EU			
	RoHS	2011/65/EU			
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	133520966	
EAC *(Eurasia)*	TR CU 004/2011, TR CU 020/2011		IEC 61800-5-1 IEC 61800-3	ЕАЭС N RU Д-DE.HB27.B.02727/20	EAC

Table 5: Standards and approvals

Devices which are configured and approved for use in explosion hazard areas (📖 Section 2.4 "Operation in potentially explosive environments "), comply with the following directives or standards.

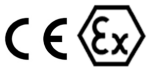
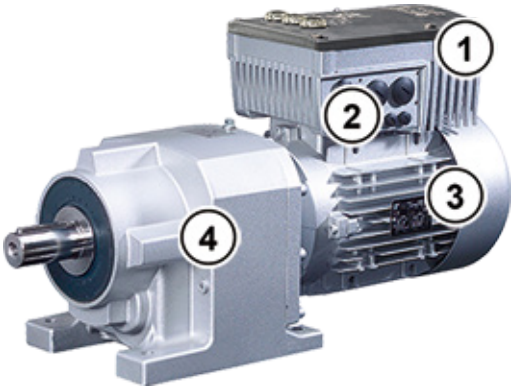
Approval	Directive		Applicable standards	Certificates	Label
ATEX *(European Union)*	ATEX	2014/34/EU	EN 60079-0 EN 60079-31 EN 61800-5-1 EN 60529 EN 61800-3 EN 50581	C432710	
	EMC	2014/30/EU			
	RoHS	2011/65/EU			
EAC Ex *(Eurasia)*	TR CU 012/2011		IEC 60079-0 IEC 60079-31	TC RU C-DE.AA87.B.01109	

Table 6: Standards and approvals for explosion hazard environments

1.6 Model code/nomenclature

Unique model codes have been defined for the individual modules and devices. These provide individual details about the device model and its electrical data, degree of protection, mounting variant and special versions. A distinction is made between the following groups:

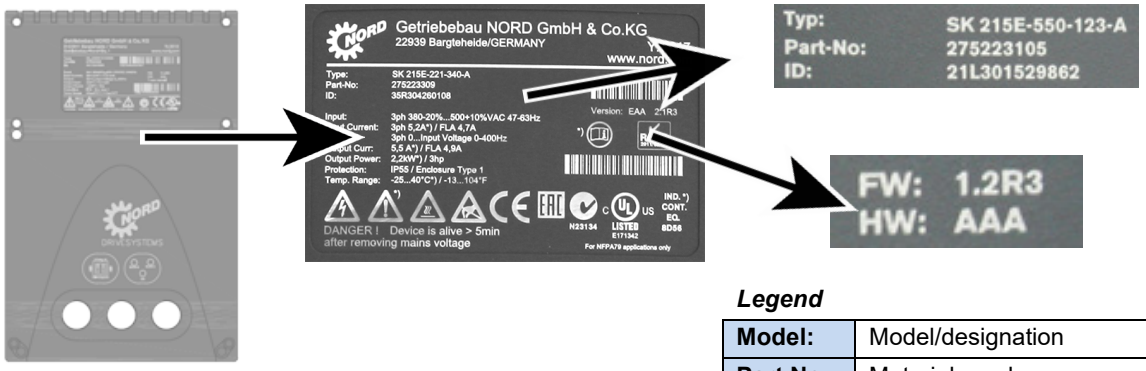


1	Variable Frequency Drive
2	Connection unit
3	Motor
4	Gear unit

5	Optional module
6	Connection unit
7	Wall mounting kit

1.6.1 Nameplate

Please refer to the nameplate for all information relevant to the device, including information about device identification.



Legend

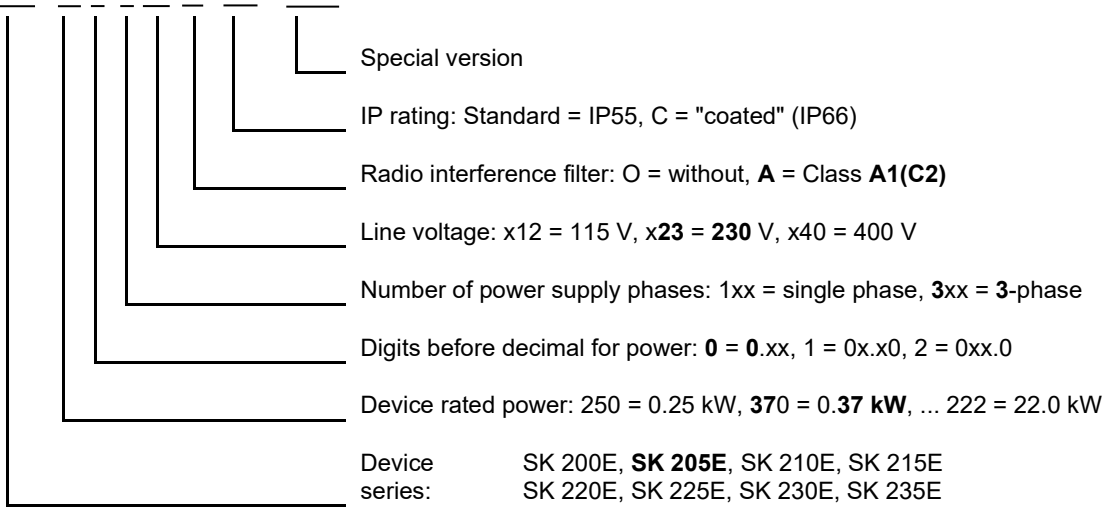
Model:	Model/designation
Part No.:	Material number
ID:	Device ID number

FW:	Firmware version (x.x Rx)
HW:	Hardware version (xxx)

Figure 1: Nameplate

1.6.2 Variable Frequency Drive model code - basic device

SK 205E-370-323-A (-C) (-xxx)

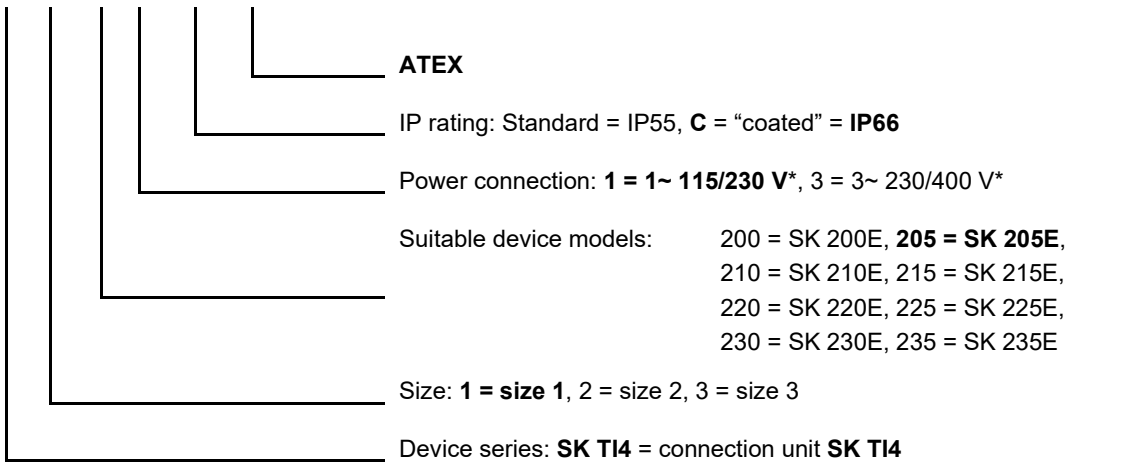


(...) Options, only implemented if required.

1.6.3 Variable Frequency Drive model code – Connection unit

Sizes 1 to 3

SK TI4-1-205-1 (-C-EX)

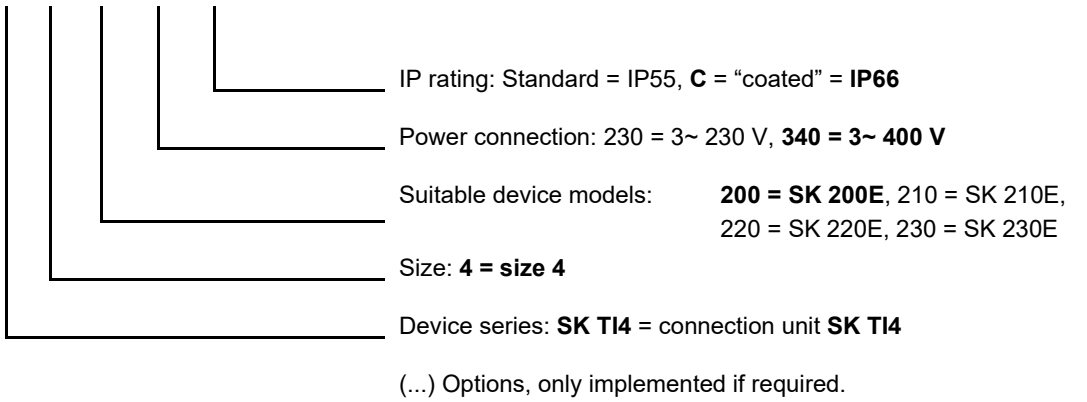


*) The voltage depends on the variable frequency drive used. Please refer to the technical data as well.

(...) Options, only implemented if required.

Size 4

SK TI4-4-200-340 (-C)



1.7 Output/size assignment

Size	AC power supply assignment SK 2xxE			
	1~ 110 - 120 V [1]	**1~ 200 – 240 V** [2]	**3~ 200 – 240 V**	**3~ 380 – 500 V**
Size 1	0.25 ... 0.37 kW	0.25 ... 0.55 kW	0.37 ... 1.1 kW	0.55 ... 2.2 kW
Size 2	0.55 ... 0.75 kW	0.75 ... 1.1 kW	1.5 ... 2.2 kW	3.0 ... 4.0 kW
Size 3	-	-	3.0 ... 4.0 kW	5.5 ... 7.5 kW
Size 4 [3]	-	-	5.5 ... 11.0 kW	11.0 … 22.0 kW

1) only available as SK 2x5E model
2) only available as SK 2x0E model in size 1
3) only available as SK 2x0E model

1.8 Version with IP55/IP66 rating

The SK 2xxE is available in IP55 (standard) or IP66 (optional). The additional modules are available in IP55 (standard) or IP66 (optional) rating.

A degree of protection that differs from the standard (IP66) must always be specified in the order when ordering!

There are no restrictions or differences in terms of functionality in the aforementioned degrees of protection. The model designation is extended accordingly in order to distinguish between the degrees of protection.

e.g. SK 2xxE-221-340-A-**C**

Information **Cable routing**

For all versions, make sure that the cables and cable screw connections at a minimum comply with the degree of protection of the device and attachment regulations and are carefully matched. Insert the cables so that water is deflected away from the device (if necessary, use loops). This is essential to ensure that the required degree of protection is maintained.

IP55 version:

The IP55 version is the **standard** version. The two installation types *motor-mounted* (fitted onto the motor) and *close to the motor* (fitted to the wall bracket) are available in this version. All connection units, technology units and customer units are also available for this version.

IP66 version:

The IP66 version is a modified **option** of the IP55 version. Both installation types *(motor-integrated*, *close to the motor*) are also available for this version. The modules available to the IP66 design (connection units, technology units and customer units) have the same functionalities as the corresponding IP55 design modules.

Information **IP66 special measures**

The modules for the IP66 version are identified by an additional "-C" in the model code and were modified with the following special measures:

- Impregnated PCBs,
- Powder coating RAL 9006 (white aluminum) for housing,
- Modified blank screw caps (UV-resistant),
- Diaphragm valve for pressure compensation in the event of temperature changes,
- Low-pressure test.
  - A free M12 screw connection is required for low-pressure testing. A diaphragm valve is inserted here after successful testing. This screw connection is therefore no longer available for the cable inlet.

If the variable frequency drive needs to be retrofitted, i.e. the drive unit (inverter pre-attached to motor) is not entirely purchased from NORD, the diaphragm valve is supplied in the accessories kit with the variable frequency drive. The valve must be professionally installed on site by the system installer (**note:** the valve must be installed in a location that is as high as possible in order to avoid contact with accumulated moisture, e.g. standing water due to condensation).

Information **"SK 2xxE-…-C" devices, size 4**

Variable Frequency Drives, size 4, could also be delivered up to week of manufacture 38/2012 (up to ID No.: 38M...) as "coated" versions "-C" *but they only comply with IP55 because of the integrated fan*. **From ID No.: 39M…. these devices are also compliant with IP66.**

"SK 2xxE-…-C" devices with output of 5.5 kW and 7.5 kW (230 V), and 11 kW and 15 kW (400 V) **from ID No.: 28M… compliant with IP66**.

Information

Diaphragm valve

The diaphragm valve (accessories kit with the IP66 version of the variable frequency drive connection unit) enables the compensation of pressure differences between the inside of the variable frequency drive and its environment and also prevents the entry of moisture. If it is mounted in an M12 screw gland of the inverter connection unit, make sure that the diaphragm valve does not come into contact with standing water.

2 Mounting and installation

2.1 Mounting SK 2xxE

The devices are available in various sizes depending on their output. They can be mounted on the terminal box of a motor or in its immediate vicinity.

Motor-mounted version	Wall-mounted version
	

When a complete drive unit (gear unit + motor + SK 2xxE) is delivered, the device is always fully installed and tested.

Information **Device version IP6x**

IP6x-compliant devices must be installed by NORD since special measures have to be taken. IP6x components that are retrofitted on site cannot guarantee this degree of protection.

The SK 2xxE is connected to the motor or the wall mounting kit using the size that is suitable for the SK TI4-… connection unit . The connection unit can also be ordered separately for subsequent mounting on an existing motor or to replace a different motor-mounted variable frequency drive.

The **Connection Unit SK TI4** module includes the following components:

- Cast housing, seal (already glued in) and insulation plate
- Power terminal block in accordance with line power connection
- Control terminal block in accordance with SK 2xxE version
- Screw kit for mounting on the motor and terminal blocks
- Ready-made cables for motor and PTC thermistor connection
- *Size 4 only:* From hardware status "EAA" (variable frequency drive) or "EA" (connection unit) toroidal core (ferrite) with fastening material

Information — Output derating

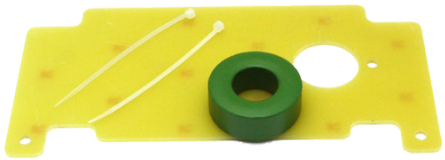
The devices require **sufficient ventilation** to protect against overheating. Failure to do so will result in a derating of the variable frequency drive. Ventilation is affected by the type of installation (motor mounting, wall mounting) or, with motor mounting, the air flow of the motor fan (continuous slow speed → lack of cooling).

Insufficient cooling can result in derating of 1-2 rating classes during S1 operation, for example, which can only be compensated for by using a nominally bigger device.

Details concerning derating and possible ambient temperatures, and other details (📖 Section **Fehler! Verweisquelle konnte nicht gefunden werden.** "**Fehler! Verweisquelle konnte nicht gefunden werden.**").

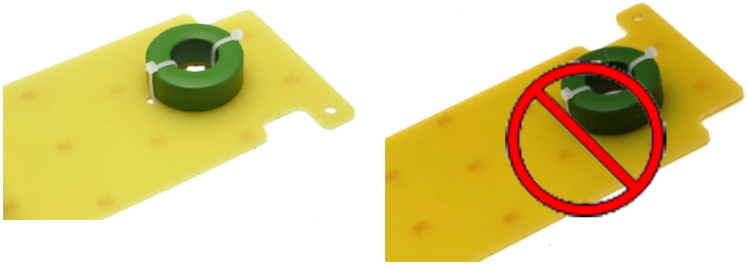
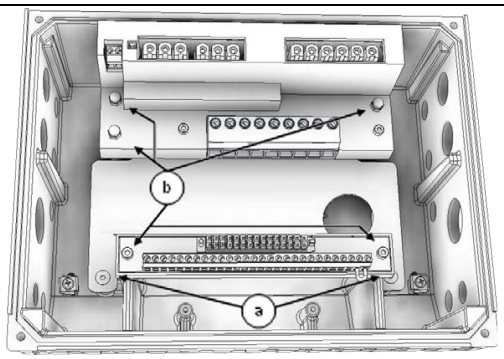
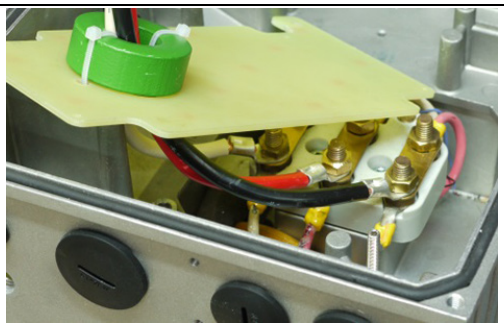
2.1.1 Installation of insulating plate – size 4

As of hardware status EAA of the variable frequency drive (suitable connection unit hardware status EA), a toroidal core must be fitted to the insulating plate (motor terminal cover). The toroidal core and the required fastening materials are included in the scope of delivery of the connection unit.



The toroidal core is required to ensure that EMC requirements are met.

Assembly sequence

1	Secure toroidal core with cable ties as shown in the figure to the left (pay attention to insulating plate alignment).	
2	Remove terminal blocks (b).	
3	Connect wiring harness (motor cable) and lead through the toroidal core attached to the insulating plate.	
4	Wire motor cable to connecting terminals U – V – W of the relevant terminal block.	
5	• Mount insulating plate (see illustration in step 2 – (a)). • Mount terminal blocks (see illustration in step 2 – (b)).	

2.1.2 Motor installation steps

1. If necessary, remove the original terminal box from the NORD motor so that only the base of the terminal box and the motor terminal block remain.
2. Place the bridges for the correct motor circuit on the motor terminal block and connect the ready-made cables for motor and PTC thermistor connections to the respective connection points on the motor.
3. Mount the connection unit on the terminal box base of the NORD motor using the existing screws and gasket as well as the enclosed toothed/contact washers. When doing this, align the housing so that the rounded side is facing in the direction of the A end shield of the motor. Carry out mechanical adaptation using the adapter kit (🕮 2.1.2.1 "Adapters for motor size"). In general, check whether motors made by other manufacturers can be connected.

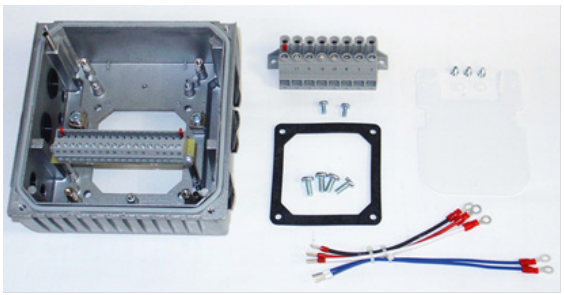
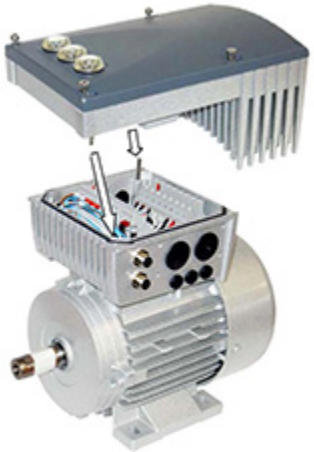


Figure 2: Connection unit size 1 … 3

Figure 3: Connection unit size 4

4. Fasten insulating plate above the motor terminal block.
   – Size 4: Fasten toroidal core to insulating plate (🕮 Section 2.1.1 "Installation of insulating plate – size 4").

   Screw on power terminal block above this using 2x M4x8 screws and the plastic washers (size 4: 3x M4 cap nuts).
5. Make electrical connections. Use screwed connections appropriate for cable cross-section for the cable entry of the connecting cable.
6. Place the variable frequency drive on the connection unit. When it comes to sizes 1 to 3, pay special attention to the correct contacting of the PE pins. These are located diagonally in 2 corners of the variable frequency drive and the connection unit.
   In order to ensure that the degree of protection for which the device is intended is achieved, make sure that all fastening screws that attach the variable frequency drive to the connection unit are tightened crosswise, step by step and at the torques indicated in the table below.
   The cable screw connections used at a minimum must correspond to the degree of protection of the device.



Size SK 2xxE	Screw size	Tightening torque
Size 1	M5 x 45	2.0 Nm ± 20%
Size 2	M5 x 45	2.0 Nm ± 20%
Size 3	M5 x 45	2.0 Nm ± 20%
Size 4	M6 x 20	2.5 Nm ± 20%

2.1.2.1 Adapters for motor size

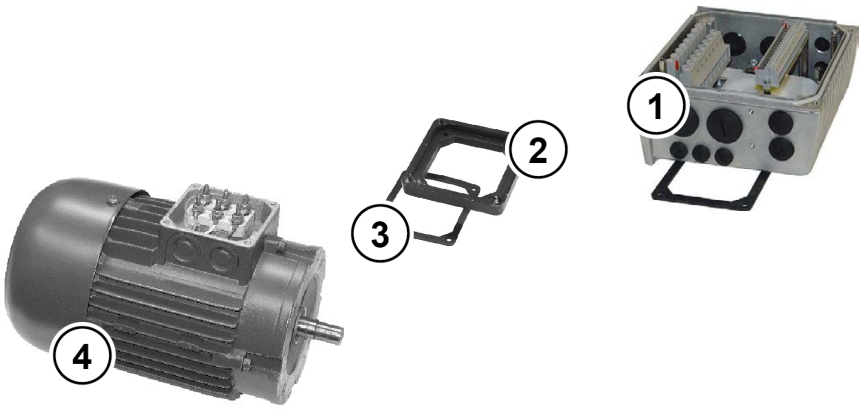
In some cases, the terminal box attachments are different for different motor sizes. Therefore, it may be necessary to use adapters to mount the device.

In order to ensure the maximum IPxx rating of the device for the entire unit, all elements of the drive unit (e.g. motor) must correspond to at least the same degree of protection.

Information **Third-party motors**

Check the adaptability of motors from other manufacturers individually!

Please refer to BU0320 for information about converting a drive to the device.



1 Connection unit SK TI4
2 Adapter plate
3 Gasket
4 Motor, size 71

Figure 4: Example of motor size adaptation

NORD motor sizes	Add-on SK 2xxE Size 1	Add-on SK 2xxE Size 2	Add-on SK 2xxE Size 3	Add-on SK 2xxE Size 4
Size 63 – 71	**with adapter kit I**	**with adapter kit I**	*Not possible*	*Not possible*
Size 80 – 112	***Direct mounting***	***Direct mounting***	**with adapter kit II**	*Not possible*
Size 132	*Not possible*	*Not possible*	***Direct mounting***	**with adapter kit III**
Size 160-180	*Not possible*	*Not possible*	*Not possible*	***Direct mounting***

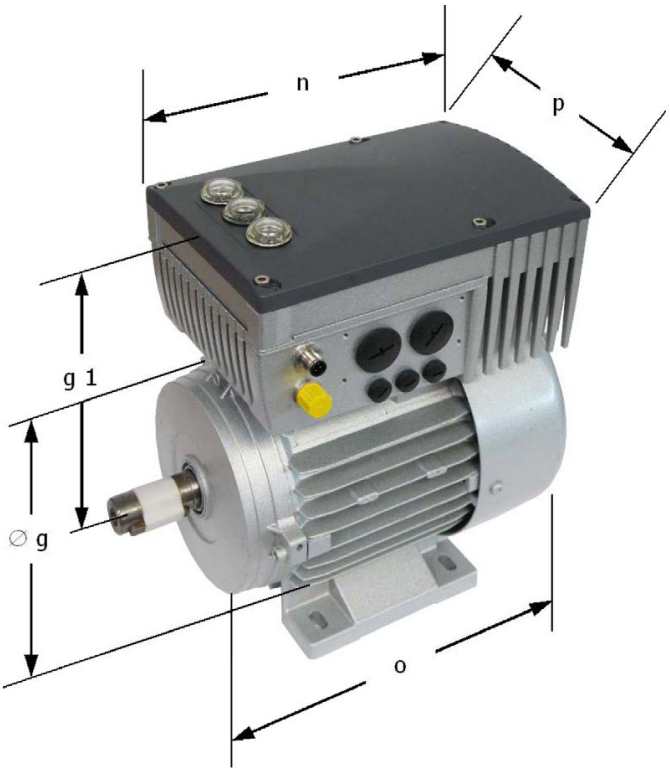
Overview of adapter kits

Adapter kit		Designation	Components	Mat. No.
Adapter kit I	IP55	SK TI4-12-adapter kit_63-71	Adapter plate, terminal box frame seal and screws	275119050
	IP66	SK TI4-12-adapter kit_63-71-C		275274324
Adapter kit II	IP55	SK TI4-3-adapter kit_80-112	Adapter plate, terminal box frame seal and screws	275274321
	IP66	SK TI4-3-adapter kit_80--C		275274325
Adapter kit III	IP55	SK TI4-4-adapter kit_132	Adapter plate, terminal box frame seal and screws	275274320
	IP66	SK TI4-132-adapter kit_132-C		275274326

2.1.2.2 Dimensions, SK 2xxE mounted on motor

Size		Housing dimensions SK 2xxE/motor					Weight of SK 2xxE without motor Approx. [kg]
VFD	Motor	∅ g	g 1	n	o	p	
Size 1	Size 71 [1)]	145	201	236	214	156	3.0
	Size 80	165	195		236		
	Size 90 S/L	183	200		251/276		
	Size 100	201	209		306		
Size 2	Size 80	165	202	266	236	176	4.1
	Size 90 S/L	183	207		251/276		
	Size 100	201	218		306		
	Size 112	228	228		326		
Size 3	Size 100	201	251	330	306	218	6.9
	Size 112	228	261		326		
	Size 132 S/M	266	262		373/411		
Size 4	Size 132	266	313	480	411	305	17.0
	Size 160	320	318		492		
	Size 180	358	335		614		

All dimensions in [mm]
1) incl. additional adapter and gasket (18 mm) [275119050]



2.2 Braking resistor (BW) - (from size 1)

During dynamic braking (frequency reduction) of a three-phase motor, electrical energy is fed back to the inverter if necessary. **From size 1** and above, an internal or external braking resistor can be used to avoid a shutdown of the device due to overvoltage. The integrated brake chopper (electronic switch) sheds the excess DC link voltage (operating point approx. 420 V/720 V_{DC}, depending on line voltage) to the braking resistor. The braking resistor converts excess energy into heat.

⚠ CAUTION

Hot surfaces

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

- Risk of injury due to local burns on contact.
- Heat damage to adjacent objects

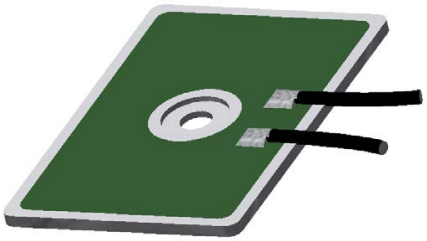
Allow sufficient cooling time before starting work on the product. Check the surface temperatures with suitable measuring equipment. Maintain an adequate distance to adjacent components.

Information **Parameterization of braking resistor data**

To protect the braking resistor from overload, the electrical characteristics of the braking resistor must be parameterized in parameters **P555**, **P556** and **P557**. With use of an *internal braking resistor* (SK BRI4-…) this is done by setting the DIP switch **S1:8** (📖 Section 2.2.1)

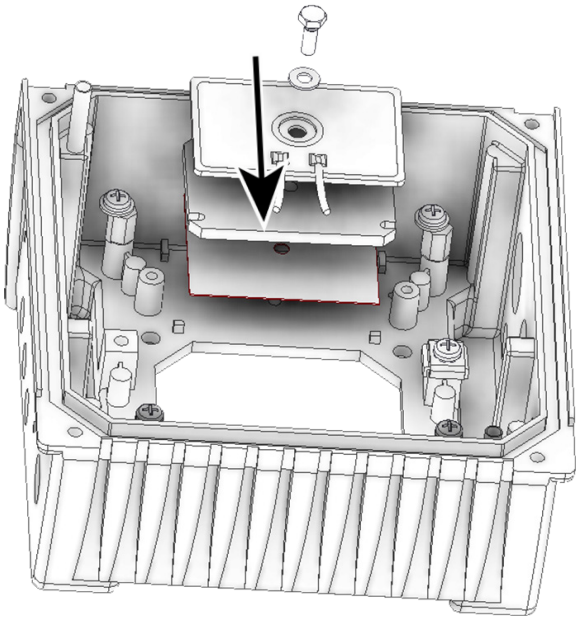
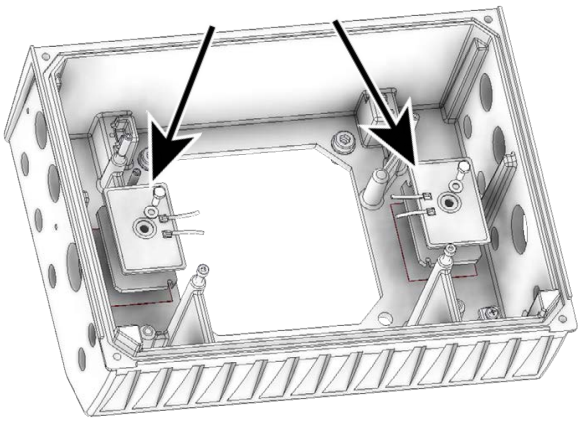
2.2.1 Internal braking resistor SK BRI4-…

The internal braking resistor can be used if only slight, short braking period are to be expected. The item includes a set of 2 braking resistors in the individual rating classes of size 4. These must be connected in parallel and thereby satisfy the electrical data from the description of the material. The mounting location for the 2nd braking resistor is opposite the mounting location of the 1st braking resistor.



Similar to illustration

Installation

Size 1 … 3	Size 4
	

The capacity of the SK BRI4 is limited (see also the following note field) and can be calculated as follows.

$P = P_n * \left(1 + \sqrt{(30/t_{brake})}\right)^2$ but the following applies $P < P_{max}$

(P=braking power (W), P_n= continuous braking power of resistor (W), P_{max}. peak braking power, t_{brake} = duration of braking process (s))

The permissible continuous braking power P_n must not be exceeded on average in the long-term.

Information — Peak load limitation - DIP switch (S1)

Switch the DIP switch (S1), DIP-No. 8 (please see chapter 4.2.2.2 "DIP switches (S1)")to "on" when using internal braking resistors. This is important in order to activate a maximum output limit to protect the braking resistor.

Electrical data

Designation (IP54)	Mat. No.	Resistor	Max. continuous output/limit [2] (P_n)	Power consumption [1] (P_{max})	Connecting cable or terminals
SK BRI4-1-100-100	275272005	100 Ω	100 W/25%	1.0 kWs	Silicone flexible lead 2x AWG 20 approx. 60 mm
SK BRI4-1-200-100	275272008	200 Ω	100 W/25%	1.0 kWs	
SK BRI4-1-400-100	275272012	400 Ω	100 W/25%	1.0 kWs	
SK BRI4-2-100-200	275272105	100 Ω	200 W/25%	2.0 kWs	Silicone flexible lead 2x AWG 18 approx. 60 mm
SK BRI4-2-200-200	275272108	200 Ω	200 W/25%	2.0 kWs	
SK BRI4-3-047-300	275272201	47 Ω	300 W/25%	3.0 kWs	Silicone flexible lead 2x AWG 16 approx. 170 mm
SK BRI4-3-100-300	275272205	100 Ω	300 W/25%	3.0 kWs	
SK BRI4-3-023-600	275272800 [3]	23 Ω (2 x 47 Ω)	600 W/25% (2 x 300 W)	6.0 kWs (2 x 3 kWs)	Silicone flexible lead 2x 2x AWG 16 approx. 170 mm
SK BRI4-3-050-600	275272801 [3]	50 Ω (2 x 100 Ω)	600 W/25% (2 x 300 W)	6.0 kWs (2 x 3 kWs)	
NOTE: DIP switch (S1), DIP-No. 8 = on	1) Maximum once within 10 s [2] 2) In order to prevent inadmissible heating of the connection unit, the continuous power is limited to 1/4 of the rated power of the braking resistor. This also has a limiting effect on energy consumption. 3) Set consisting of 2 resistors to be connected in parallel				

2.2.2 External braking resistor SK BRE4-... / SK BRW4-… / SK BREW4-…

The external braking resistor is provided for energy feedback, e.g. as occurs in pulsed drive units or lifting gear. It may be necessary here to plan for the exact braking resistor required (see adjacent figure).

Installation of an SK BRE4-… is not possible in combination with wall mounting kit **SK TIE4-WMK…..**. In this case, braking resistors of type **SK BREW4-…** are available as an alternative and they can also be mounted on the variable frequency drive.

In addition **SK BRW4-…** type braking resistors are available for mounting on a wall near the device.

Electrical data

Designation [1] (IP67)	Resistor	Max. continuous power (P_n)	Power consumption [2] (P_{max})
SK BRx4-1-100-100	100 Ω	100 W	2.2 kWs
SK BRx4-1-200-100	200 Ω	100 W	2.2 kWs
SK BRx4-1-400-100	400 Ω	100 W	2.2 kWs
SK BRx4-2-100-200	100 Ω	200 W	4.4 kWs
SK BRx4-2-200-200	200 Ω	200 W	4.4 kWs
SK BRx4-3-050-450	50 Ω	450 W	3.0 kWs
SK BRx4-3-100-450	100 Ω	450 W	3.0 kWs
	1) SK BRx4-: Variants: SK BRE4-, SK BRW4-, SK BREW4-		
	2) Maximum once within 120 s		

Information **Braking resistor**

Other versions or installation variants for external braking resistors can be provided upon request.

2.3 Electrical connection

⚠ WARNING

Electric shock

Dangerous voltages can be present at the power input and the motor connection terminals even when the device is not in operation.

- Before starting work, check whether all relevant components (voltage source, connection cables, connection terminals of the device) are de-energized using suitable measuring equipment.
- Use insulated tools (e.g. screwdrivers).
- DEVICES MUST BE GROUNDED.

Information

Temperature sensor and PTC thermistor (TF)

As with other signal cables, PTC thermistors must be laid separately from motor cables. Otherwise the interference signals induced by the motor winding into the line will cause a disturbance in the device.

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

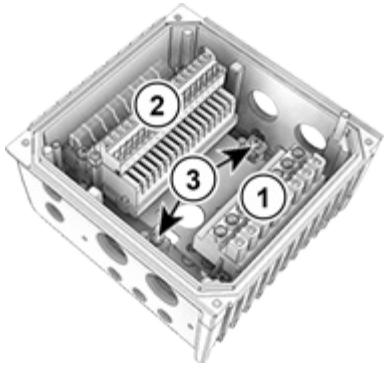
In order to establish the electrical connections, remove the SK 2xxE from the SK TI4-... connection unit (📖 Section 2.1.2 "Motor installation steps").

One terminal block is provided for the power connections and one for the control connections.

The PE connections (device ground) are inside the cast housing of the connection unit on the bottom. One contact is available on the power terminal block for size 4.

The terminal block assignments differ according to the version of the device. The correct assignment can be found on the inscription on the respective terminal or the terminal overview plan printed inside the device.

	Connecting terminals for
(1)	Power cable Motor cable Braking resistor wires
(2)	Control wires Electromechanical brake PTC thermistor (TF) of motor
(3)	PE



2.3.1 Wiring guidelines

The devices were developed for use in an industrial environment. Electromagnetic interference in this environment can cause disturbances in the device. In general, correct installation ensures safe and problem-free operation. To meet the limiting values of the EMC directives, take account of the following instructions.

1 Make sure that all devices connected to a common grounding point or a grounding bar are well grounded using short ground conductors with a large cross-section. It is especially important that each control unit which is connected to the electronic drive equipment (e.g. an automatic device) is connected to the same grounding point as the device itself through a short conductor with a large cross-section. Flat conductors (e.g. metal brackets) are preferable as they have a lower impedance at high frequencies.

2 Connect the PE conductor of the device-controlled motor as directly as possible to the ground terminal of the associated device. The presence of a central grounding bar and the grouping together of all protective conductors on this bar normally ensures proper operation.

3 Use shielded cables for control circuits where possible. Connect the shielding at the cable end carefully and make sure the wires do not run over long stretches without shielding.

   The shields of analog setpoint cables should only be grounded on one side on the device.

4 Install control cables as far as possible from power cables using separate cable ducts, etc.Create an angle of 90° in cable crossings where possible.

5 Make sure the contactors in the cabinets are interference-protected by using either RC circuitry in case of AC contactors or freewheeling diodes for DC contactors, **whereby the interference suppression devices are attached to the contactor coils**. Varistors for overvoltage limitation are also effective.

6 Use shielded or armored cables for load connections (motor cable, if necessary). The shielding or armoring must be grounded at both ends. Grounding should be done directly on the PE of the device if possible.

In addition, EMC-compliant wiring must be ensured.

Observe the safety regulations under all circumstances when installing the devices!

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 to be tested from the device before performing a high-voltage insulation test.

Information **Daisy-chaining of the line voltage**

Adhere to the permissible current load for connection terminals, plugs and supply cables when Daisy-chaining the line voltage. Noncompliance will result in thermal damage to live modules and their immediate vicinity.

2.3.2 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 (📖 Section **Fehler! Verweisquelle konnte nicht gefunden werden.** "**Fehler! Verweisquelle konnte nicht gefunden werden.**").

- Use of shielded motor cables is essential in order to comply with the specified radio interference suppression level.

Please note the following when connecting the device:

1 Make sure that the AC power supply provides the correct voltage and is suitable for the current required (📖 Section 7 "Technical Data").
2 Make sure that suitable branch circuit protection with the specified rated current range are installed between the voltage source and the device.
3 Power cable connection: to terminals **L1-L2/N-L3** and **PE** (depending on device)
4 Motor connection: to terminals **U-V-W**

   Use a 4-core motor cable if the device is being wall-mounted. In addition to **U-V-W**, connect **PE** as well. In this case, mount the cable shield, if present, on a large area of the metal screw connection of the cable inlet.

The use of ring cable lugs is recommended for connecting to PE.

Information — **Connection cables**

Use only copper cables with temperature class 80°C or equivalent for the connection. Higher temperature classes are permissible.

The maximum connection cross-section can be reduced when using **ferrules**.

Device	Cable Ø [mm²]		AWG	Tightening torque	
Size	rigid	flexible		[Nm]	[lb-in]
1 … 3	0.5 … 6	0.5 … 6	20-10	1.2 … 1.5	10.62 … 13.27
4	0.5 … 16	0.5 … 16	20-6	1.2 … 1.5	10.62 … 13.27
Electromechanical brake					
1 … 3	0.2 … 2.5	0.2 … 2.5	24-14	0.5 … 0.6	4.42 … 5.31
4	0.2 … 4	0.2 … 2.5	24-12	0.5 … 0.6	4.42 … 5.31

Table 7: Connection data

2.3.3 Electrical connection of the control unit

Connection data:

Terminal block		Size 1-4	Size 4
		typically	Terminals 79/80
Cable Ø *	[mm²]	0.2 … 2.5	0.2 … 4
AWG standard		24-14	24-12
Tightening torque	[Nm]	0.5 … 0.6	0.5 … 0.6
	[lb-in]	4.42 … 5.31	4.42 … 5.31
Slotted screwdriver	[mm]	3.5	3.5

* flexible cable with ferrules (with or **without** plastic collar) or rigid cable

SK 2x0E

The device generates its own 24 V DC control voltage and provides this to terminal 43 (for connecting external sensor systems, for example).

However, size 4 devices can also be supplied by an external control voltage source (connection to terminal 44). The switchover between the internal and external power supply unit takes place automatically.

SK 2x5E

The device must be provided with an external 24 V DC control voltage. Alternatively, an optional 24 V DC power supply unit model SK CU4-… or SK TU4-… can be used.

The control voltage for devices that use the AS interface (SK 225E and SK 235E) must be supplied via the yellow AS interface line. However, in this case the variable frequency drive must not have an additional supply via terminal 44 in order to prevent damage to the power supply unit or the AS interface bus.

Information — **Control voltage overload**

A control unit overload caused by impermissibly high currents may destroy the unit. Impermissibly high currents occur if the total current actually obtained exceeds the permissible total current, or if the 24 V DC control voltage for other devices is passed through the variable frequency drive. Use double ferrules, for example, to avoid conduction through the variable frequency drive.

The control unit can also be overloaded and destroyed if the 24 V DC supply terminals of devices with an integrated power supply unit (SK 2x0E) are connected to a different voltage source. For this reason, make sure that any wires for the 24 V DC power supply are not connected to the device but are insulated accordingly, particularly when installing connectors for the control connection (example of connector for system bus connection SK TIE4-M12-SYSS).

Information — **Total currents**

24 V DC can be taken from several terminals as necessary. This also includes e.g. digital outputs or an operating module connected via RJ45.

The sum total of currents obtained must not exceed the following limits:

Device model	Size 1 to 3	Size 4
SK 2x0E	200 mA	500 mA
SK 2x5E	200 mA	-
Devices with AS interface, when using the AS interface	60 mA	60 mA

Information

Reaction time of digital inputs

The reaction time of a digital signal is approx. 4-5 ms and consists of the following:

Scan time	1 ms
Signal stability check	3 ms
Internal processing	< 1 ms

For digital inputs DIN2 and DIN3 there is a parallel channel which relays the signal pulses between 250 Hz and 205 kHz directly to the processor, and therefore makes it possible for a rotary encoder to be evaluated.

Information

Cable routing

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

If the cables are routed in parallel, keep a minimum distance of 20 cm from cables which carry a voltage of > 60 V. The minimum distance may be reduced by shielding live cables or by using grounded metal separator within the cable ducts.

Alternatively: Use of a hybrid cable with shielded control lines.

Control terminal details

Labeling, function

SH:	Function: Safe stop	DOUT:	Digital output
ASI+/-:	Integrated AS interface	24 V SH:	"Safe stop" input
24 V:	24 V DC control voltage	0 V SH:	"Safe stop" reference potential
10 V REF:	10 V DC reference voltage for AIN	AIN +/-	Analog input
AGND:	Reference potential for analog signals	SYS H/L:	System bus
GND:	Reference potential for digital signals	MB+/-:	Control of electromechanical brake
DIN:	Digital input	TF+/-:	PTC thermistor connection of motor

Connections depending on the variable frequency drive type

Detailed information regarding **functional safety** (safe stop) can be found in supplementary manual BU0230. - www.nord.com -

Sizes 1 ... 3

SK 200E	SK 210E SH	SK 220E ASI	SK 230E SH+ASI	Device model Labeling Pin			SK 205E	SK 215E SH	SK 225E ASI	SK 235E SH+ASI
24 V (output)				**43**	1	**44**	24 V (input)*			
AIN1+		ASI+		**14/84**	2	**44/84**	24 V (input)*		ASI+	
AIN2+				**16**	3	**40**	GND			
AGND		ASI-		**12/85**	4	**40/85**	GND		ASI-	
DIN1				**21**	5	**21**	DIN1			
DIN2				**22**	6	**22**	DIN2			
DIN3				**23**	7	**23**	DIN3			
DIN4	24 V SH	DIN4	24 V SH	**24/89**	8	**24/89**	DIN4	24 V SH	DIN4	24 V SH
GND	0 V SH	GND	0 V SH	**40/88**	9	**40/88**	GND	0 V SH	GND	0 V SH
DOUT1				**1**	10	**1**	DOUT1			
GND				**40**	11	**40**	GND			
SYS H				**77**	12	**77**	SYS H			
SYS L				**78**	13	**78**	SYS L			
10 V REF				**11**	14	**-**	---			
DOUT2				**3**	15	**79**	MB+			
GND				**40**	16	**80**	MB-			
TF+				**38**	17	**38**	TF+			
TF-				**39**	18	**39**	TF-			

* when using the AS interface, terminal 44 provides an output voltage (26.5 V DC … 31.6 V DC, max. 60 mA). In this case, no voltage sources may be connected to this terminal!

Size 4

Device model		SK 200E	SK 210E (SH)	SK 220E (ASI)	SK 230E (SH+ASI)
Pin	**Labeling**				
1	**43**	24 V (output)			
2	**43**	24 V (output)			
3	**40**	GND			
4	**40**	GND			
5	**-/84**	/		ASI+	
6	**-/85**	/		ASI-	
7	**11**	10 V REF			
8	**14**	AIN1+			
9	**16**	AIN2+			
10	**12**	AGND			
11	**44**	24 V (input)			
12	**44**	24 V (input)			
13	**40**	GND			
14	**40**	GND			
15	**21**	DIN1			
16	**22**	DIN2			
17	**23**	DIN3			
18	**24/89**	DIN4	24 V SH	DIN4	24 V SH
19	**40/88**	GND	0 V SH	GND	0 V SH
20	**40**	GND			
21	**1**	DOUT1			
22	**40**	GND			
23	**3**	DOUT2			
24	**40**	GND			
25	**77**	SYS H			
26	**78**	SYS L			
27	**38**	TF+			
28	**39**	TF-			
Separate terminal block (2-pole):					
1	**79**	MB+			
2	**80**	MB-			

Information — DIN 2 and DIN 3 double allocation

Digital inputs DIN2 and DIN3 are used for 2 different functions:

1. for digital functions that can be parameterized (e.g. “enable left”),
2. for evaluation of an incremental encoder.

Both functions are coupled by an OR link.

Evaluation of an incremental encoder is always activated. This means that when an incremental encoder is connected, make sure that the digital functions are switched off (parameter (P420 [-02] and [-03]) or with DIP switch (chapter 4.2.2.2)).

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 (line number) of the encoder can be set with a negative prefix in the **P301** parameter.

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 can occur that can cause encoder signal problems or destruction of the encoder.

2.4 Operation in potentially explosive environments

WARNING — **Explosion hazard due to electricity**

Electric sparks may ignite an explosive atmosphere.

- Do not open the device in an explosive atmosphere and do not remove any covers (e.g. diagnostic openings).
- All work on the device must only be carried out with the system **de-energized**.
- Wait for the required time (≥ 30 min) after switching off.
- Before starting work, check that all relevant components (voltage source, connection cables, connection terminals of the device) are de-energized using suitable measuring equipment.

WARNING — **Explosion hazard due to high temperatures**

High temperatures may cause the ignition of an explosive atmosphere.

Temperatures may occur within the device and the motor, which are higher than the maximum permissible surface temperature of the housing. Dust deposits may restrict the cooling of the device.

- Clean the device at regular intervals to prevent the accumulation of impermissible dust deposits.
- Do not open or remove the device from the motor in an explosive atmosphere.

WARNING — **Explosion hazard due to electrostatic charge**

Electrostatic charges may cause sudden discharges with the formation of sparks. Sparks may ignite an explosive atmosphere.

The housing cover is made of plastic. This may become electrostatically charged, e.g. due to a flow of particles caused by the fan.

- Avoid air movement or air flows at the operating location of the device.

With appropriate modification, the device can be used in certain potentially explosive areas.

If the device is connected to a motor and a gear unit, the EX labeling of the motor and the gear unit must also be observed. Otherwise, operating the drive in this environment is unauthorized.

Information — **SK 2xxE, size 4**

Size 4 devices (SK 2x0E-551-323 … -112-323 and SK 2x0E-112-340 … -222-340) are **not** approved for operation in potentially explosive environments.

2.4.1 Operation in potentially explosive environments - ATEX zone 22 3D

All of the conditions which must be observed for operation of the device in an explosion hazard environment (ATEX) are summarized below.

2.4.1.1 Modification of the device for compliance with category 3D

Only a specially modified device is permissible for operation in ATEX zone 22. This adaptation is only made at the NORD factory. In order to use the device in ATEX zone 22, the diagnostic caps are replaced with anodized oil inspection glasses, among other things.

(1) Year of manufacture

(2) Labelling of the device (ATEX)

IP55:	II 3D Ex tc IIIB T125°C Dc X
IP66:	II 3D Ex tc IIIC T125°C Dc X

Allocation:

- Protection with "housing"
- Procedure "A" zone "22" category 3D
- IP55/IP66 rating (according to the device)

  →IP66 is required for conductive dust

- Maximum surface temperature 125°C
- Ambient temperature -20°C to +40°C

Information

Possible damage caused by mechanical overload

Devices in series SK 2xxE and the permitted options are only designed for a degree of mechanical stress that corresponds to a low impact energy of 4J.

Higher loads will lead to damage to or in the device.

The components needed for the modification are contained in an appropriately modified variable frequency drive connection unit (SK TI4-…-EX).

2.4.1.2 Options for ATEX zone 22, category 3D

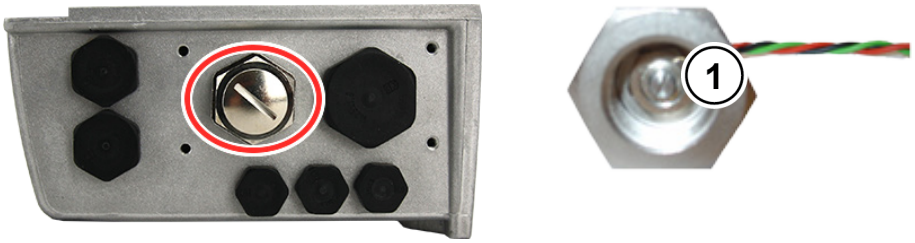
In order to ensure that the device is ATEX-compliant, its optional modules must also be approved for potentially explosive areas. Optional modules that are not in the following list may **not** be used in an ATEX zone 22 3D. This also includes connectors and switches that may also not be used in such an environment.

Control and parameterization units are basically **not** approved for **operation in ATEX - zone 22 3D**. They may therefore only be used for commissioning or maintenance purposes and if it has been ensured that there is no explosive dust atmosphere.

Designation	Material number	Use permissible
Braking resistors		
SK BRI4-1-100-100	275272005	Yes
SK BRI4-1-200-100	275272008	Yes
SK BRI4-1-400-100	275272012	Yes
SK BRI4-2-100-200	275272105	Yes
SK BRI4-2-200-200	275272108	Yes
Bus interfaces		
SK CU4-CAO(-C)	275271001 / (275271501)	Yes
SK CU4-DEV(-C)	275271002 / (275271502)	Yes
SK CU4-ECT(-C)	275271017 / (275271517)	Yes
SK CU4-EIP(-C)	275271019 / (275271519)	Yes
SK CU4-PBR(-C)	275271000 / (275271500)	Yes
SK CU4-PNT(-C)	275271015 / (275271515)	Yes
SK CU4-POL(-C)	275271018 / (275271518)	Yes
IO -extensions		
SK CU4-IOE(-C)	275271006 / (275271506)	Yes
SK CU4-IOE2(-C)	275271007 / (275271507)	Yes
SK CU4-REL(-C)	275271011 / (275271511)	Yes
Power supply units		
SK CU4-24V-123-B(-C)	275271108 / (275271608)	Yes
SK CU4-24V-140-B(-C)	275271109 / (275271609)	Yes
Potentiometers		
SK ATX-POT	275142000	Yes
Miscellaneous		
SK CU4-FUSE(-C)	275271122 / (275271622)	Yes
SK CU4-MBR(-C)	275271010 / (275271510)	Yes
Wall mounting kits		
SK TIE4-WMK-1-EX	275175053	Yes
SK TIE4-WMK-2-EX	275175054	Yes
Adapter kits		
SK TI4-12-Adapter kit_63_71-EX	275175038	Yes
SK TI4-3-Adapter kit_80_112-EX	275175039	Yes

SK ATX-POT

The category 3D variable frequency drive can be equipped with an ATEX-compliant 10 kΩ potentiometer (SK ATX-POT) which can be used for setpoint (e.g. speed) adjustment on the device. The potentiometer is used with an M20-M25 extension in one of the M25 cable screw connections. The selected setpoint can be adjusted with a screwdriver. Due to the detachable cap, this component complies with ATEX requirements. Permanent operation may only be carried out with the cap closed.



1 Setpoint adjustment using a screwdriver

SK ATX-POT wire color	Designation	Terminal SK CU4-24V…	Terminal SK CU4-IOE	Terminal SK 2x0E
Red	+10 V reference	[11]	[11]	[11]
Black	AGND/0 V	[12]	[12]	[12]/[40]
Green	Analog input	[14]	[14]/[16]	[14]/[16]

Information — **Internal braking resistor "SK BRI4-…"**

If an internal braking resistor of type SK BRI4-x-xxx-xxx is used, activate the power limitation for this under all circumstances (📖 Section 2.2.1 "Internal braking resistor SK BRI4-…"). Only the resistors assigned to the relevant inverter type may be used.

2.4.1.3 Maximum output voltage and torque reduction

As the maximum achievable output voltage depends on the pulse frequency to be set, in some cases the torque which is specified in document B1091-1 must be reduced for values above the rated pulse frequency of 6 kHz.

For F_{pulse} > 6 kHz: $T_{reduction}[\%] = 1\ \% * (F_{pulse} – 6\ kHz)$

Therefore, the maximum torque must be reduced by 1% for each kHz pulse frequency above 6 kHz. The torque limitation must be taken into account when reaching the breaking frequency. The same applies for the degree of modulation (P218). With the factory setting of 100%, a torque reduction of 5% must be taken into account in the field reduction range:

For P218 > 100%: $T_{reduction}[\%] = 1\% * (105 – P218)$

No reduction needs to be taken into account above a value of 105%. However, with values above 105% no increase in torque above that of the Planning Guideline will be achieved. Under certain circumstances, degrees of modulation > 100% may lead to oscillations and motor vibration due to higher harmonics.

Information — **Power derating**

At pulse frequencies above 6 kHz (400 V devices) or 8 kHz (230 V) devices, the reduction in power must be taken into account for the design of the drive unit.

If parameter (P218) is set to < 105%, the derating of the degree of modulation must be taken into account in the field weakening range.

2.4.1.4 Commissioning information

For zone 22 the cable inlets must at least comply with the IP55 rating. Unused openings must be closed with blank screw caps that are suitable for ATEX zone 22 3D (generally IP66).

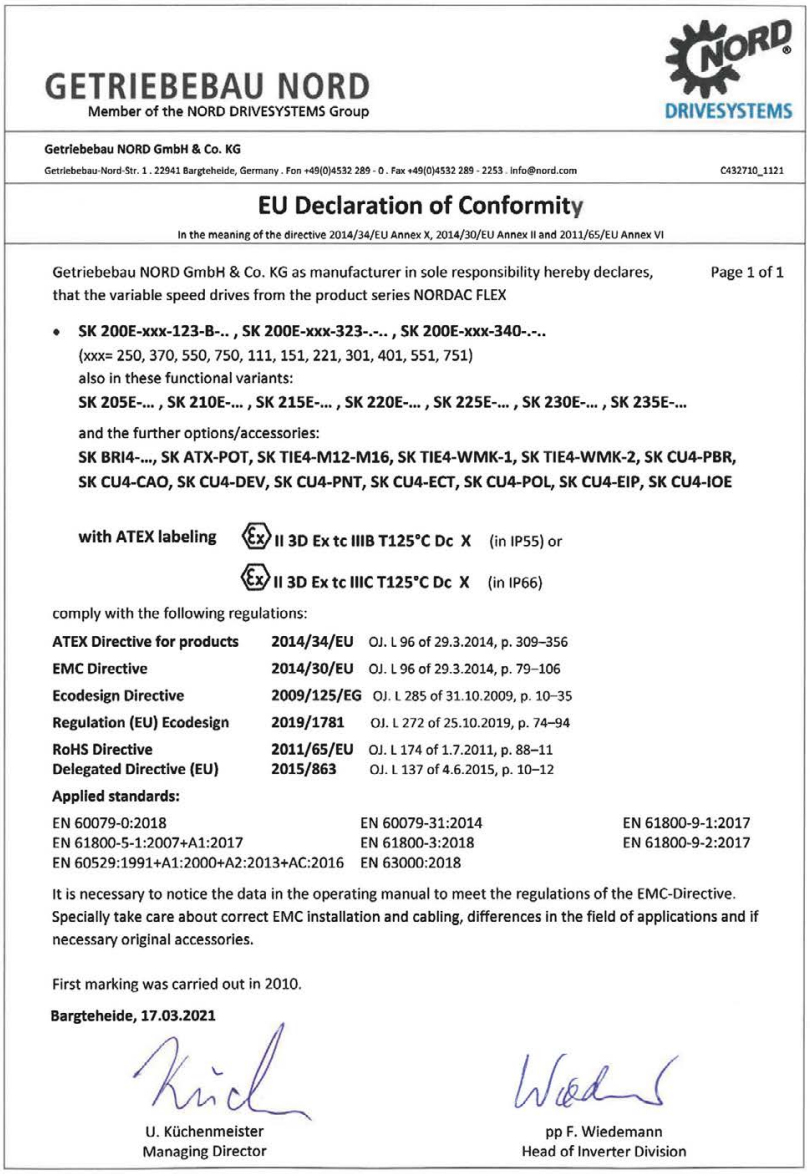
The motors are protected from overheating by the device. This takes place by means of evaluation of the motor PTC thermistor (TF) on the device. In order to ensure this function, the PTC thermistor must be connected to the intended input (terminal 38/39).

In addition, make sure to use a NORD motor from the motor list (P200). If a standard 4-pole NORD motor or a motor from a different manufacturer is not used, data for the motor parameters ((P201) to (P208)) must be adjusted to those on the motor nameplate. *The stator resistance of the motor (see P208) must be measured by the inverter and at ambient temperature. To do this, set parameter P220 to 1.* In addition, parameterize the variable frequency drive so that the motor can be operated with a maximum speed of 3000 rpm. For a four-pole motor, set the maximum frequency to a value that is less than or equal to 100 Hz ((P105) ≤ 100). Adhere to the maximum permissible output speed of the gear unit here. In addition, switch on I²t motor monitoring (parameter (P535)/(P533)) and set the pulse frequency to between 4 kHz and 6 kHz.

Overview of required parameter settings:

Parameter	Setting value	Factory setting	Description
P105 maximum frequency	≤ 100 Hz	[50]	This value relates to a 4-pole motor. Basically, the value must only be so large that a motor speed of 3000 rpm is not exceeded.
P200 motor list	Select appropriate motor power	[0]	If a 4-pole NORD motor is used, the pre-set motor data can be called up.
P201 – P208 Motor data	Data according to nameplate	[xxx]	If a 4-pole NORD motor is not used, the motor data on the nameplate must be entered here.
P218 degree of modulation	≥ 100%	[100]	Determines the maximum possible output voltage
P220 parameter identification	1	[0]	Measures the stator resistance of the motor. When the measurement is complete, the parameter is automatically reset to 0. The value that is determined is written to P208
P504 Pulse frequency	4 kHz … 6 kHz	[6]	For pulse frequencies above 6 kHz a reduction of the maximum torque is necessary.
P533 I^2t motor factor	< 100%	[100]	A torque reduction can be taken into account with values less than 100 in I^2t monitoring.
P535 I^2t motor	According to motor and ventilation	[0]	The I^2t monitoring of the motor must be switched on. The set values depend on the type of ventilation and the motor used, see B1091-1

2.4.1.5 EU conformity declaration - ATEX



GETRIEBEBAU NORD
Member of the NORD DRIVESYSTEMS Group

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 C432710_1121

EU Declaration of Conformity

In the meaning of the directive 2014/34/EU Annex X, 2014/30/EU Annex II and 2011/65/EU Annex VI

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

Page 1 of 1

- **SK 200E-xxx-123-B-.. , SK 200E-xxx-323-.-.. , SK 200E-xxx-340-.-..**
  (xxx= 250, 370, 550, 750, 111, 151, 221, 301, 401, 551, 751)
  also in these functional variants:
  SK 205E-... , SK 210E-... , SK 215E-... , SK 220E-... , SK 225E-... , SK 230E-... , SK 235E-...

  and the further options/accessories:
  SK BRI4-..., SK ATX-POT, SK TIE4-M12-M16, SK TIE4-WMK-1, SK TIE4-WMK-2, SK CU4-PBR, SK CU4-CAO, SK CU4-DEV, SK CU4-PNT, SK CU4-ECT, SK CU4-POL, SK CU4-EIP, SK CU4-IOE

with ATEX labeling Ⓔx **II 3D Ex tc IIIB T125°C Dc X** (in IP55) or
Ⓔx **II 3D Ex tc IIIC T125°C Dc X** (in IP66)

comply with the following regulations:

ATEX Directive for products	**2014/34/EU**	OJ. L 96 of 29.3.2014, p. 309–356
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 60079-0:2018	EN 60079-31:2014	EN 61800-9-1:2017
EN 61800-5-1:2007+A1:2017	EN 61800-3:2018	EN 61800-9-2:2017
EN 60529:1991+A1:2000+A2:2013+AC:2016	EN 63000:2018	

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 2010.

Bargteheide, 17.03.2021

U. Küchenmeister
Managing Director

pp F. Wiedemann
Head of Inverter Division

2.4.2 Operation in potentially explosive environments - EAC Ex

All of the conditions which must be observed for operation of the device in an explosion hazard environment according to EAC Ex are summarized below. The conditions according to 🕮 Section 2.4.1 "Operation in potentially explosive environments - ATEX zone 22 3D "apply .Deviations which are relevant for approval according to EAC Ex are described below and must be complied with.

2.4.2.1 Modification of the device

🕮 Section 2.4.1.1applies.

Labeling of the device according to EAC EX deviates as follows.

Device labeling

The following applies for wall mounted devices:

IP55:	Ex tc IIIB T125 °C Dc X
IP66:	Ex tc IIIC T125 °C Dc X

For motor mounted devices, the following apply:

IP55:	Ex tc IIIB Dc U
IP66:	Ex tc IIIC Dc U

Allocation:

- Protection with "housing"
- Procedure "A" zone "22" category 3D
- IP55/IP66 rating (according to the device)

  →IP66 is required for conductive dust

- Maximum surface temperature 125°C
- Ambient temperature -20°C to +40°C

Information — **Code "U"**

Code "U" applies for devices which are intended for motor mounting. Devices which are so labeled are classed as incomplete and may only be operated together with a corresponding motor. If a device with code "U" is mounted on a motor, the codes and restrictions indicated on the motor or geared motor also apply.

Information — **Code "X"**

Code "X" indicates that the permissible ambient temperature range is between -20°C and +40°C.

2.4.2.2 Further information

Further information about explosion protection can be found in the following sections.

Description	🕮 Section
"Options for ATEX zone 22, category 3D"	2.4.1.2
"Maximum output voltage and torque reduction"	2.4.1.3
"Commissioning information"	2.4.1.4

2.4.2.3 EAC Ex Certificate

TC RU C-DE.AA87.B.01109

3 Display, operation and options

In the factory default configuration, without additional options, the diagnostic LEDs are externally visible. These indicate the actual device status. Two potentiometers (only SK 2x5E) and 8 DIP switches (S1) are provided in order to set the most important parameters. In this minimum configuration no other adapted parameters are stored in the external (plug-in) EEPROM. The only exception is data concerning operating hours, faults and fault circumstances. This data can only be saved in the external EEPROM (memory module) up to firmware version V1.2. As of firmware version 1.3, this data is saved in the internal EEPROM of the variable frequency drive.

The memory module (external EEPROM) can be pre-parameterized independently of the variable frequency drive using programming adapter SK EPG-3H.

Figure 5: SK 2xxE (size 1), top view

Figure 6: SK 2xxE (size 1), internal view

No.	Designation	SK 2x0E size 1 … 3	SK 2x5E and SK 2x0E size 4
1	Diagnostic opening 1	RJ12 connection	RJ12 connection
2	Diagnostic opening 2	DIP switch AIN (250 Ω for current setpoint)	Diagnostic LEDs
3	Diagnostic opening 3	Diagnostic LEDs	Potentiometers (P1/P2)
4	8x DIP switches		
5	Plug-in EEPROM		

Information

Diagnostic caps' tightening torques

The tightening torque for the transparent diagnostic caps (inspection glasses) is 2.5 Nm.

3.1 Control and parameterization options

Various control options are available that can be mounted directly to the device or in close proximity to it and directly connected.

Parameterization units also provide a facility for accessing and adjusting the parameters of the device.

Designation		Material number	Document
Switches and potentiometers (attachment)			
SK CU4-POT	Switch/Potentiometer	275271207	🕮 Section 3.1.2 "Potentiometer adapter, SK CU4-POT"
SK TIE4-POT	Potentiometer 0-10 V	275274700	TI 275274700
SK TIE4-SWT	L-OFF-R switch	275274701	TI 275274701
Control and parameterization units (handheld)			
SK CSX-3H	Simple Box	275281013	BU0040
SK PAR-3H	Parameter Box	275281014	BU0040

3.1.1 Use of control and parameterization units

All parameters can be conveniently accessed for reading or editing by means of an optional Simple Box or Parameter Box. The modified parameter data is stored in the non-volatile EEPROM memory.

Up to 5 complete device data sets can be stored in the Parameter Box and then retrieved.

The Simple Box or the Parameter Box is connected to the device through an RJ12-RJ12 cable.

Figure 7: Simple Box, handheld, SK CSX-3H

Figure 8: Parameter Box, handheld, SK PAR-3H

Module	Description	Data
SK CSX-3H (handheld Simple Box)	Used for commissioning, parameterization, configuration and control of the device [1].	• 4-digit, 7-segment LED display, membrane button • IP20 • RJ12-RJ12 cable (connection to the device [1])
SK PAR-3H (handheld Parameter Box)	Used for commissioning, parameterization, configuration and control of the variable frequency drive and its options (SK xU4-…). Entire parameter data sets can be stored.	• 4-line backlit LCD display, membrane keys • Stores up to 5 complete parameter data sets • IP20 • RJ12-RJ12 cable (connection to the device) • USB cable (connection to PC)
1)	Does not apply to optional modules such as bus interfaces	

Connection

1. Remove diagnostics glass of the RJ12 socket.
2. Establish RJ12-RJ12 cable connection between control unit and FEHLER - Variable ohne Inhalt.

   When a diagnostics glass or a blind plug is open, make sure no dirt or moisture enters the device.
3. After commissioning, screw the **diagnostics glass or blind plugs back in again** and make sure they are **tightly sealed** before starting regular operation.

Information

Diagnostic caps' tightening torques

The tightening torque for the transparent diagnostic caps (inspection glasses) is 2.5 Nm.

3.1.2 Potentiometer adapter, SK CU4-POT

Part no.: 275 271 207

Digital signals R and L can be directly applied to the corresponding digital inputs 1 and 2 of the variable frequency drive.

The potentiometer (0 - 10 V) can be evaluated via an analog input of the variable frequency drive (if present) or via an I/O extension. An optional 24 V module (SK xU4-24V-...) also provides the possibility of converting analog setpoints to proportional pulses (frequencies). These pulses, in turn, can be evaluated via one of the digital inputs 2 or 3 (P420 [02]/[03] = 26/27) of the variable frequency drive in the form of a setpoint (P400 [-06]/[-07]).

Module		SK CU4-POT Part no.: 275 271 207)	Connection: Terminal No.			Function
			SK 2x0E	SK 2x5E		
Pin	Color		VFD	VFD	Power supply unit	
1	brown	24 V supply voltage	43		44	Rotary switch L - OFF - R
2	black	Enable R (e.g. DIN1)	21	21		
3	white	Enable L (e.g. DIN2)	22	22		
4	white	Access to AIN+	14		14	Potentiometer 10 kΩ
5	brown	Reference voltage 10 V	11		11	
6	blue	Analog ground AGND	12		12	

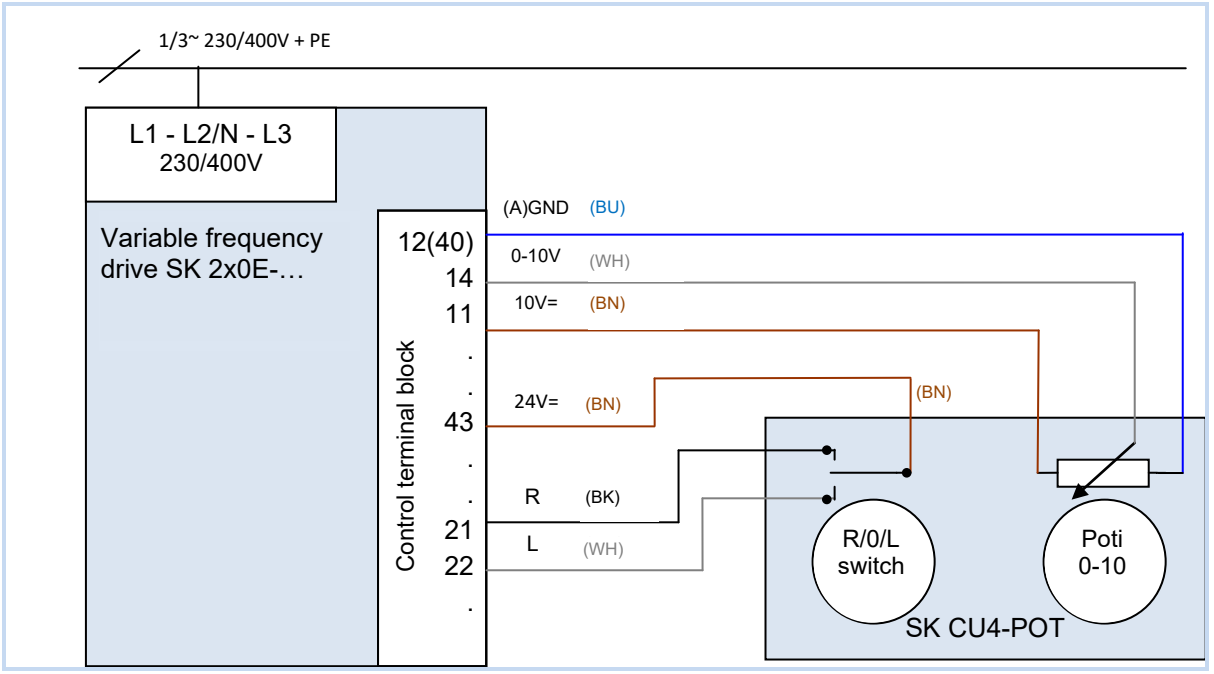


Figure 9: Connection diagram SK CU4-POT, example SK 2x0E

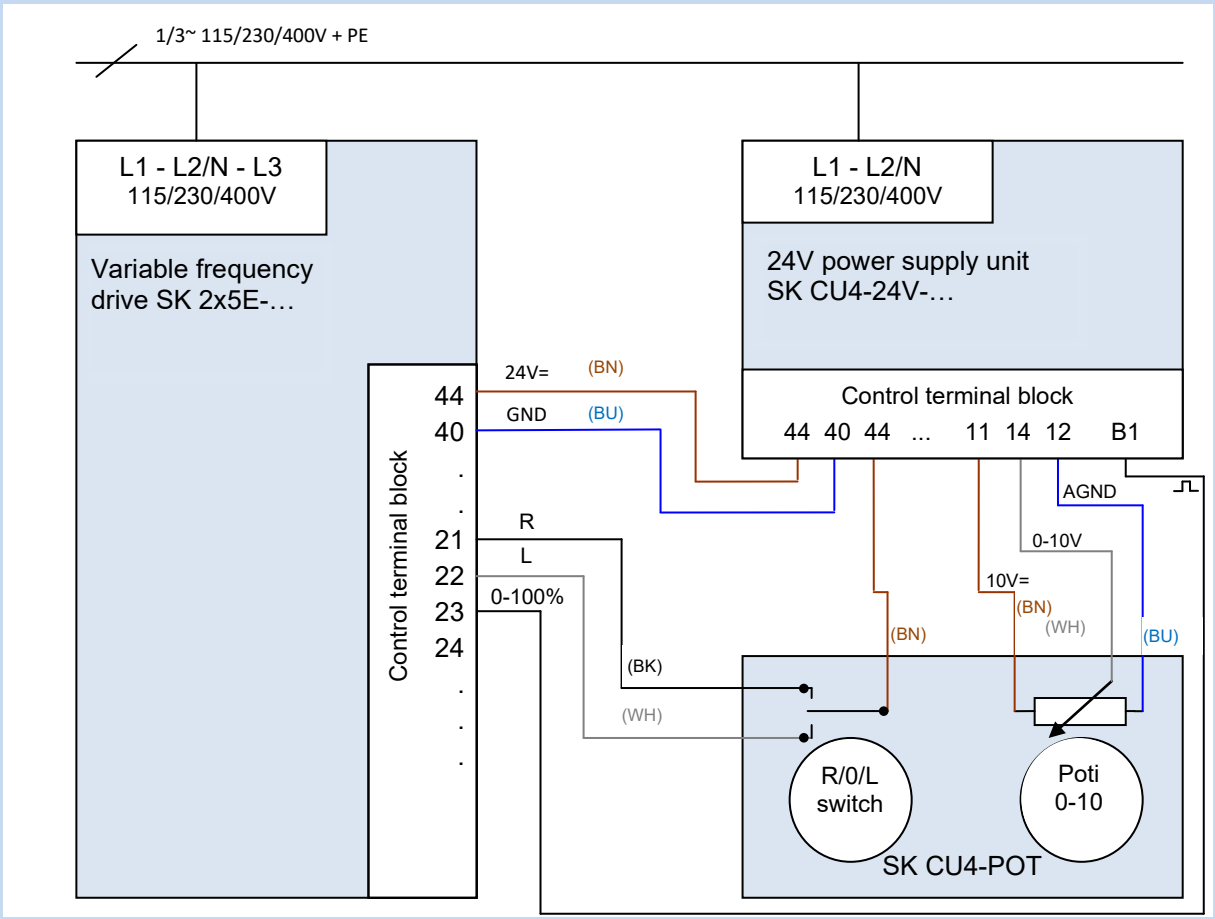


Figure 10: Connection diagram and parameterization of SK CU4-POT, example SK 2x5E

DIP switch settings (S1:):	DIP3 = off, DIP4 = on, DIP5 = off (please see chapter 4.2.2.2 "DIP switches (S1)" on page 58)	
or		
Recommended parameter setting,	P400 [07] = 1	P420 [02] = 2
S1: DIP1-8 = off	P420 [01] = 1	P420 [03]= 26

4 Commissioning

WARNING

Unexpected movement

Connection of the supply voltage may directly or indirectly set the device into motion. This may 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.:

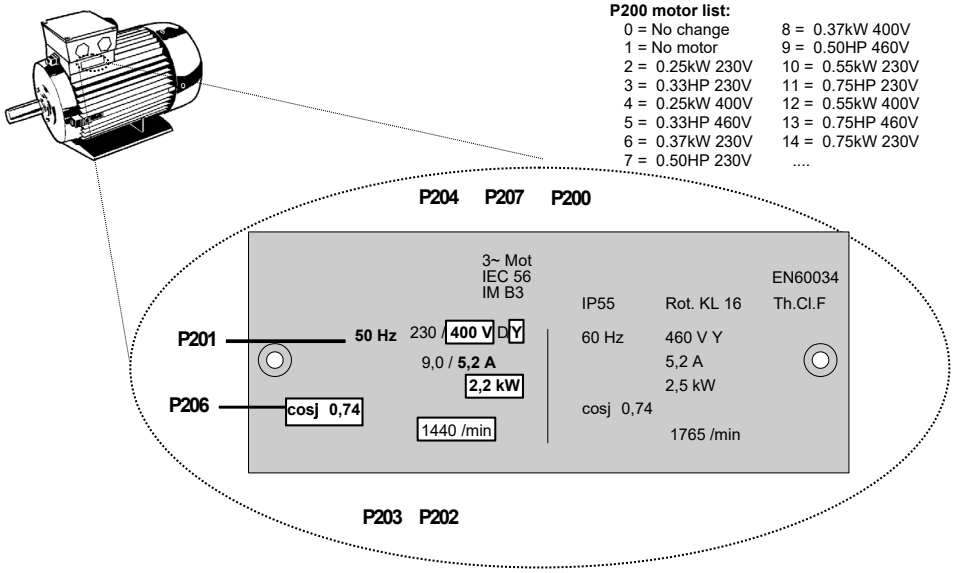
- Parameterization of an "automatic start"
- Incorrect parameterization
- Control of the device with an enabling signal from a higher level control unit (via I/O or bus signals)
- Incorrect motor data
- Incorrect encoder connection
- Release of a mechanical holding brake
- External influences such as gravity or other kinetic energy which acts on the drive unit
- In IT systems: System fault (ground fault)

• 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, make sure that there are no persons within the area of action and the danger area of the system.

4.1 Factory settings

All variable frequency drives supplied by Getriebebau NORD are pre-programmed with the default setting for standard applications with 4 pole standard motors (same voltage and power). When using motors with another output or number of poles, enter data from the nameplate of the motor in parameters **P201**...**P207** under the menu item >Motor data<.

All motor data (IE1, IE4) can be pre-set using parameter **P200**. After using this function, this parameter is reset to 0 = no change! The data is loaded automatically to parameters **P201**...**P209** and can be compared again with data on the motor nameplate.



For the correct operation of the drive unit, it is necessary to input the motor data from the nameplate as precisely as possible. In particular, an automatic stator resistance measurement using parameter **P220** is recommended.

Motor data for IE2 / IE3 motors are provided via the **NORDCON** software. The required data record can be selected and imported into the variable frequency drive with the aid of the "Import motor parameter" function (also refer to the manual for the **NORDCON** software BU 0000).

Information — DIN 2 and DIN 3 double allocation

Digital inputs DIN2 and DIN3 are used for 2 different functions:

1. for digital functions that can be parameterized (e.g. “enable left”),
2. for evaluation of an incremental encoder.

Both functions are coupled by an OR link.

Evaluation of an incremental encoder is always activated. This means that when an incremental encoder is connected, make sure that the digital functions are switched off (parameter (P420 [-02] and [-03]) or with DIP switch (please see chapter 4.2.2.2 "DIP switches (S1)" on page 58)).

Information — DIP switch priority

Please note that DIP switch settings on the variable frequency drive (**S1**) have priority over parameter settings.

The settings of integrated potentiometers **P1** and **P2** must also be taken into consideration.

4.2 Starting up the device

The variable frequency drive can be commissioned in various ways:

a) For simple applications (e.g conveyor applications) by means of the DIP switches (S1) integrated in the variable frequency drive (internal) and the externally accessible potentiometers (SK 2x5E only).

   The plug-in EEPROM is not required in this configuration.

b) By changing parameters with the control and parameterization unit (SK CSX-3H or SK PAR-3H) or the NORD CON PC-supported software.

   The changes to the parameters in the plug-in EEPROM (memory module) are stored when doing this. Data is automatically saved in the internal EEPROM if no EEPROM is plugged in as of firmware **V1.3**.

   Data is generally stored in the internal EEPROM as of firmware **V1.4 R2**. Data is stored in parallel on the external EEPROM.

   For older firmware versions an external EEPROM must always be plugged in during operation in order to save changed parameter values permanently.

Information **Presetting of physical I/O and I/O bits**

For commissioning standard applications, a limited number of the variable frequency drive inputs and outputs (physical and I/O bits) have predefined functions. These settings may need to be changed (parameters (P420), (P434), (P480), (P481)).

4.2.1 Connection

In order to provide basic operational capability, connect the power and motor lines to the relevant terminals after the device is mounted on the motor or the wall mounting kit (📖 Section 2.3.2 "Electrical connection of power unit").

SK 2x5E: It is also essential for the device to be provided with a 24 V DC control voltage.

Information **Control voltage SK 2x5E:**

The required 24 V control voltage can be implemented by means of an integrated (SK CU4-24V-…) or external (SK TU4-24V-…) optional power module or a comparable 24 V DC power source (📖 Section 2.3.3 "Electrical connection of the control unit").

4.2.2 Configuration

Changes to individual parameters are usually necessary for operation.

However, configuration can be carried out to a limited extent by means of the integrated 8-pole DIP switch (S1).

Information — **Configuration via DIP switch**

Avoid mixing DIP switch configuration and (software) parameterization.

4.2.2.1 Parameterization

The use of a Parameter Box (SK CSX-3H/SK PAR) or the NORDCON- software is required in order to adapt the parameters.

Parameter group	Parameter numbers	Functions	Comments
Basic parameters	P102 … P105	Ramp times and frequency limits	
Motor data	P201 … P207, (P208)	Data on motor nameplate	
	P220, function 1	Measure stator resistance	Value is written to P208
	alternatively P200	Motor data list	Selection of a 4-pole standard NORD motor from a list
	alternatively P220, function 2	Motor identification	Complete measurement of a connected motor Prerequisite: Motor no more than 3 power levels less than the variable frequency drive
Control terminals	P400, P420	Analog and digital inputs	

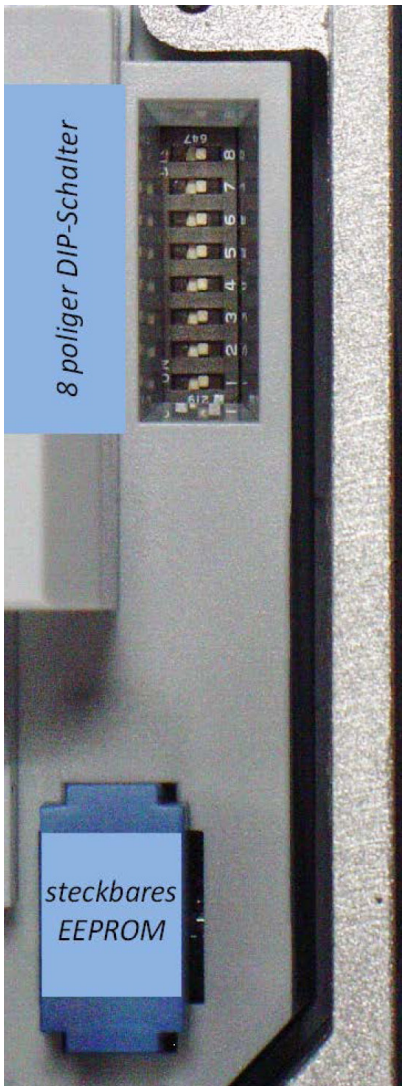
Information — **Factory settings**

Prior to commissioning, make sure the variable frequency drive is in its factory settings (P523).

If configuration is carried out at parameter level, the DIP- switches (S1) must also be set to the 0 (OFF) position.

4.2.2.2 DIP switches (S1)

These DIP switches make it possible to carry out commissioning without additional control units. Further settings are entered through the potentiometer on top of the variable frequency drive (P1/P2, SK 2x5E only).



No. / Bit	DIP switch (S1)		
8 2^7	**Int R_{Brake}** Internal braking resistor	0	Internal brake resistor not existing
		I	Internal brake resistor existing (📖 Section2.2.1)
7 2^6	**60 Hz** [1] 50/60 Hz operation	0	Motor data corresponding to the rated power of the VFD in kW relative to 50 Hz, fmax = 50 Hz
		I	Motor data corresponding to the rated power of the VFD in hp relative to 60 Hz, fmax = 60 Hz
6 2^5	**COPY** [2] EEPROM copy function	0	No function
		I	EEPROM copy function active, once
5/4 $2^{4/3}$	**I/O** Potentiometer function, digital inputs and AS interface	*DIP No. 5*	*DIP No. 4*
		0	0 — Corresponding to P420 [1-4] and P400 [1-2] or P480 [1-4] and P481 [1-4]
		0	I — Further details in the next table. (depends on the DIP3 "BUS")
		I	0 — Further details in the next table. (depends on the DIP3 "BUS")
		I	I — Further details in the next table. (depends on the DIP3 "BUS")
3 2^2	**BUS** Source control word and setpoint	0	Corresponding to P509 and P510 [1] [2]
		I	System bus (⇒ P509=3 and P510=3)
2/1 $2^{1/0}$	**ADR** System bus address/ baud rate	*DIP No. 2*	*DIP No. 1*
		0	0 — Corresponding to P515 and P514 [32, 250 kBaud]
		0	I — Address 34, 250 kBaud
		I	0 — Address 36, 250 kBaud
		I	I — Address 38, 250 kBaud

1) A changed setting is applied the next time the power supply is switched on. Existing settings in parameters P201-P209 and P105 are overwritten!

2) up to firmware version 1.4 R1 the DIP switch designation was **U/F**. A changeover between the control procedures (U/F/ISD control) has been made possible via the DIP switch.

Information — Factory setting, as delivered

In the factory setting configuration, all DIP switches are in the 0 (off) position. Actuation takes place using the digital control signals (P420 [01]-[04]) and potentiometers P1 and P2 integrated in the VFD (P400 [01]-[02]) (P1/P2 with SK 2x5E only).

Information — IO bit factory settings:

To control the variable frequency drive via In/Out bits (e.g.: AS-i, DIG In 1 - 4) typical values are pre-set in the relevant parameters (P480) and (P481) (details: 📖 Section 5 "Parameter").

These settings apply to both control via AS-i bits and BUS I/O bits.

Details of DIP switch S1: 5/4 and 3

Applies to devices SK 20xE, SK 21xE (without on-board AS interface)

DIP			Functions as per the list of digital functions (P420)				Functions as per the list of analog functions (P400)	
5	4	3	Dig 1	Dig 2	Dig 3	Dig 4**	Poti 1***	Poti 2***
off	off	off	P420 [01]*{01} "Enable R“	P420 [02]*{02} "Enable L“	P420 [03]* {04} "fixed freq 1" =5 Hz (P465[01])	P420 [04]* {05} "fixed freq 2" =10 Hz (P465[02])	P400 [01]* {01} "F setpoint"	P400 [02]* {15} "ramp"
off	on	off	{01} "Enable R"	{02} "Enable L"	{26} "F setpoint"***	{12} "Quit"	{05} "F max"	{04} "F min"
on	off	off	{45} "3-on"	{49} "3-off"	{47} "Freq. +"	{48} "Freq. -"	{05} "F max"	{15} "Ramp"
on	on	off	{50} "F Arr Bit0" =5Hz (P465[01])	{51} "F Arr Bit1" =10 Hz (P465[02])	{52} "F Arr Bit2" =20 Hz (P465[03])	{53} "F Arr Bit3" =35 Hz (P465[04])	{05} "F max"	{15} "Ramp"
off	off	on	The functions of the digital inputs are inactive (control via system bus) but the settings entered in the parameters (P420 [01 … 04]) for functions designated with ..² in the function list (e.g.: {11}²= "quick stop") result in the activation of the correspondingly parameterized input.				P400 [01] {01} "F setpoint"	P400 [02] {15} "ramp"
			P420 [01] no function	P420 [02] no function	P420 [03] {04} "fixed freq1" =5 Hz (P465[01])	P420 [04] {05} "fixed freq2" =10 Hz (P465[02])		
off	on	on	{14} "Remote control"	"Encoder track A"	"Encoder track B"	{01} "Enable R"	{01} "F setpoint"	{05} "F max"
on	off	on	{14} "Remote control"	{01} "Enable R"	{10} "Block"	{66} "Release brake"	{01} "F setpoint"	{05} "F max"
on	on	on	{14} "Remote control"	{51} "F Arr Bit1" =10 Hz (P465[02])	{52} "F Arr Bit2" =20 Hz (P465[03])	{53} "F Arr Bit3" =35 Hz (P465[04])	{05} "F max"	{15} "Ramp"

Explanation: (values underlined in brackets) = (relevant parameter/source of function), **e.g.: Parameter (P420[01])**
{curly brackets} = {function} **e.g.: {01} "Enable right"**
* Default setting
** only if present (devices without "safe stop" function)
*** only with SK 2x5E

Applies to devices SK 22xE, SK 23xE (without AS interface on board)

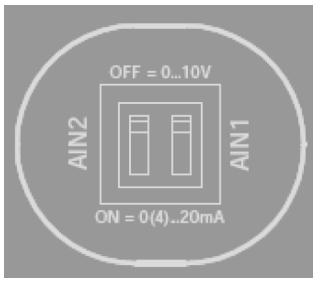
DIP			Functions as per the list of digital functions (P420)				Functions as per the list of digital outputs (P434)			
5	4	3	ASi In1	ASi In2	ASi In3	ASi In4	ASi Out1	ASi Out2	ASi Out3	ASi Out4
off	off	off	P480 [01]*{01} "Enable R“	P480 [02]*{02} "Enable L“	P480 [03]*{04} "Fixed freq. 1" =5 Hz (P465[01])	P480 [04]*{12} "Quit"	P481 [01]* {07} "Error"	P481 [02]* {18} "Ready"	"DigIn1"	"DigIn2"
off	on	off	{04} "Fixed freq. 1"=5 Hz (P465[01])	{05} "Fixed freq. 2"=10 Hz (P465[02])	{06} "Fixed freq. 3"=20 Hz (P465[03])	{07} "Fixed freq. 4"=35 Hz (P465[04])	{07} "Error"	{18} "Ready"	"DigIn1"	"DigIn2"
on	off	off	{01} "Enable R"	{02} "Enable L"	{47} "Freq. +"	{48} "Freq. -"	{07} "Error"	{18} "Ready"	"DigIn1"	"DigIn2"
on	on	off	{51} "F Arr B1" =10 Hz (P465[02])	{52} "F Arr B2" =20 Hz (P465[03])	{53} "F Arr B3" =35Hz (P465[04])	{14} "Remote control"	{07} "Error"	{18} "Ready"	"DigIn1"	"DigIn2"
off	off	on	The functions of the ASI-In bits are inactive (control via system bus) but the settings entered in the parameters (P480 [01 … 04]) for functions designated with ..² in the function list (e.g.: {11}²= "quick stop") result in the activation of the correspondingly parameterized bit				P481 [01]{07} "Error"	P481 [02]{18} "Ready"	"DigIn1"	"DigIn2"
			P480 [01] no function	P480 [02] no function	P480 [03]{04} "Fixed freq. 1"=5 Hz (P465[01])	P480 [04]{12} "Quit"				
off	on	on	{14} "Remote control"	{04} "Fixed freq. 1"=5 Hz (P465[01])	{05} "Fixed freq. 2"=10 Hz (P465[02])	{06} "Fixed freq. 3"=20 Hz (P465[03])	{07} "Error"	{18} "Ready"	"DigIn1"	"DigIn2"
on	off	on	{14} "Remote control"	{01} "Enable R"	{47} "Freq. +"	{48} "Freq. -"	{07} "Error"	{18} "Ready"	"DigIn1"	"DigIn2"
on	on	on	{14} "Remote control"	{50} "F Arr B0" =5Hz (P465[01])	{51} "F Arr B1" =10 Hz (P465[02])	{52} "F Arr B2" =20Hz (P465[03])	{07} "Error"	{18} "Ready"	"DigIn1"	"DigIn2"

Explanation: See table above
Note:
The functions of potentiometers*** P1 and P2 correspond to those of devices without an AS interface (see table above).
With DIP switches 5 and 4 in the OFF position (default setting), the digital inputs are also active. The functions then correspond to those of devices without an AS interface (table above). In all other DIP switch combinations the functions of the digital inputs are deactivated.
ASi OUT1 and ASi OUT2 loop the signal level (High/Low) of digital inputs 1 and 2.

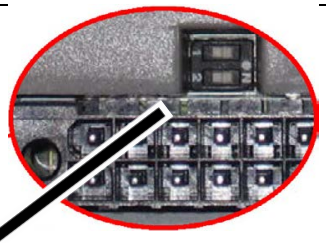
4.2.2.3 DIP switches, analog input (only SK 2x0E)

The analog inputs in the SK 2x0E are suitable for current and voltage setpoints. For correct processing of current setpoints (0-20 mA/4-20 mA) the relevant DIP switch must be set for current signals ("ON").

Adjustment to wire-break-proof signals (2-10 V/4-20 mA) is made via parameters (P402) and (P403).

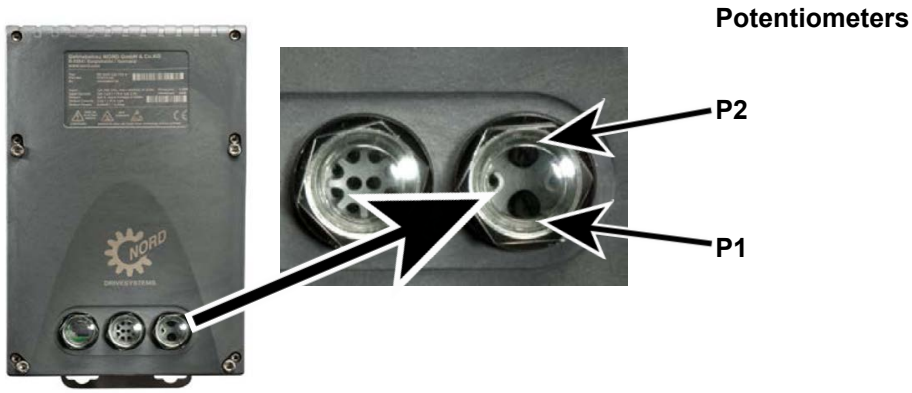


Access to DIP switches

SK 2x0E	Access	Detail
Size 1 … 3	… from outside, middle diagnostic opening	
Size 4	... from inside	 

4.2.2.4 Potentiometers P1 and P2 (SK 2x0E size 4 and SK 2x5E)

The setpoint can be set to a fixed value with integrated potentiometer P1. Adjustment of startup and braking ramps can be made via potentiometer P2.



Potentiometers					
P1 (continuous)			**P2** (stepped)		
0%	P102/103	P105	-	-	-
10%	0.2 s	10 Hz	1	P102/103	P104
20%	0.3 s	20 Hz	2	0.2 s	2 Hz
30%	0.5 s	30 Hz	3	0.3 s	5 Hz
40%	0.7 s	40 Hz	4	0.5 s	10 Hz
50%	1.0 s	50 Hz	5	0.7 s	15 Hz
60%	2.0 s	60 Hz	6	1.0 s	20 Hz
70%	3.0 s	70 Hz	7	2.0 s	25 Hz
80%	5.0 s	80 Hz	8	3.0 s	30 Hz
90%	7.0 s	90 Hz	9	5.0 s	35 Hz
100%	10.0 s	100 Hz	10	7.0 s	40 Hz

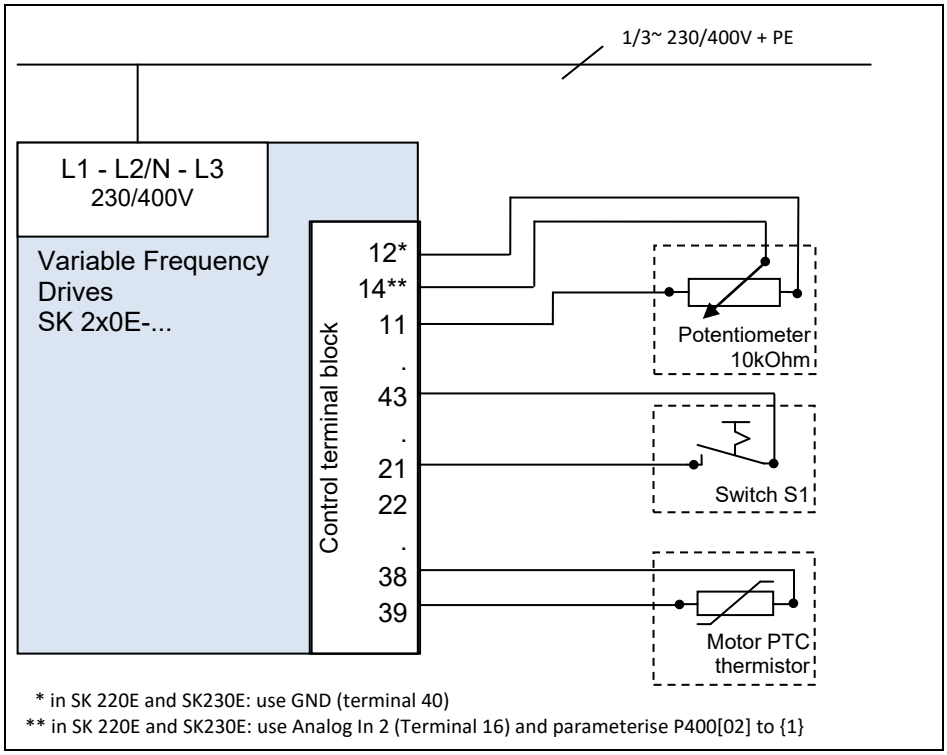
The function of P1 and P2 depends on DIP 4/5. The meaning changes according to the setting.
By default, P1 sets the setpoint value of 0%-100% and P2 sets the ramp from 0.2-7 s.

4.2.3 Commissioning examples

All SK 2xxE devices can basically be operated in the condition in which they are delivered. Standard motor data of a standard NORD 4-pole asynchronous motor of the same power is parameterized. The PTC input must be bypassed if no motor PTC is available. Parameter (P428) must be changed if an automatic startup with "Power On" is required.

4.2.3.1 SK 2x0E minimum configuration

The variable frequency drive provides all the necessary control voltages (24 VDC/10 VDC).

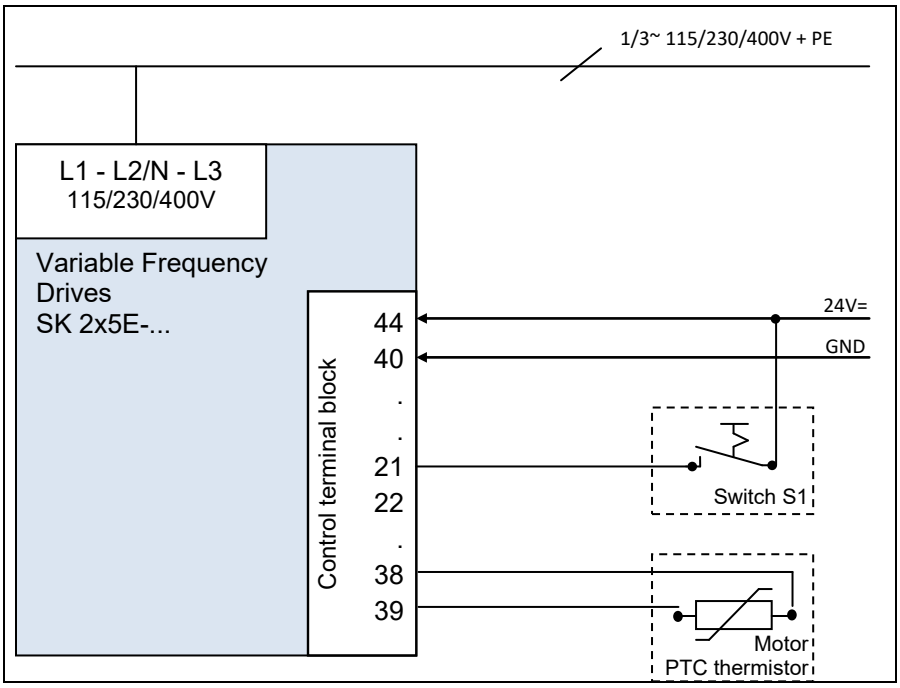


Function	Setting
Setpoint	External 10 kΩ potentiometer
Controller enable	External switch S1

4.2.3.2 SK 2x5E minimum configuration

Minimal configuration without options

The variable frequency drive must be provided with an external control voltage.



Function	Setting
Setpoint	Integrated potentiometer P1
Frequency ramp	Integrated potentiometer P2
Controller enable	External switch S1

Minimum configuration with options

One switch and one potentiometer (such as SK CU4-POT) are required in order to implement completely autonomous operation (independent of control lines, etc.). In combination with an integrated power supply unit (SK CU4-…-24V), a solution that only has the power supply line can be set up with an SK 2x5E, and demand-oriented speed and rotation direction control can be ensured (🕮 Section 3.1.2 "Potentiometer adapter, SK CU4-POT").

Information — **Convert analog signal**

An 8-bit A/D - converter is integrated in the SK TU4-…-24V and SK CU4-…-24V power supply units. This makes it possible to connect a potentiometer or another analog setpoint source to the power supply unit. The power supply unit can convert the analog setpoint into an appropriate pulse signal. This signal can be connected to a digital input of the variable frequency drive and processed by it as a setpoint.

Test operation

Variable Frequency Drive versions SK 2x0E in size 4 and SK 2x5E may be operated without any auxiliary equipment for test purposes.

For this purpose, after electrical connection is established, (please see chapter 2.3 "Electrical connection")set DIP switches S1: 1 to 5 of the variable frequency drive to position 0 (OFF) (please see chapter 4.2.2.2 "DIP switches (S1)")and wire digital input DIN1 (terminal 21) permanently to the 24 V control voltage.

Enabling is carried out as soon as the inverter's own setpoint potentiometer (potentiometer P1) is moved from the 0% position.

The setpoint can be adjusted to the requirements by further continuous adjustment of the potentiometer.

Resetting the setpoint to 0% sets the variable frequency drive to "Ready for switch on" status.

Stepwise adjustment of ramp times within defined limits is also possible with the aid of potentiometer P2.

Information **Test operation**

This setting method is not suitable for the implementation of a so-called "automatic AC line starting".

In order to use this function, it is essential that parameter (P428) "Automatic Start" be set to the "ON" function. Adjustment of parameters is possible with the aid of a Parameter Box (SK xxx-3H) or with the NORD CON software (Windows PC and adapter cable required).

5 Parameter

⚠ WARNING

Unexpected movement

Connection of the supply voltage may directly or indirectly set the device into motion. This may 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.:

- Parameterization of an "automatic start"
- Incorrect parameterization
- Control of the device with an enabling signal from a higher level control unit (via I/O 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 systems: System fault (ground fault)

- 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, make sure that there are no persons within the area of action and the danger area of the system.

⚠ WARNING

Unexpected movement due to parameter changes

Parameter changes become effective immediately. Dangerous situations can occur under certain conditions, even when the drive is stationary. Functions such as **P428** "Automatic starting" or **P420** "Digital inputs" or the "Brake off" setting can put the drive in motion and put persons at risk due to moving parts.

Therefore:

- Changes to parameter settings must only be made when the FEHLER - Variable ohne Inhalt is not enabled.
- During parameterization work precautions must be taken to prevent unwanted drive movements (e.g. lifting gear plunging down). The danger area of the system must not be entered.

⚠ 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 underdimensioning 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 gear).

To prevent any risk, the following must be observed:

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

The relevant parameters for the device are described in the following. The parameters are accessed using a parameterization tool (e.g. NORDCON- software or control and parameterization unit, see also (🕮 Section 3.1.1 "Use of control and parameterization units") and therefore makes it possible to adapt the device to the drive task in the best possible way. 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.

SK 2x5E type devices must be provided with a 24 V DC control voltage to do this (🕮 Section 2.3.3 "Electrical connection of the control unit").

SK 2x0E type devices must be equipped with a power supply that generates the 24 V DC control voltage required for this purpose by applying the line voltage (🕮 Section **Fehler! Verweisquelle konnte nicht gefunden werden.** "**Fehler! Verweisquelle konnte nicht gefunden werden.**").

Limited adaptations of individual functions of the relevant devices can be implemented via DIP - switches. Access to the parameters of the device is essential for all other adaptations. **It should be noted that hardware configurations (DIP - switches) have priority over configuration via software (parameterization).**

Every variable frequency drive is factory-set for a motor of the same power. All parameters can be adjusted online. Four switchable parameter sets are available during operation. The scope of the parameters to be displayed can be changed through supervisor parameter **P003**.

Information **Incompatibility**

In the software change of version **V1.2 R0** of the variable frequency drive, the structure of individual parameters was modified for technical reasons.

(E.g.: Up to version V 1.1 R2 (P417) was a single parameter but from version V1.2 R0 it was subdivided into two arrays ((P417) [-01] and [-02]).

When plugging an EEPROM (memory module) from a variable frequency drive with an earlier software version into a variable frequency drive with software version V1.2 or higher, the stored data is automatically converted to the new format. New parameters are stored with the default setting. This therefore provides correct functionality.

However, it is not permissible to plug in an EEPROM (memory module) with a software version of V1.2 or above into a variable frequency drive with a previous software version since this would lead to loss of all data.

As delivered, an external EEPROM (memory module) is plugged into the variable frequency drive.

The following applies up to firmware version V1.4 R1:

All parameter changes are made in the plug-in (external) EEPROM. As of firmware version 1.3, an internal EEPROM is automatically activated for data management if the plug-in EEPROM is removed. Parameter changes therefore affect the internal EEPROM.

The variable frequency drive treats the external EEPROM with a higher priority. This means that as soon as an external EEPROM (memory module) is plugged in, the dataset of the internal EEPROM is concealed.

The datasets can be copied between the internal and the external EEPROM (P550).

The following applies as of firmware version V1.4 R2:

All parameter changes are made in the internal EEPROM. If an external EEPROM has been connected, all changes are automatically stored on this as well. The external EEPROM therefore acts as an additional data backup. Parameter P550 can be used to transfer data from the external EEPROM to the internal EEPROM (e.g. during the data transfer between different devices of the same type). It is also possible to trigger the copying procedure using DIP switches (🕮 Section 4.2.2.2 "DIP switches (S1)").

The relevant parameters for the device are described below. Please refer to the respective supplementary manuals for explanations for parameters which concern the field bus options or the special functionality of the POSICON, for example.

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

Menu group	No.	Master function
Status displays	(P0--)	Display of parameters and operating values
Basic parameters	(P1--)	Basic device settings, e.g. behavior when switching on and off
Motor data	(P2--)	Electrical settings for the motor (motor current or starting voltage)
Speed control	(P3--)	Setting of current and speed controllers and settings for rotary encoders (incremental encoders) and settings for the integrated PLC
Control terminals	(P4--)	Assignment of functions for the inputs and outputs
Additional parameters	(P5--)	Mainly monitoring functions and other parameters
Positioning	(P6--)	Setting of the positioning function (details 🕮 BU0210)
Information	(P7--)	Display of operating values and status messages

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 changed earlier and could have an unexpected influence on the operating behavior 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 variable frequency drive beforehand.

5.1 Parameter overview

Operating displays

P000 Operating display	**P001** Display selection	**P002** Display factor
P003 Supervisor code		

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
P120 Ext control units		

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 precontrol
P215 Boost precontrol	**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 PMSM
P247 Switch freq VFC PMSM		

Speed control

P300 Servo mode	**P301** Incremental encoder	**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** I-weak
P320 Weak border	**P321** Speed ctr.I brake off	**P325** Function encoder
P326 Ratio encoder	**P327** Speed slip error	**P328** Speed slip delay
P330 Ident. startrotor pos.	**P331** Switch over freq.	**P332** Hyst. switchover freq.
P333 Flux feedb. fact. PMSM	**P334** Encoder offset PMSM	**P336** Mode rotor pos. ident.
P350 PLC functionality	**P351** PLC set val. select.	**P353** Bus status via PLC
P355 PLC integer setvalue	**P356** PLC long setvalue	**P360** PLC display value
P370 PLC status		

Control terminals

P400	Function Setpoint inputs	**P401**	Analog input mode	**P402**	Adjustment: 0%
P403	Adjustment: 100%	**P404**	Analog input filter	**P410**	Min. freq. Auxiliary setpoint
P411	Max. freq. Auxiliary setpoint	**P412**	Process controller setpoint	**P413**	PI controller P comp.
P414	PI controller I comp.	**P415**	Process controller limit	**P416**	Ramp time PI setpoint
P417	Analog output offset	**P418**	Function Analog output	**P419**	Standard Analog output
P420	Digital inputs	**P426**	Quick stop time	**P427**	Emerg. stop Fault
P428	Automatic start	**P434**	Digital output function	**P435**	Dig. out scaling
P436	Dig. out. hysteresis	**P460**	Watchdog time	**P464**	Fixed frequency mode
P465	Fixed freq. field	**P466**	Minimum freq. process controller	**P475**	Delay on/off switch
P480	Function BusIO In bits	**P481**	Function BusIO Out bits	**P482**	Standard BusIO Out bits
P483	Hyst. BusIO Out bits				

Additional parameters

P501	Inverter name	**P502**	Master function value	**P503**	Master function output
P504	Pulse frequency	**P505**	Absolute minimum freq.	**P506**	Auto. Fault acknowledgement
P509	Source control word	**P510**	Source setpoints	**P511**	USS baud rate
P512	USS address	**P513**	Telegram timeout	**P514**	CAN bus baud rate
P515	CAN address	**P516**	Skip frequency 1	**P517**	Skip freq. area 1
P518	Skip frequency 2	**P519**	Skip freq. area 2	**P520**	Flying restart circuit
P521	Flying restart circuit Resolution	**P522**	Flying restart circuit Offset	**P523**	Factory setting
P525	Load control max	**P526**	Load control min	**P527**	Load monitoring Freq.
P528	Load monitoring delay	**P529**	Load control mode	**P533**	I²t factor
P534	Torque shutoff limit	**P535**	I²t motor	**P536**	Current limit
P537	Pulse disconnection	**P539**	Output monitoring	**P540**	Rotation direction mode
P541	Set relays	**P542**	Set analog output	**P543**	Bus actual value
P546	Function bus setpoint	**P549**	Pot box function	**P550**	EEPROM Copy Order
P552	CAN master cycle	**P553**	PLC setpoint	**P555**	P limit chopper
P556	Braking resistor	**P557**	Braking resistor capacity	**P558**	Magnetizing time
P559	DC run-on time	**P560**	Parameter saving mode		

Positioning

P600	Position control	**P601**	Actual position	**P602**	Actual setpoint position
P603	Actual pos. diff.	**P604**	Distance measuring system	**P605**	Absolute encoder
P607	Transformation ratio	**P608**	Reduction ratio	**P609**	Offset position
P610	Setpoint mode	**P611**	Position controller P	**P612**	Target window limit
P613	Position	**P615**	Maximum position	**P616**	Minimum position
P625	Output hysteresis	**P626**	Comparative position Output	**P630**	Position slip error
P631	Slip error Abs./inc.	**P640**	Unit of pos. value		

Information

P700	Current operating state	**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.
P709	Analog input voltage	**P710**	Analog output voltage	**P711**	State of relays
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	**P736**	DC link voltage	**P737**	Usage rate brake res.
P738	Usage rate motor	**P739**	Heat sink temperature	**P740**	PZD bus in
P741	PZD bus out	**P742**	Database version	**P743**	Inverter ID
P744	Configuration				
P747	Inverter volt. range	**P748**	Status CANopen	**P749**	Status DIP switches
P750	Stat. overcurrent	**P751**	Stat. overvoltage	**P752**	Stat. mains failure
P753	Stat. overtemperature	**P754**	Stat. parameter loss	**P755**	Stat. system error
P756	Stat. timeout	**P757**	Stat. customer error	**P760**	Input current
P780	Device ID	**P799**	Op. time last error		

Parameter list - inverter functions (selection)

Parameter	Description	Factory setting	Settings/functions (selection)
P102 Acceleration time	Startup time (acceleration ramp) is the time corresponding to the linear frequency rise from 0 Hz to the set maximum frequency (P105).	[2.00]	Note: Values < 0.1 must be avoided
P103 Deceleration time	Deceleration time (deceleration ramp) is the time corresponding to the linear frequency reduction from the set maximum frequency (P105) to 0 Hz.	[2.00]	Note: Values < 0.1 must be avoided
P104 Minimum frequency	The minimum frequency is the frequency supplied by the VFD as soon as it is enabled and no additional setpoint is set.	[0]	
P105 Maximum frequency	If the frequency provided by the VFD after it has been enabled and the maximum setpoint value is available.	[50]	
P200 Motor list	If a 4-pole NORD motor is used, the pre-set motor data can be called up.	[0]	Select appropriate motor power
P201 – P208 Motor data	If a 4-pole NORD motor is not used, the motor data on the nameplate must be entered here.	[xxx]	Data according to nameplate
P220 Parameter identification	The motor data is automatically determined by the VFD with this parameter.	[0]	01= stator resistor only 02 = motor identification
P400 Function, setpoint inputs	Definition of the functions of the various setpoint inputs *Input selection:* Potentiometer P1 (P400, [-01]) - SK 2x5E Potentiometer P2 (P400, [-02]) - SK 2x5E AIN1 (P400, [-01]) - SK 2x0E AIN2 (P400, [-02]) - SK 2x0E DIN 2 (P400, [-06]) DIN 3 (P400, [-07])	[xxx]	00 = no function 01 = setpoint frequency 15 = ramp time (P1/P2 only)
P420 Digital input functions	Definition of the functions of the various digital inputs *Input selection:* DIN 1 (P420, [-01]) DIN 2 (P420, [-02]) DIN 3 (P420, [-03]) DIN 4 (P420, [-04])	[xxx]	00 = no function 01 = enable right 02 = enable left 04 = fixed frequency 1 05 = fixed frequency 2 26= analog function 0-10 V (only DIN2/3)
P428 Automatic start	Inverter enable with "Power On"	[0]	0: off (enable with flank) 1: on (enable with level) **Note:** one digital input must be programmed and set to enable!
P465 Fixed frequency/ fixed array	Definition of fixed frequency values *Selection:* Fixed frequency 1 (P465, [-01]) Fixed frequency 2 (P465, [-02])	[xxx]	
P509 Source control word	Selection of the interface through which the VFD is controlled.	[0]	00 = control terminals or keyboard 01 = only control terminals 03 = system bus
P523 Factory setting	Variable Frequency Drive is restored to the factory setting	[0]	00 = no change 01= load factory setting

Parameter list - inverter information (selection)

Parameter	Description	Settings/functions (selection)
P700 Current operating status	Display of current messages on the actual operating status of the variable frequency drive such as faults, warnings or the cause of a switch-on block. *Selection:* Current fault (P700, [-01]) Current warning (P700, [-02]) Reason for switch-on block (P700), [-03])	Error group: 1 / 2 = inverter/motor overtemperature 3 / 4 = overcurrent fault 5 = overvoltage fault 16 = phase monitoring motor 19…= error in parameter identification
P701 Last error	Displays the last 5 variable frequency drive faults. *Selection:* Last fault (P701), [-01]) Penultimate fault (P701, [-02])	See P700
P707 Software version	Displays the firmware version/Inverter revision *Selection:* Software version (P707, [-01]) Revision (P707, [-02])	
P708 Status of digital input	Shows the switching status of the digital inputs.	Bit 0 = DIN 1 Bit 1 = DIN 2 …
P709 Voltage of analog input	Displays the measured analog input value. *Input selection:* Potentiometer P1 (P400, [-01]) - SK 2x5E Potentiometer P2 (P400, [-02]) - SK 2x5E AIN1 (P400, [-01]) - SK 2x0E AIN2 (P400, [-02]) - SK 2x0E DIN 2 (P400, [-06]) DIN 3 (P400, [-07])	
P719 Actual current	Displays the actual output current.	
P740 Process data bus in	Displays the actual control word and the setpoints.	[-01] = STW (source P509) [-02…-04] SW 1…3 (source P510[-01] [-11…-13] SW 1…3 (source P510[-02]
P749 State of DIP switch	Displays the actual DIP switch setting (S1).	Bit 0 = DIP switch 1 Bit 1 = DIP switch 2 …

6 Operating status messages

The device and technology units generate appropriate messages if they deviate from their normal operating status. There is a differentiation between warning and error messages. If the device is in the status "Start disabled", the reason for this can also be displayed.

The messages generated for the device are displayed in the corresponding array of parameter (**P700**). The display of the messages for technology units is described in the respective additional instructions and data sheets for the modules concerned.

Switch-on block, "not ready" → (P700 [-03])

If the device is in the status "Not Ready" or "Start Disabled", the reason for this is indicated in the third array element of parameter (**P700**).

Display is only possible with the NORD CON software or the Parameter Box (SK PAR-3H).

Warning messages → (P700 [-02])

Warning messages are generated as soon as a defined limit is reached. However this does not cause the variable frequency drive to switch off. These messages can be displayed via the array-element [**-02**] in parameter (**P700**) until either the reason for the warning is no longer present or the variable frequency drive has gone into a fault state with an error message.

Fault messages → (P700 [-01])

Faults cause the device to switch off, in order to prevent a device fault.

The following options are available to reset a fault (acknowledge):

- Switching power off and on,
- By an appropriately programmed digital input (**P420**),
- By switching off the "enable" on the device (if no digital input is programmed for acknowledgement),
- By bus acknowledgement

- By **P506**, automatic error acknowledgement.

6.1 Display of messages

LED displays

The device status is indicated by integrated and externally visible status LEDs included in the factory default kit. Depending on the device model, this is a two-color LED (DS = Device State) or two monochromatic LEDs (DS Device State and DE = Device Error).

Meaning:	**Green** indicates the standby status and the presence of mains voltage. During operation an increasingly rapid flashing code indicates the degree of overload of the device output. **Red** indicates the presence of an error by flashing with a frequency which corresponds to the number code of the fault. This flashing code indicates the error groups (e.g.: E003 = 3x flashes).

SimpleBox display

The SimpleBox displays a fault with its number and the prefix "E". In addition, the current fault can be displayed in array element [**-01**] of parameter (**P700)** . The last fault messages are stored in parameter **P701**. Please refer to parameters **P702** to **P706**/**P799** for further information on device status at the time the fault occurs.

If the cause of the fault 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 device has switched to the Fault state. Display of the message is suppressed if the warning appears during parameterization.

The current 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.

Parameter Box display

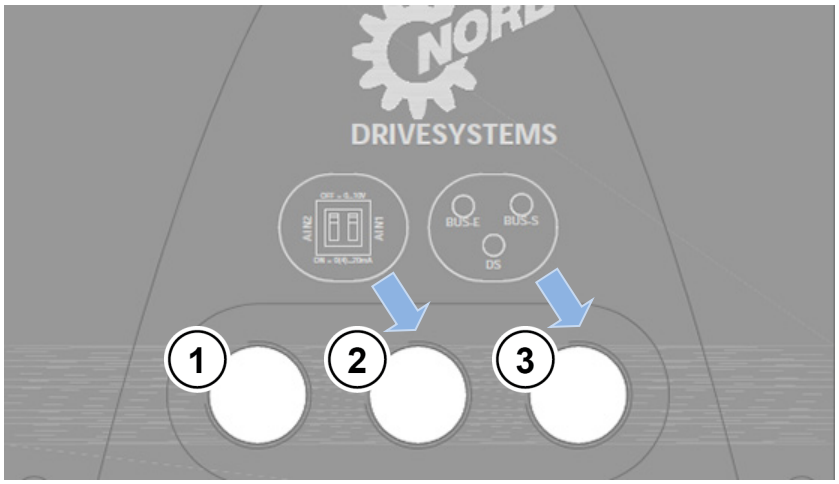
The Parameter Box displays messages in plain text.

6.2 Diagnostic LEDs on device

The device generates operating status messages. These messages (warnings, errors, switching statuses, measurement data) can be 🕮 3.1.1 "Use of control and parameterization units"displayed with parameterization tools (e.g. Parameter Box) (parameter group **P7xx**).

To a limited extent, the messages are also indicated via the diagnostic and status LEDs.

6.2.1 Diagnostic LEDs on SK 2x0E (size 1 … 3)



1 RJ12,
RS 232, RS 485

2 DIP switch AIN1/2

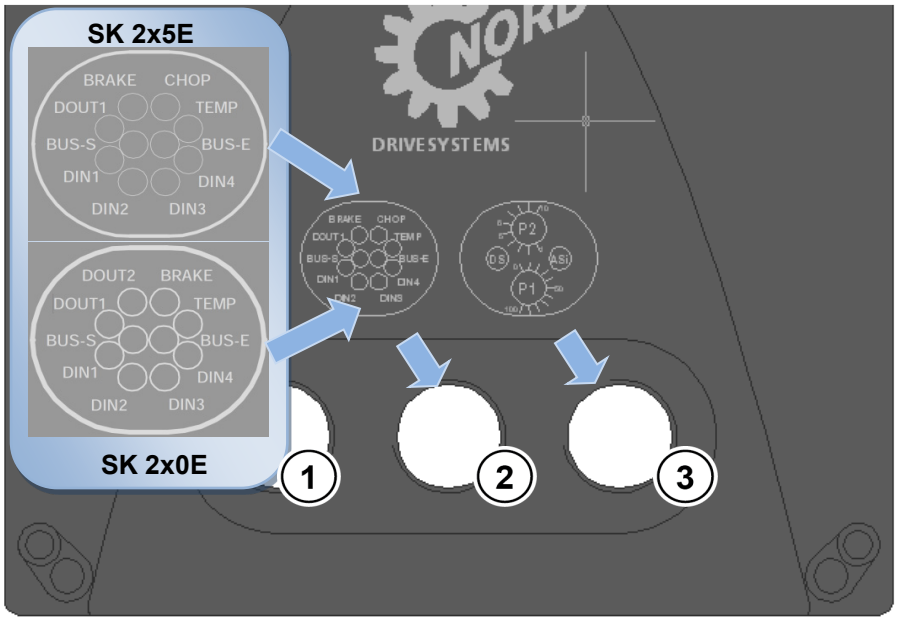
3 Diagnostic LEDs

Figure 11: Diagnostic openings SK 2x0E (size 1 … 3)

Diagnostic LEDs

LED			Signal status		Meaning
Name	**Color**	**Description**			
BUS-S	green	System bus Status	off		No process data communication
			Flashing	4 Hz	"BUS Warning"
			On		Process data communication active → Receipt of at least 1 telegram/s → SDO data transfer is not indicated
BUS-E	red	System bus Error	off		No error
			Flashing	4 Hz	Monitoring error P120 or P513 → E10.0/E10.9
			Flashing	1 Hz	Error in an external system bus module → Bus module → Timeout on the external BUS (E10.2) → System bus module has a module error (E10.3)
			On		System bus in state "BUS off"
DS	dual red/green	VFD status	off		VFD not on standby, → no line and control voltage
			green on		VFD is enabled (VFD running)
			flashing green	0.5 Hz	VFD is in standby or not enabled
				4 Hz	VFD is in switch-on block
			red/green alternating	4 Hz	Warning
				1 Hz	Degree of overload of switched-on VFD
			flashing red		Error, flashing frequency → error number

6.2.2 Diagnostic LEDs on the SK 2x0E (size 4) and SK 4x5E



1 RJ12, RS 232, RS 485

2 Diagnostic LEDs

3 P1/P2, LED-VFD, LED-ASi

Figure 12: Diagnostic openings SK 2x0E size 4 or SK 4x5E

Status LEDs

LED			Signal		
Name	Color	Description	Status		Meaning
DS	dual red/green	VFD status	off		VFD not on standby, → no line and control voltage
			green on		VFD is enabled (VFD running)
			green Flashing	0.5 Hz	VFD is in standby or not enabled
				4 Hz	VFD is in switch-on block
			red/green Alternating	4 Hz	Warning
				1 Hz	Degree of overload of switched-on VFD
			green on + flashing red		VFD not on standby, → Control voltage available but no line voltage
			flashing red		Error, flashing frequency → error number
AS-i	dual red/green	Status AS-i			Details (📖 Section **Fehler! Verweisquelle konnte nicht gefunden werden. "Fehler! Verweisquelle konnte nicht gefunden werden.**")

Diagnostic LEDs

LED			Signal	
Name	**Color**	**Description**	**Status**	**Meaning**
DOUT 1	yellow	Digital output 1	on	High signal applied
DIN 1	yellow	Digital input 1	on	High signal applied
DIN 2	yellow	Digital input 2	on	High signal applied
DIN 3	yellow	Digital input 3	on	High signal applied
DIN 4	yellow	Digital input 4	on	High signal applied
TEMP	yellow	Motor PTC thermistor	on	Motor overtemperature
CHOP	yellow	Brake chopper	on	Brake chopper active, brightness → degree of load *(only SK 2x5E)*
BRAKE	yellow	Mech. Brake	on	Mech. Brake released
DOUT 2	yellow	Digital output 2	on	High signal present *(only SK 2x0E)*
BUS-S	green	System bus Status	off	No process data communication
			Flashing (4 Hz)	"BUS Warning"
			On	Process data communication active → Receipt of at least 1 telegram/s → SDO data transfer is not indicated
BUS-E	red	System bus Error	off	No error
			Flashing (4 Hz)	Monitoring error P120 or P513 → E10.0/E10.9
			Flashing (1 Hz)	Error in an external system bus module →Bus module →Timeout on external BUS (E10.2) → System bus module has module error (E10.3)
			on	System bus in state "BUS off"

6.3 Messages

Error messages

Display in the Simple Box/Control Box		Fault	Cause
Group	Details in P700 [-01] / P701	Text in the Parameter Box	• Remedy
E001	**1.0**	**Overtemp. inverter** *"Inverter overtemperature"* (inverter heat sink)	Temperature monitoring of the inverter Measuring results lie outside the permissible temperature range, that is, the error is triggered when falling short of the permissible lower temperature limit or when exceeding the permissible upper temperature limit. • Depending on cause: Reduce or increase ambient temperature • Check device fan/cabinet ventilation • Check the device for dirt
	1.1	**Overtemp. VFD internal** *"Internal VFD overtemperature"* (internal area of the variable frequency drive)	
E002	**2.0**	**Overtemp. Motor PTC** *"Overtemperature motor PTC"*	Motor temperature sensor (PTC thermistor) has triggered • Reduce motor load • Increase motor speed • Use external motor fan
	2.1	**Overtemp. I²t motor** *"Overtemperature I²t motor"* Only if I²t motor (P535) is programmed.	I²t motor has triggered (calculated overtemperature of motor) • Reduce motor load • Increase motor speed
	2.2	**Overtemp. ext. brak. res.** *"Overtemperature of external braking resistor"* Overtemperature via digital input (P420 […])={13}	Temperature monitor (e.g. braking resistor) has activated • Digital input is low • Check connection, temperature sensor

E003	**3.0**	**I^2t overcurrent limit**	a.c. VFD: I^2t limit has triggered, e.g. > 1.5 x I_n for 60 s (also note P504) • Continuous overload at VFD output • Possible encoder fault (resolution, defect, connection)
	3.1	**Chopper overtemperature I^2t**	Brake chopper: I^2t limit has activated, 1.5 times values reached for 60 s (please also pay attention to P554, if present, and P555, P556, P557) • Avoid overcurrent in brake resistance
	3.2	**IGBT overcurrent** 125% monitoring	Derating (output reduction) • 125% overcurrent for 50 ms • Brake chopper current too high • For fan drives: enable flying start circuit (P520)
	3.3	**IGBT overcurrent fast** 150% monitoring	Derating (output reduction) • 150% overcurrent • Brake chopper current too high
E004	**4.0**	**Overcurrent module**	Error signal from module (short duration) • Short circuit or ground fault at VFD output • Motor cable is too long • Use external output choke • Braking resistor faulty or resistance too low **→ Do not switch off P537!** **The occurrence of a fault can significantly shorten the service life of the VFD or even destroy it.**
	4.1	**Overcurrent measurem** *"Overcurrent measurement"*	P537 (pulse current switch-off) was reached 3x within 50 ms (only possible if P112 and P536 are disabled) • VFD is overloaded • Drive sluggish, insufficiently sized, • Ramps (P102/P103) too steep -> Increase ramp time • Check motor data (P201 … P209)
E005	**5.0**	**Overvoltage Ud**	DC link voltage too high • Increase deceleration time (P103) • If necessary, set switch-off mode (P108) with delay (not with lifting equipment) • Extend emergency stop time (P426) • Fluctuating speed (e.g. due to high centrifugal masses), →adjust U/f characteristic curve if necessary (P211, P212) Devices with brake chopper: • Reduce energy return using a braking resistor • Check the function of the connected braking resistor (broken cable) • Resistance value of connected braking resistor too high
	5.1	**Mains overvoltage**	Line voltage is too high • See technical data (🕮 Section 7)
E006	**6.0**	**Charging error**	DC link voltage is too low • Line voltage too low • See technical data (🕮 Section 7)
	6.1	**Mains low voltage**	Line voltage too low • See technical data (🕮 Section 7)

E007	**7.0**	**Mains phase failure**	Fault on supply connection side • A power phase is not connected • Line power is asymmetric
	7.1	**Phase failure dc-link**	DC link voltage too low • A power phase is not connected • Load temporarily too high
	On 7.1		**Devices with external 24 V DC supply of the control unit:** If the line voltage is switched off, but the control unit is still supplied with 24 V DC, this error message also occurs. If the line voltage is switched on again, the error message must be acknowledged. It is not before until then that the variable frequency drive can be released.
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 VFD. **NOTE:** Faulty parameters are automatically reloaded (default data). • EMC interferences (see also E020)
	8.1	**Inverter ID error, "Inverter type incorrect"**	• EEPROM faulty
	8.2	**Reserved**	
	8.3	**EEPROM KSE error** (Customer unit incorrectly identified (customer's interface equipment))	The upgrade level of the variable frequency drive was not correctly identified. EEPROM with a firmware status of version 1.2 or above plugged in to an VFD with older firmware status → **Loss of parameters!** (also see *Information* in section 5) • Switch line voltage off and on again.
	8.4	**Internal EEPROM error** (Database version incorrect)	
	8.7	**EEPROM copy differs, "EEPR copy not the same"**	
E009	**---**	**Reserved**	

E010	**10.0**	**Bus timeout**	(Telegram timeout/bus off 24 V int. CANbus • Data transfer is faulty. Check P513. • Check physical bus connections • Check bus protocol program process. • Check bus master. • Check 24 V supply of internal CAN/CANopen bus. • *Node guarding* error (internal CANopen) • *Bus off* error (internal CANbus)
	10.2	**Bus timeout option**	Telegram timeout • Telegram transfer is faulty. • Check physical bus connections • Check bus protocol program process. • Check bus master. • PLC is in the "STOP" or "ERROR" state.
	10.4	**Init error option**	Initialization error in bus module • Check bus module current supply. • DIP switch setting of a connected I/O extension module is incorrect
	10.1 **10.3** **10.5** **10.6** **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 analog output
	10.9	**Module missing/P120**	The module entered in parameter (P120) is not available. • Check connections

E011	**11.0**	**Control terminals**	A/D inverter error Internal customer unit (internal data bus) faulty or damaged by radio radiation (EMC) • Check control connections for short circuit. • Minimize EMC interference by laying control and power cables separately. • Device and shielding must be well grounded.
E012	**12.0**	**External watchdog**	The Watchdog function is selected at a digital input and the impulse at the corresponding digital input is not present for longer than the time set in parameter P460 >Watchdog time<. • Check connections • Check setting P460
	12.1	**Limit moto./Customer** *"Motor switch-off limit"*	The drive switch-off limit (P534 [-01]) has triggered. • Reduce load on motor • Set higher value in (P534 [-01]).
	12.2	**Limit gen.** *"Generator switch-off limit"*	The generator switch-off limit (P534 [-02]) has triggered. • Reduce load on motor • Set higher value in (P534 [-02]).
	12.3	**Torque limit**	Limit from potentiometer or setpoint source has switched off. P400 = 12
	12.4	**Current limit**	Limit from potentiometer or setpoint source has switched off. P400 = 14
	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 • Change limit values ((P525) ... (P527)) • Increase delay time (P528) • Change monitoring mode (P529)
	12.8	**AI minimum,** ***"Analog In minimum"***	Switch-off due to undershooting of the 0% adjustment value (P402) with setting (P401) "0-10 V with switch-off on error 1" or "....2"
	12.9	**AI maximum,** ***"Analog In maximum"***	Switch-off due to overshooting of the 100% adjustment value (P402) with setting (P401) "0-10 V with switch-off on error 1" or "....2"

E013	**13.0**	**Encoder error**	No signal from encoder • Check 5 V sensor if available • Check supply voltage of encoder
	13.1	**Speed slip error** *"Speed slip error"*	The slip speed error limit was reached. • Increase value in P327
	13.2	**Disconnect. control,** ***"Shut-down monitoring"***	The slip error monitoring was triggered; the motor could not follow the setpoint. • Check motor data P201-P209! (important for current controllers) • Check motor circuit • Check encoder settings P300 and following in servo mode • Increase value for torque limit in P112 • Increase value for current limit in P536 • Check deceleration time P103 and extend if necessary
	13.5	**Reserved**	Error message for POSICON → see supplementary manual
	13.6	**Reserved**	Error message for POSICON → see supplementary manual
E014	**---**	**Reserved**	Error message for POSICON → see supplementary manual
E015	**---**	**Reserved**	
E016	**16.0**	**Motor phase error**	A motor phase is not connected. • Check P539 • Check motor connection
	16.1	**Magn. Current Watch** *"Magnetizing current monitoring"*	Required exciting current not achieved at moment of switch-on. • Check P539 • Check motor connection
E018	**18.0**	**Reserved**	Error message for “Safe Pulse Block”, see supplementary instructions
E019	**19.0**	**parameter ident.** *"Parameter identification"*	Automatic identification of the connected motor was unsuccessful • Check motor connection • Check preset motor data (P201 … P209) • PMSM – CFC Closed Loop Operation: Rotor position of motor incorrect in relation to incremental encoder Determine rotor position (initial enable after a "Power On" only with motor stationary) (P330)
	19.1	**Star/delta incorrect** *"Motor star/delta circuit incorrect"*	

E020 E021	**20.0**	**Reserved**	System error in program execution, triggered by EMC interference. • Observe wiring guidelines • Use additional external mains filter • VFD must be very well grounded
	20.1	**Watchdog**	
	20.2	**Stack overflow**	
	20.3	**Stack underflow**	
	20.4	**Undefined opcode**	
	20.5	**Protected Instruct.** *"Protected Instruction"*	
	20.6	**Illegal word access**	
	20.7	**Illegal Inst. Access** *"Illegal instruction access"*	
	20.8	**Prog. memory error** *"Program memory error"* **(**EEPROM error)	
	20.9	**Dual-ported RAM**	
	21.0	**NMI error** (Not used by hardware)	
	21.1	**PLL error**	
	21.2	**ADU error** "Overrun"	
	21.3	**PMI error** "Access Error"	
	21.4	**User stack overflow**	

E022	**---**	**Reserved**	Error message for PLC → see supplementary manual BU 0550

E023	**---**	**Reserved**	Error message for PLC → see supplementary manual BU 0550

E024	**---**	**Reserved**	Error message for PLC → see supplementary manual BU 0550

Warning messages

Display in the Simple Box/Control Box		Warning	Cause
Group	Details in P700 [-02]	Text in the Parameter Box	• Remedy
C001	**1.0**	**Inverter overtemp.** *"Inverter overtemperature"* (inverter heat sink)	Temperature monitoring of the inverter Warning, permissible temperature limit reached. • Reduce ambient temperature • Check device fan/cabinet ventilation • Check the device for dirt
C002	**2.0**	**Motor overtemp. PTC** *"Motor overtemp. PTC"*	Warning from motor temperature sensor (triggering threshold reached) • Reduce motor load • Increase motor speed • Use external motor fan
	2.1	**Motor overtemp. I²t** *"Motor overtemperature I²t"* Only if I²t motor (P535) is programmed.	Warning: I2t motor monitoring (1.3 times the rated current reached for the time period specified in (P535)) • Reduce motor load • Increase motor speed
	2.2	**Ext Resistor Temp** *"Overtemperature of external braking resistor"* Overtemperature via digital input (P420 […])={13}	Warning: Temperature monitor (e.g. braking resistor) has activated • Digital input is low
C003	**3.0**	**I²t overcurrent limit**	Warning: a.c. inverter: I²t limit has triggered, e.g. > 1.3 x I_n for 60 s (also note P504) • Continuous overload at inverter output
	3.1	**Chopper overtemperature I²t**	Warning: I²t limit for the brake chopper has activated, 1.3 times values reached for 60 s (please also pay attention to P554, if present, and P555, P556, P557) • Avoid overcurrent in brake resistance
	3.5	**Torque current limit**	Warning: Torque current limit reached • Check (P112)
	3.6	**Current limit**	Warning: Current limit reached • Check (P536)

C004	**4.1**	**Overcurrent measurem** *"Overcurrent measurement"*	Warning: pulse switch off is active The limit for activation of pulse switch off (P537) has been reached (only possible if P112 and P536 are switched off) • VFD is overloaded • Drive sluggish, insufficiently sized, • Ramps (P102/P103) too steep -> Increase ramp time • Check motor data (P201 … P209) • Switch off slip compensation (P212)
C008	**8.0**	**Parameter loss**	Warning: One of the cyclically saved messages such as *operating hours* or *enabling time* could not be saved successfully. The warning disappears as soon as saving can be successfully performed.
C012	**12.1**	**Limit moto./Customer** *"Motor switch-off limit"*	Warning: 80% of the drive switch-off limit (P534 [-01]) has been exceeded. • Reduce load on motor • Set higher value in (P534 -[01])
	12.2	**Limit gen.** *"Generator switch-off limit"*	Warning: 80% of the generator switch-off limit (P534 [-02]) has been reached. • Reduce load on motor • Set higher value in (P534 [-02]).
	12.3	**Torque limit**	Warning: 80% of the limit from the potentiometer or the setpoint source has been reached. P400 = 12
	12.4	**Current limit**	Warning: 80% of the limit from the potentiometer or the setpoint source has been reached. P400 = 14
	12.5	**Load monitor**	Warning due to overshooting or undershooting of permissible load torques ((P525) … (P529)) for the time set in (P528). • Adjust load • Change limit values ((P525) ... (P527)) • Increase delay time (P528)

Notifications switch-on block, "not ready"

Display in the SimpleBox / ControlBox		Reason: Text in the ParameterBox	Cause • Remedy
Group	**Details in P700 [-03]**		
I000	**0.1**	**Disable voltage from IO**	If the "disable voltage" function is parameterized, input (P420/P480) is Low • "Set high" input • Check signal cable (broken cable)
	0.2	**IO fast stop**	If the function "fast stop" is parameterized, input (P420/P480) is at low • "Set high" input • Check signal cable (broken cable)
	0.3	**Block voltage from bus**	• Bus operation (P509): control word bit 1 is "low"
	0.4	**Bus fast stop**	• Bus operation (P509): control word bit 2 is "low"
	0.5	**Enable on start**	Enable signal (control word, Dig I/O or Bus I/O) was already applied during the initialization phase (after line power "ON", or control voltage "ON"). Or electrical phase is lacking. • Only issue enable signal after completion of initialization (i.e. when the VFD is ready) • Activation of "Automatic Start" (P428)
	0.6 – 0.7	**Reserved**	Information message for PLC → see supplementary instructions
	0.8	**Right direction blocked**	Switch-on block with inverter shut-off activated by: **P540** or by "Enable right block" **(P420** = 31, 73) or "Enable left block" (**P420** = 32, 74), The variable frequency drive switches to "Ready for switching on" status
	0.9	**Left direction blocked**	
I006 [1]	**6.0**	**Charging error**	Charging relay not energized, because: • Line/DC link voltage too low • Line voltage failure • Evacuation run active ((P420)/(P480))
I011	**11.0**	**Analog Stop**	If an analog input of the variable frequency drive or a connected IO extension is configured to detect cable breaks (2-10 V signal or 4-20 mA signal), the variable frequency drive switches to the status "ready for switch-on" if the analog signal undershoots the value **1 V** or **2 mA** This also occurs if the relevant analog input is parameterized to function "0" ("no function"). • Check connection
I014 [1]	**14.4**	**Reserved**	Information message for POSICON → see supplementary manual
I018 [1]	**18.0**	**Reserved**	Information message for "Safe stop" function → see supplementary manual

1) Indication of operating mode (message) on the *Parameter Box* or virtual operating unit of the *NORD CON-Software*: **"Not ready"**

6.4 FAQ operational problems

Fault	Possible cause	Remedy
Device will not start (all LEDs off)	• No line voltage or wrong line voltage • SK 2x5E: No 24 V DC control 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 flank)	• Reset enable • Reset **P428** if necessary: "0" = device expecting a 0→1/"1" flank = 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)	• Line phase missing	• Check connections and supply cables • Check switches/fuses
Motor rotating in wrong direction	• Motor cable: U-V-W interchanged	• Motor cable: Change 2 phases • Alternatively: – Check motor phase sequence (**P583**) – Change Enable right/left functions (**P420**) – Swap control word bits 11/12 (with bus actuation)
Motor not reaching required speed	• Maximum frequency parameter setting too low	• Check**P105**

Motor speed does not correspond to setpoint	• Analog input function set to "Frequency additions" and another setpoint is present	• Check **P400** • Check setting of integrated potentiometer (**P1**) (only SK 2x5E) • **P420**, check active fixed frequencies • Check bus setpoints • Check **P104/P105** "min/max frequency" • Check **P113** "jog 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 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
Intermittent communication error between VFD and optional modules	• System bus terminating resistors incorrectly set • Poor connection contact • Faults on system bus line • Maximum system bus length exceeded	• First and last subscriber only: set DIP switches for terminating resistor • Check connections • Connect GND of all VFDs connected to system bus • Pay attention to routing regulations (separate routing of signal and control cables and power and motor cables) • Check cable lengths (system bus)

Table 8: FAQ operational problems

7 Technical Data

7.1 General data for variable frequency drive

Function	Specification
Output frequency	0.0 … 400.0 Hz
Pulse frequency	3.0 … 16.0 kHz, factory setting = 6 kHz Power reduction > 8 kHz with 115 / 230 V device, > 6 kHz with 400 V device
Typical overload capacity	150% for 60 s, 200% for 3.5 s
Efficiency	> 95% according to size
Insulation resistance	> 5 MΩ
Operating/ambient temperature	-25°C … +40°C, for detailed information (among others UL-values) about individual device models and operating modes, please see (chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**). ATEX: -20…+40°C (chapter 2.4)
Storage and transport temperature	-25°C … +60/70°C
Long-term storage	(chapter 9.1)
Degree of protection	IP55, optional IP66 (chapter 1.8) NEMA1, higher NEMA classifications upon request
Max. installation altitude above sea level	*Up to 1000 m* No power reduction *1000 m...2000 m:* 1 % / 100 m power reduction, overvoltage category 3 *2000 m...4000 m:* 1%/100 m power reduction, overvoltage category 2, external overvoltage protection required at power input
Ambient conditions	*Transport (IEC 60721-3-2):* Mechanical: 2M2 *Operation (IEC 60721-3-3):* Mechanical: 3M7, 3M6 (size 4) Climatic: 3K3 (IP55) 3K4 (IP66)
Environmental protection	*Energy-saving function* (chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**), see P219 *EMC* (chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**) *RoHS* (chapter 1.5)
Protective measures against	Overtemperature of the variable frequency drive Overvoltage and undervoltage Short circuit, ground fault, overload, idle running
Motor temperature monitoring	I^2t motor, PTC/bimetallic switch
Regulation and control	Sensorless current vector control (ISD), linear V/f characteristic, VFC open-loop, CFC open-loop, CFC closed-loop
Waiting time between two power-up cycles	60 s for all devices in normal operating cycle
Interfaces	*Standard* RS485 (USS) (for parameterization units only) RS232 (Single Slave) System bus *Optional* AS-i on board (chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**) Various bus modules (chapter 1.2)
Electrical isolation	Control terminals
Connecting terminals, electrical connection	*Power unit* (chapter 2.3.2) *Control unit* (chapter 2.3.3)

8 Additional information

Additional information relating to the operation of the variable frequency drive, such as

- EMC
- Derating
- Standardization of setpoint/target values

can be found in the main instructions for the variable frequency drive

9 Maintenance and servicing information

9.1 Maintenance Instructions

When used as intended, variable frequency drives are *maintenance-free*(please see chapter 7 "Technical Data").

Dusty environments

If the device is being used in a dusty environment, the cooling surfaces should be regularly cleaned with compressed air.

Long-term storage

The device must be connected regularly to the supply network for at least 60 min.

If this is not done, there is a danger that the device may be destroyed.

If a device is to be stored for longer than one year, it must be recommissioned with the aid of a regulating transformer before normal connection to power supply.

Long-term storage for 1 - 3 years

- 30 min with 25% line voltage,
- 30 min with 50% line voltage,
- 30 min with 75% line voltage,
- 30 min with 100% line voltage

Long-term storage for >3 years or if the storage period is not known:

- 120 min with 25% line voltage,
- 120 min with 50% line voltage,
- 120 min with 75% line voltage,
- 120 min with 100% line voltage

The device must not be subject to load during the regeneration process.

After the regeneration process, the regulations described above apply again (at least 60 min on the grid 1x per year).

Information — **Control voltage with SK 2x5E**

With devices of type SK 2x5E, a 24 V control voltage supply must be provided in order to make the regeneration process possible.

Information — **Accessories**

The regulations for **long-term storage** apply to the accessories such as 24 V power supply modules (SK xU4-24V-…, SK TU4-POT-…) and the electronic brake inverter (SK CU4-MBR).

9.2 Service notes

Out technical support is available to reply to technical queries.

If you contact our technical support, please have the precise device model (nameplate/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:

NORD Electronic DRIVESYSTEMS GmbH
Tjüchkampstrasse 37
D-26605 Aurich

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.

You can obtain a return note from our web site (Link) or from our technical support.

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 (telephone)

Technical support	During normal business hours	+49 (0) 4532-289-2125
	During normal business hours	+49 (0) 180-500-6184
Repair inquiries	During normal business hours	+49 (0) 4532-289-2115

The manual and additional information can be found on the Internet under www.nord.com.

Key word index

NORD DRIVESYSTEMS Group

Headquarters and Technology Centre
in Bargteheide, close to Hamburg

Innovative drive solutions
for more than 100 branches of industry

Mechanical products
parallel shaft, helical gear, bevel gear and worm gear units

Electrical products
IE2/IE3/IE4 motors

Electronic products
centralised and decentralised frequency inverters,
motor starters and field distribution systems

7 state-of-the-art production plants
for all drive components

Subsidiaries and sales partners
in 98 countries on 5 continents
provide local stocks, assembly, production,
technical support and customer service

More than 4,000 employees throughout the world
create customer oriented solutions

www.nord.com/locator

Headquarters:

Getriebebau NORD GmbH & Co. KG
Getriebebau-Nord-Straße 1
22941 Bargteheide, Germany
T: +49 (0) 4532 / 289-0
F: +49 (0) 4532 / 289-22 53
info@nord.com, www.nord.com

Member of the NORD DRIVESYSTEMS Group

NORD® DRIVESYSTEMS

6072403 / 4920