INTELLIGENT DRIVESYSTEMS, WORLDWIDE SERVICES

BU 0240 – en

NORDAC® *FLEX* (SK 200E ... SK 235E)

Brief instructions for Frequency Inverters

NORD® DRIVESYSTEMS

Documentation

Title:	BU 0240	
Order – No.:	6072402	
Series:	SK 200E	
Device series:	SK 200E, SK 210E, SK 220E, SK 230E, SK 205E, SK 215E, SK 225E, SK 235E	
Device types:	*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	6072402 / 2210	V 1.2 R0	First version based on BU 0200 DE / 1310
BU 0240, June 2014	6072402 / 2314	V 1.4 R3	Revised version based on BU 0200 DE / 2314
BU 0240, March 2016	6072402 / 1216	V 2.1 R0	Revised version based on BU 0200 DE / 1216
BU 0240, December 2017	6072402 / 5117	V 2.1 R3	Revised version based on BU 0200 DE / 5117
BU 0240, July 2018	6072402 / 3118	V 2.1 R4	Revised version based on BU 0200 DE / 3118

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 is also definitive for commissioning. These brief instructions summarise 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 frequency inverter as well as any supplementary instructions for field bus options (e.g. PROFIBUS DP) or inverter functionalities (e.g.: PLC).

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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 in the following, this refers to information that applies to all devices in this family.

If the information exclusively applies to the 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 recognisable 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 technical data)
- Integrated EMC mains filter for limit curve A Category C2 or C3 (not with 115 V devices)
- Automatic measurement of the stator resistance and determination of the precise motor data possible
- 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 summarised 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 24V power supply	x		x		x		x	
Optionally available 24V mains 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 analogue 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, sizes 1 ... 3

Additional characteristics, size 4

Feature	200E	210E	220E	230E
Integrated 24V power supply	x	x	x	x
Number of digital inputs (DIN)	4	3	4	3
Number of digital outputs (DO)	2	2	2	2
Number of analogue 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 equipment **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 operating instructions

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

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

These safety instructions must be kept in a safe place!

1. General

Do not use defective devices or devices with defective or damaged housings or missing covers (e.g. blind plugs for cable glands). Otherwise there is a risk of serious or fatal injuries caused by electric shock or bursting electrical components such as powerful electrolytic capacitors.

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

During operation and depending on the protection class of the devices, there may be live, bare, moving or rotating parts or hot surfaces.

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

The device is not equipped with a mains switch and is therefore always live when connected to the power supply. Voltages may therefore be connected to a connected motor at standstill.

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

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

The device and any power plug connectors must not be disconnected while a voltage is applied to the device. Failure to comply with this may cause arcing, which in addition to the risk of injury, also results in a 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 mains and is without voltage.

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

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

All work on the device, e.g. transportation, installation, commissioning and maintenance work must be carried out by qualified 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.

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

Further information can be found in this documentation.

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. An electrician is a person who, because of their technical training and experience, has sufficient knowledge with regard to

- switching on, switching off, isolating, earthing 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

The frequency inverters are devices for industrial and commercial systems used for the operation of three-phase asynchronous motors with squirrel-cage rotors and Permanent Magnet Synchronous Motors – PMSM. These motors must be suitable for operation with frequency inverters, other loads must not be connected to the devices.

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

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

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

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

a. Supplement: Correct purpose of use within the European Union

When installed in machines, the devices must not be commissioned (i.e. commencement of proper use) until it has been ensured that the machine fulfils the provisions of EC Directive 2006/42/EC (Machinery Directive); EN 60204-1 must also be complied with.
Commissioning (i.e. start-up of proper use) is only permitted if the EMC directive (2014/30/EU) has been complied with.

b. Supplement: Correct purpose of use outside the European Union

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

4. Phases of life

Transport, storage

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

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

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

Installation and assembly

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

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

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

Electrical Connection

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

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

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

Information regarding EMC-compliant installation such as shielding, earthing, location of filters and routing of cables can be found in the documentation for the devices and in the technical information manual TI 80-0011. CE marked devices must also comply with these instructions. Compliance with the limit values specified in the EMC regulations is the responsibility of the manufacturer of the system or machine.

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

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

The voltage supply of the device may directly or indirectly put it into operation, or touching electrically conducting components may then cause an electric shock with possible fatal consequences.

All phases of all power connections (e.g. power supply) must always be disconnected.

Set-up, troubleshooting and commissioning

When working on live devices, the applicable national accident prevention regulations must be complied with (e.g. BGV A3, formerly VBG 4).

The voltage supply of the device may directly or indirectly put it into operation, or touching electrically conducting components may then cause an electric shock with possible fatal consequences.

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

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

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

Operation

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

All covers must be kept closed during operation.

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

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

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

Maintenance, repair and decommissioning

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

For further information, please refer to the manual for the device.

Disposal

The product and its parts and accessories must not be disposed of as domestic waste. At the end of its life, the product must be properly disposed of according to the local regulations for industrial waste. In particular, this product contains integrated semiconductor circuits (PCBs and various electronic components, including high power capacitors). In case of incorrect disposal there is a risk of formation of toxic gases, which may cause contamination of the environment and direct or indirect injuries (e.g. chemical burns). In the case of high power 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 notes from the manual of the device 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 authorised for all assembly, service, commissioning and operation work on association with explosion hazard environments may work with the devices described here (including the motors, geared motors, any accessories and all connection technology).

- 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 drive must comply with the specifications of ***"Planning guideline for the operating and installation instructions B1091"*** B1091-1.
- Only original parts which are approved for the device and for operation in an explosion hazard area ATEX Zone 22 3D, EAC Ex must be used.
- **Repairs may only be carried out by Getriebebau NORD GmbH & Co. KG.**

1.4 Warning and hazard information

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

1.4.1 Warning and hazard information on the product

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

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

1) Texts are written in English.

Table 4: Warning and hazard information on the product

1.4.2 Warning and hazard information in the document

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

The warning and hazard information is classified as follows according to the risk and the 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 SK 200E series comply with the standards and directives listed below.

Approval	Directive		Applied standards	Certificates	Code
CE *(European Union)*	Low Voltage Directive	2014/35/EU	EN 61800-5-1 EN 60529 EN 61800-3 EN 50581	C310700_2016 C310401_2016	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	
C-Tick *(Australia)*				N 23134	
EAC *(Eurasia)*	TR CU 004/2011, TR CU 020/2011		IEC 61800-5-1, IEC 61800-3	TC RU C-DE.АЛ32.В.00000	EAC

Table 5: Standards and approvals

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

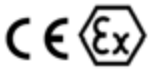
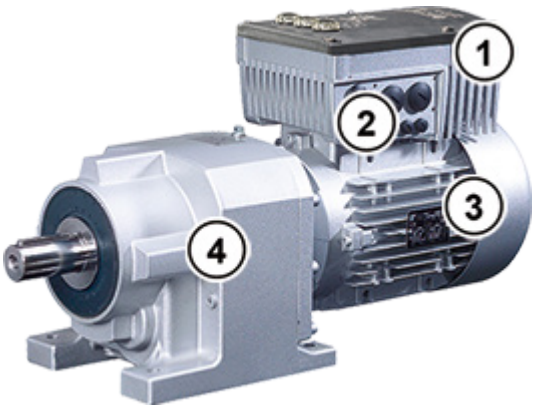
Approval	Directive		Applied standards	Certificates	Code
ATEX *(European Union)*	ATEX	2014/34/EU	EN 60079-0 EN 60079-31 EN 61800-5-1 EN 60529 EN 61800-3 EN 50581	C432710_2016	
	EMC	2014/30/EU			
	RoHS	2011/65/EU			
EAC Ex *(Eurasia)*	TR CU 012/2011		IEC 60079-0 IEC 60079-31	TC RU C-DE.AA87.B.01109	

Table 6: Standards and approvals for explosion hazard environments

1.6 Type code / nomenclature

Unique type codes have been defined for the individual modules and devices. These provide individual details of the device type and its electrical data, protection class, fixing version and special versions. A differentiation is made according to the following groups:

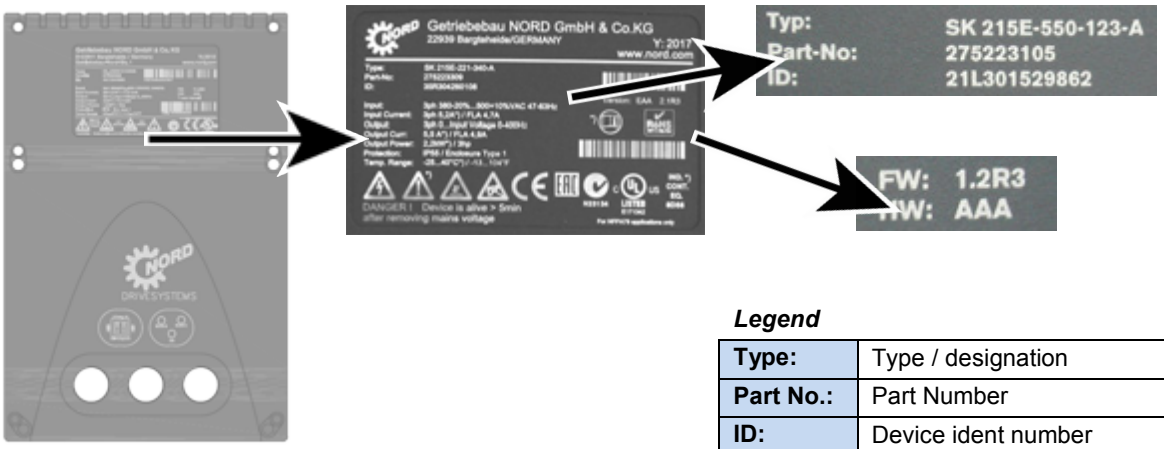


1	Frequency inverter
2	Connection unit
3	Motors
4	Gear units

5	Optional module
6	Connection unit
7	Wall-mounting kit

1.6.1 Name plate

All of the information which is relevant for the device, including information for the identification of the device can be obtained from the type plate.



Legend

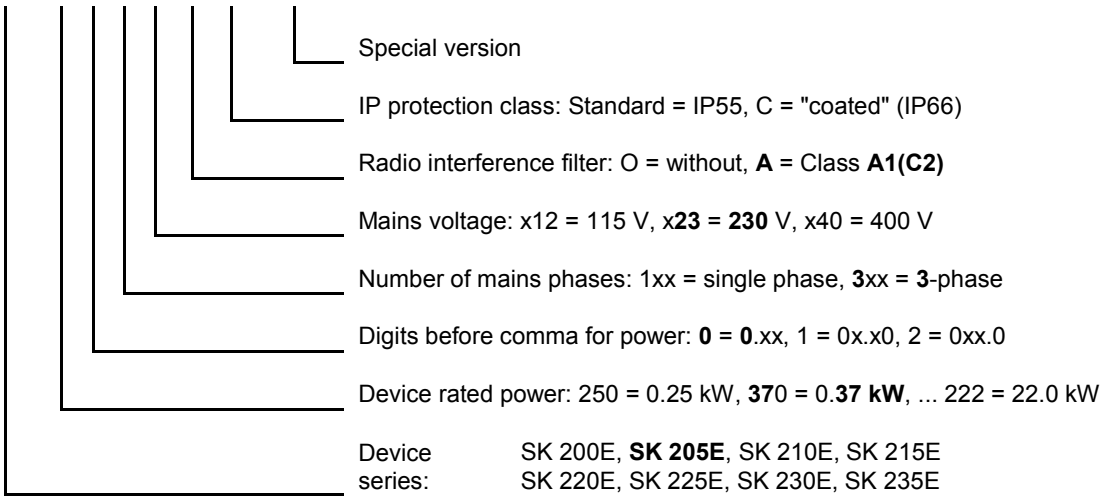
Type:	Type / designation
Part No.:	Part Number
ID:	Device ident number

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

Figure 1: Name plate

1.6.2 Frequency inverter type code - Basic device

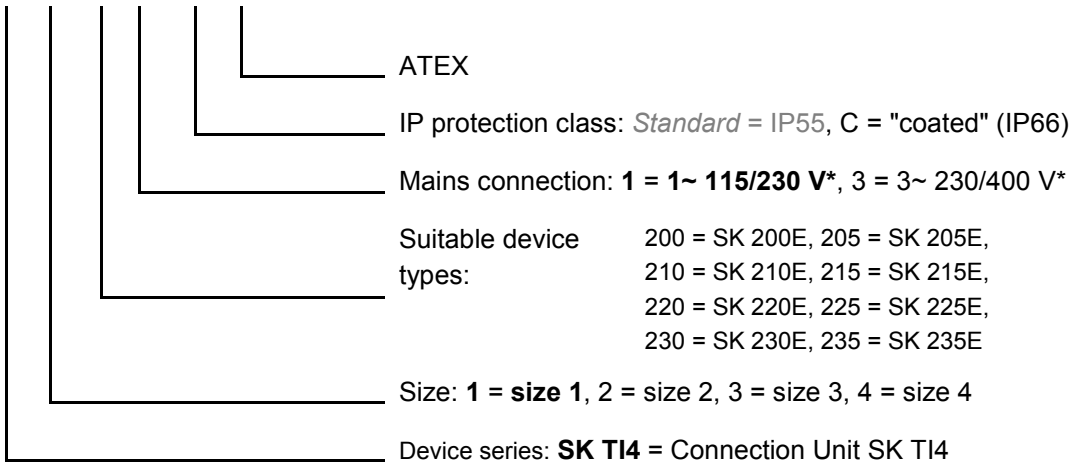
SK 205E-370-323-A (-C) (-xxx)



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

1.6.3 Frequency inverter type code - Connection unit

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



*) The voltage depends on the frequency inverter used; refer to the technical data.

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

1.7 Power rating / Motor size

Size	Mains / Power category 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	-	-	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

1.8 Version in protection class IP55, IP66

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

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

There are no restrictions or differences to the scope of functionality in the protection classes that have been mentioned. The type designation is extended accordingly in order to distinguish between the protection classes.

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

Information **Cable laying**

For all versions, care must be taken that the cables and the cable glands at least comply with the protection class of the device and the attachment regulations and are carefully matched. The cables must be inserted so that water is deflected away from the device (if necessary use loops). This is essential to ensure that the required protection class is maintained.

IP55 version:

The IP55 version is the **standard** version. In this version, the two installation types *motor mounted* (fitted onto the motor) and *close coupled* (fitted to the wall bracket) are available. All adapter 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 coupled*) are also available for this version. The modules available to the IP66 design (adapter 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 type key, and are modified with the following special measures:

- impregnated PCBs,
- Powder coating RAL 9006 (white aluminium) 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. After successful testing, a diaphragm valve is inserted here. This screw connection is therefore no longer available for a cable gland.

If the frequency inverter is going to be retrofitted, i.e. the entire drive unit (inverter pre-attached to motor) is not being purchased from NORD, the diaphragm valve is supplied in the bag enclosed with the frequency inverter. 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

Up to week of manufacture 38 / 2012 (up to ID no. 38M...), size 4 frequency inverters are also available as "coated" versions "-C", *but they only fulfil 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… already compliant with IP66**.

2 Assembly and installation

2.1 Installation 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 implemented. IP6x components that are retrofitted on site cannot ensure that this protection class is provided.

The SK 2xxE is connected to the motor or the wall-mounting kit using the size that is suitable for the SK T14-… connection unit . The adapter unit can also be ordered separately for subsequent mounting on an existing motor or to replace a different motor-mounted frequency inverter.

The **"Adapter unit SK T14"** module includes the following components:

- Cast housing, seal (already glued in) and insulation plate
- Power terminal block, in accordance with mains connection
- Control terminal block, in accordance with SK 2xxE version
- Screw kit, for mounting on the motor and the terminal bars
- Pre-fabricated cable for motor and PTC connections
- *Size 4 only:* As of hardware status "EAA" (frequency inverter) or "EA" (connection unit) ring core (ferrite) with fastening material

Information

Power derating

The equipment requires **sufficient ventilation** to protect against overheating. If this cannot be guaranteed, this results in power reduction (derating) of the frequency inverter. The ventilation is influenced by the type of installation (motor-mounting, wall-mounting) and/or with motor-mounting: the air flow of the motor fan (continuous slow speed → lack of cooling).

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

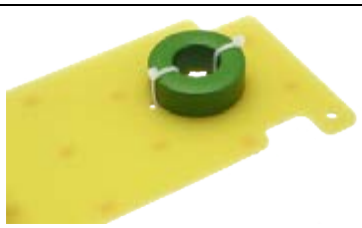
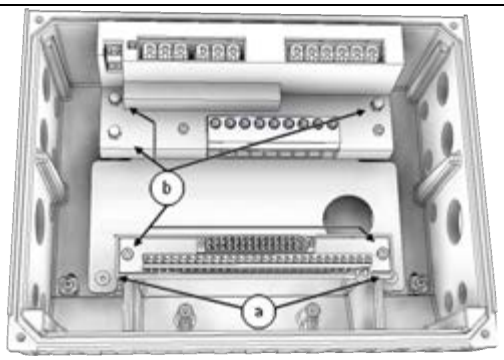
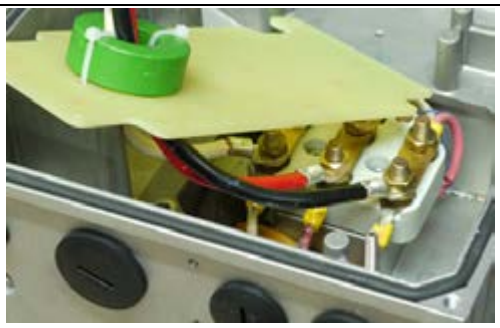
Details concerning output reduction and possible ambient temperatures, and other details (📖 BU 0200).

2.1.1 Installation of insulating plate – size 4

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

The ring core is required to ensure that the EMC requirements are adhered to.

Assembly sequence

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

2.1.2 Motor installation work operations

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. Set the bridges for the correct motor circuit at the motor terminal block and connect the pre-fabricated cables for motor and PTC connections to the respective connection points of the motor.
3. Mount the connecting unit on the terminal box base of the NORD motor using the existing screws and seal 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 bearing shield of the motor. Carry out mechanical adaptation using the "Adapter kit" (🕮 2.1.2.1 "Adapters for different motors"). It must generally be checked whether motors made by other manufacturers can be connected.

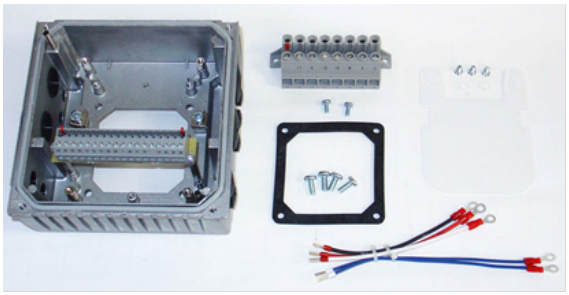


Figure 2: Connecting unit size 1 … 3

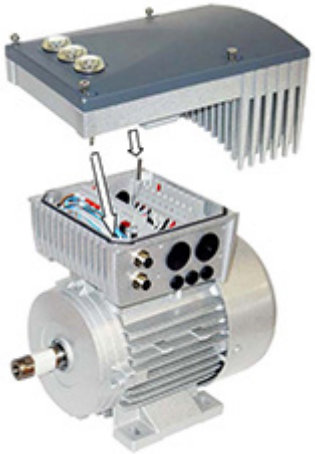
Figure 3: Connecting unit size 4

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

   Screw on the power terminal block above this using 2x M4x8 screws and the plastic washers. (Size 4: 3x M4 cap nuts).
5. Make the electrical connections. For the cable gland of the connecting cable, appropriate screwed connections for cable cross-section must be used.
6. Fit the frequency inverter to the connection unit With sizes 1 to 3, special attention must be paid to correct contacting of the PE pins. These are located diagonally in 2 corners of the frequency inverter and the connection unit.

   In order to ensure that the protection class for which the device is intended is achieved, it must be ensured that all fastening screws that attach the frequency inverter to the connecting unit are tightened crosswise, step-by-step and with the torques stated in the table below.

   The cable screw connections that are used must at least correspond with the protection class 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 different motors

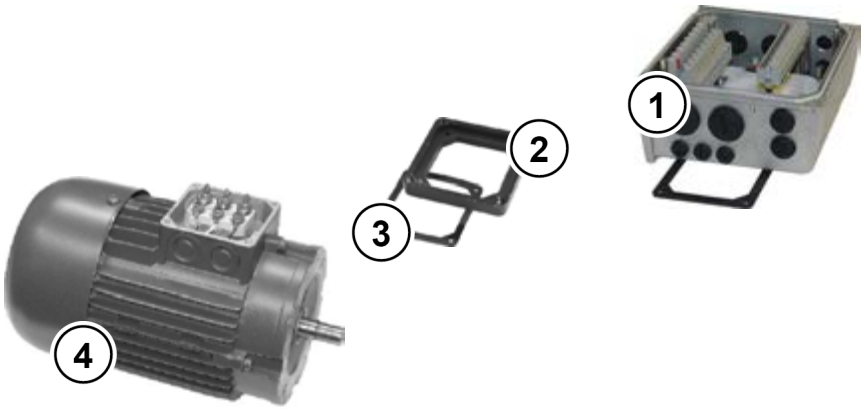
In some cases, the terminal box attachments are different for different motor sizes. Therefore, it may be necessary to use adapters to mount the device.

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

Information — **External motors**

The adaptability of motors from other manufacturers must be checked individually!

Information about converting a drive to the device can be found in BU0320.



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	Part 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_80-112-C		275274325
Adapter kit III	IP55	SK TI4-4-Adapter kit_132	Adapter plate, terminal box frame seal and screws	275274320
	IP66	SK TI4-4-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]
FI	Motor	∅ g	g 1	n	o	p	
Size 1	Size 71 *	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]
*) including additional adapter and seal [13097000]

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

During dynamic braking (frequency reduction) of a three-phase motor, electrical energy is returned to the inverter if necessary. **From size 1 and above**, an internal or external braking resistor can be used to avoid a shut-down of the device due to overvoltage. With this, the integrated brake chopper (electronic switch) pulses the link circuit voltage (switching threshold approx. 420 V / 720 V_{DC}, depending on mains voltage) into 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.

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

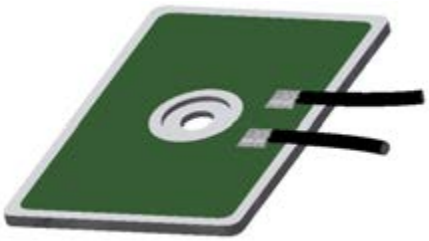
Allow sufficient cooling time before starting work on the product. Check the surface temperatures with suitable measuring equipment. Maintain an adequate distance to adjacent components or provide protection against contact.

Information **Parameterisation of braking resistor data**

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

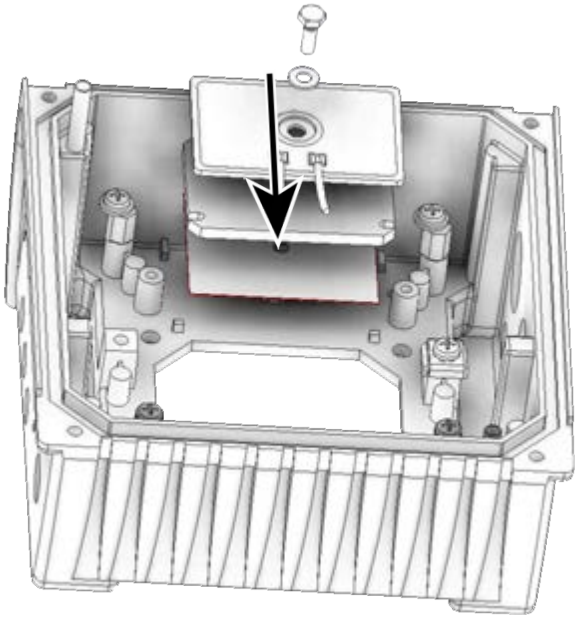
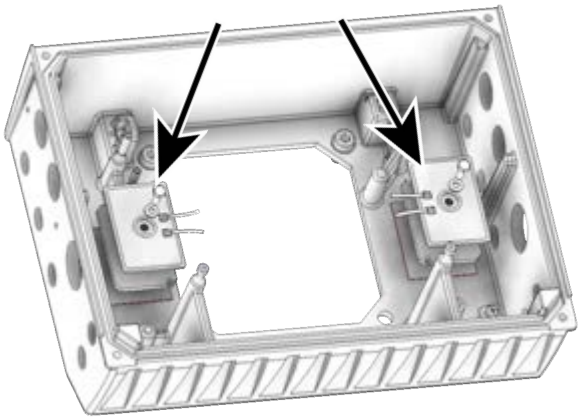
2.2.1 Internal brake resistor SK BRI4-…

The internal brake resistor can be used if only slight, short braking phases are to be expected. For the individual power ranges of size 4, the item includes a set of 2 brake resistors. These must be connected in parallel and thereby achieve the electrical data from the description of the material. The installation location for the 2nd brake resistor is opposite the installation location of the 1st brake resistor.



similar to Figure

Assembly

Size 1 … 3	Size 4
	

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

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

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

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

Information **Peak load limitation - DIP switches (S1)**

When using internal brake resistors, DIP switches (S1), No. 8 (please see chapter 4.2.2.2 "DIP switches (S1)")must be set to "on". This is important for activating a peak output limit for protecting the brake resistor.

Electrical data

Designation (IP54)	Part No.	Resistance	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 conductor 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 conductor 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 conductor 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 conductor 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 switches (S1), DIP switch No. 8 = on	1) maximum one-off within 10 s [2] 2) In order to prevent non-permissible heating of the connection unit, the continuous power is limited to 1/4 of the rated power of the brake resistor. This also has a limiting effect on the 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. Here, it may be necessary to plan for the exact braking resistor that is required (see adjacent figure).

Installation of an SK BRE4-… is not possible in combination with the wall-mounting kit **SK TIE4-WMK…**. In this case, braking resistors of type **SK BREW4-…** are available as an alternative, which can also be fitted to the frequency inverter.

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

Electrical data

Designation [1] (IP67)	Resistance	Max. continuous power (P_n)	Energy 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-: versions: SK BRE4-, SK BRW4-, SK BREW4-		
	2) Maximum once within 120s		

Information **Braking resistor**

If required, other versions or installation variants for external braking resistors can be provided.

2.3 Electrical Connection

WARNING — **Electric shock**

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

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

Information — **Temperature sensor and PTC (TF)**

As with other signal cables, thermistor cables must be laid separately from the motor cables Otherwise the interfering signals from the motor winding that are induced into the line affect the device.

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

In order to access the electrical connections, the SK 2xxE must be removed from the SK TI4-… connection unit (📖 Section 2.1.2 "Motor installation work operations").

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

The PE connections (device-earth) are inside the cast housing of the connecting unit on the base. A contact is available on the power terminal block for size 4.

The terminal strip 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 Brake resistance lines
(2)	Control lines Electromechanical brake PTC (TF) of motor
(3)	PE

2.3.1 Wiring guidelines

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

1. Ensure that all devices are securely earthed to a common earthing point or earthing rail using short earthing cables with a large cross-section. It is especially important that each control unit which is connected to the electronic drive technology (e.g. an automatic device) has a short cable with a large cross-section, which is connected to the same earthing point as the device itself. Flat cables (e.g. metal stirrups) are preferable, as they have a lower impedance at high frequencies.
2. The bonding cable of the motor controlled by the soft starter should be connected directly to the earthing terminal of the associated device. The presence of a central earthing bar in the control cabinet and the grouping together of all bonding conductors to this bar normally ensures safe operation.
3. Where possible, shielded cables should be used for control circuits. The shielding at the cable end should be carefully sealed and it must be ensured that the wires are not laid over longer distances without shielding.

   The shields of analogue setpoint cables should only be earthed on one side on the device.
4. The control cables should be installed as far as possible from power cables, using separate cable ducts, etc. Where cables cross, an angle of 90° should be ensured as far as possible.
5. Ensure that the contactors in the cabinet are interference protected, either by RC circuits in the case of AC contactors or by free-wheeling diodes for DC contactors, for which **the interference traps must be positioned on the contactor coils**. Varistors for over-voltage limitation are also effective.
6. Shielded or armoured cables should be used for the load connections (motor cable if necessary). The shielding or armouring must be earthed at both ends. The earthing should be provided directly to the PE of the device if possible.

In addition, EMC-compliant wiring must be ensured.

The safety regulations must be complied with 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 which is to be tested from the device before performing a high voltage insulation test.

Information **Looping of the mains voltage**

The permissible current load for the connection terminals, plugs and supply cables must be observed when looping the mains voltage. Failure to comply with this will result in thermal damage to current-carrying modules and the immediate vicinity thereof.

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 (📖 BU 0200).

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

When the device is being connected, please note the following:

1. Ensure that the mains supply provides the correct voltage and is suitable for the current required (📖 Section 7 "Technical data").
2. Ensure that suitable electrical fuses with the specified nominal current range are installed between the voltage source and the device.
3. Mains cable connection: to terminals **L1**-**L2/N**-**L3** and **PE** (depending on device)
4. Motor connection: to terminals **U**-**V**-**W**

   A 4-core motor cable must be used if the device is being wall-mounted As well as **U**-**V**-**W**, **PE** must also be connected. If present, in this case the cable shielding must be connected to a large area of the metallic screw connector of the cable gland.

The use of wire end rings is recommended for connecting to PE.

Information — **Connection cables**

Only use copper cables with temperature class 80°C or equivalent for connection. Higher temperature classes are permissible.

When using **wiring sleeves**, the maximum connection cross-section can be reduced.

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 wire-end 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 device can also be supplied by an external control voltage source (connection to terminal 44). The switchover between the internal and external power supply takes place automatically.

SK 2x5E

The device must be provided with an external 24 V DC supply. Alternatively, an optionally available 24 V DC power supply of type 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 frequency inverter must not have an additional supply via terminal 44 in order to prevent damage to the mains unit or the AS interface bus.

Information — **Control voltage overload**

A control unit overload caused by non-permissible high currents can destroy the unit. Impermissibly high currents occur if the total cuurent which is actually obtained exceeds the permissible total current, or if the 24 V DC control voltage for other devices is passed through the frequency inverter. To avoid conduction through the frequency inverter, e.g. double wire end ferrules must be used.

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

Information — **Total currents**

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

The sum total of the currents that are obtained must not exceed:

Device type	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 the 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

A parallel channel exists for digital inputs DIN2 and DIN3, which relays the signal pulses between 250 Hz and 205 kHz directly to the processor, and therefore makes it possible for an encoder to be evaluated.

Information

Cable laying

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

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

Alternative: Using a hybrid cable with shielding of the control lines.

2.3.3.1 Control terminal details

Labelling, function

SH:	Function: Safe stop	DOUT:	Digital output
AS1+/-:	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 +/-	Analogue input
AGND:	Reference potential for analogue signals	SYS H/L:	System bus
GND:	Reference potential for digital signals	MB+/-:	Control of electro-mechanical brake
DIN:	Digital input	TF+/-:	Motor thermistor (PTC) connection

Connections depending on the development stage

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 AS1	SK 230E SH+AS1	Device type Labelling Pin			SK 205E	SK 215E SH	SK 225E AS1	SK 235E SH+AS1
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	0V SH	GND	0V SH	**40/88**	9	**40/88**	GND	0V SH	GND	0V 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 type		SK 200E	SK 210E (SH)	SK 220E (ASI)	SK 230E (SH+ASI)
Pin	**Labelling**				
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	0V SH	GND	0V 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

The digital inputs DIN2 and DIN3 are used for 2 different functions:

1. For digital functions which can be parameterised (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 if an incremental encoder is connected, it must be ensured that the digital functions are disabled (Parameter (P420 [-02] and [-03]) or via 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 (pulse number) of the encoder in **P301** can be set with a negative prefix.

Information — Encoder signal faults

Wires that are not required (e.g. Track A inverse / B inverse) must be isolated.

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 — **Danger of explosion 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 **power to the system switched off**.
- 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 free of voltage 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 operation 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 labelling of the motor and the gear unit must also be observed. Otherwise the drive must not be operated.

Information — **SK 2xxE, size 4**

Devices of size 4 (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 frequency inverter in an explosion hazard environment (ATEX) are listed 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 aluminium / glass versions, among other things.

(1) Year of manufacture

(2) Marking of the device (ATEX)

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

Categorisation:

- Protection with "housing"
- Procedure "A" Zone "22" Category 3D
- Protection class IP55 / IP66 (according to the device)

  →IP66 is required for conductive dust
- Maximum surface temperature 125°C
- Ambient temperature -20°C to +40°C

Information **Potential damage**

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 which are required for the modification are contained in an appropriately modified frequency inverter connection unit (SK TI4-…-EX).

2.4.1.2 Options for ATEX Zone 22, category 3D

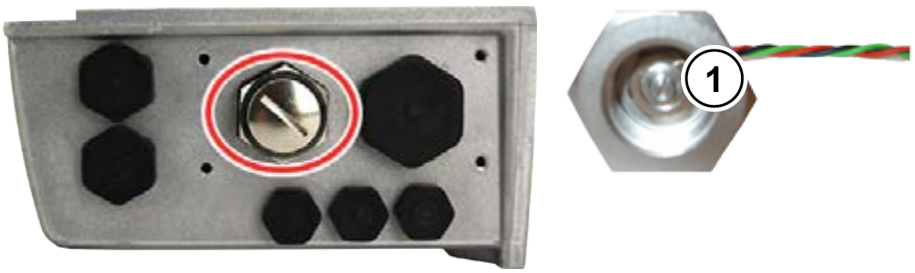
In order to ensure that the device is ATEX-compliant, its optional modules must also be approved for potentially explosive areas. Option modules that are not in the following list may **not** be used in an ATEX zone 22 3D. This also includes connectors and switches that may also not be used in such an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

Control and parametrisation 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 no explosive dust atmosphere exists.

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



1 Setting adjustment using a screwdriver

SK ATX-POT wire colour	Name	Terminal SK CU4-24V…	Terminal SK CU4-IOE	Terminal SK 2x0E
red	+10 V reference	[11]	[11]	[11]
black	AGND / 0V	[12]	[12]	[12] / [40]
green	Analogue 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, the power limitation for this must be activated under all circumstances (📖 Section 2.2.1 "Internal brake 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 on reaching the break frequency. The same applies for the degree of modulation (P218). With the factory setting of 100 %, in the field reduction range a torque reduction of 5 % must be taken into account:

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

Above a value of 105 %, no reduction needs to be taken into account. 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 increased 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 reduction range.

2.4.1.4 Commissioning information

For Zone 22 the cable glands must at least comply with protection class IP55. Unused openings must be closed with blank screw caps that are suitable for ATEX Zone 22 3D (generally IP 55).

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

In addition, care must be taken that a NORD motor from the motor list (P200) is set. If a standard 4-pole NORD motor or a motor from a different manufacturer is not used, the data for the motor parameters ((P201) to (P208)) must be adjusted to those on the motor rating plate. *The stator resistance of the motor (see P208) must be measured by the inverter and at ambient temperature. In order to do this, parameter P220 must be set to "1".* In addition, the frequency inverter must be parameterised so that the motor can be operated with a maximum speed of 3000 rpm. For a four-pole motor, the "maximum frequency" must be set to a value which is smaller or equal to 100 Hz ((P105) ≤ 100). Here the maximum permissible output speed of the gear unit must be observed. In addition, the monitoring "I²t-Motor" (Parameter (P535) / (P533)) must be switched on and the pulse frequency set 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. On principle, 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 rating plate	[xxx]	If a 4-pole NORD motor is not used, the motor data on the rating plate 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 Factor I^2t-Motor	< 100%	[100]	A reduction in torque can be taken into account with values less than 100 in the I²t monitoring.
P535 I²t motor	According to motor and ventilation	[0]	The I²t- 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

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C432710_1418

EU Declaration of Conformity

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

Page 1 of 1

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

- **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 Ex **II 3D Ex tc IIIB T125°C Dc X** (in IP55) or

Ex **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
RoHS Directive	**2011/65/EU**	OJ. L 174 of 1.7.2011, P. 88–110

Applied standards:

EN 60079-0:2012+A11:2013	EN 60079-31:2014	EN 61800-9-1:2017
EN 61800-5-1:2007+A1:2017	EN 61800-3:2004+A1:2012+AC:2014	EN 61800-9-2:2017
EN 60529:1991+A1:2000+A2:2013+AC:2016	EN 50581:2012	

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, 06.04.2018

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 frequency inverter in an explosion hazard environment according to EAC Ex are listed below. All of 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 2.4.1.1 applies.

The labelling of the device according to EAC Ex differs as follows.

Labelling of the device:

The following applies for wall mounted devices;

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

The following applies for motor mounted devices;

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

Categorisation:

- Protection with "housing"
- Procedure "A" Zone "22" Category 3D
- Protection class IP55 / IP66 (depending on 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 frequency inverters which are intended for motor mounting. Devices which are so labelled are considered to be incomplete and may only be operated in combination with a corresponding motor. If a device which is coded "U" is mounted in a motor, the labels and restrictions which are marked on the motor or the geared motor also apply.

Information **Code "X"**

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

2.4.2.2 Further Information

Further information regarding 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

As supplied, without additional options, the diagnostic LEDs are externally visible. These indicate the actual device status. 2 potentiometers (only SK 2x5E) and 8 DIP switches (S1) are provided in order to set the most important parameters. In this minimal configuration no other adapted parameters are stored in the external (plug-in) EEPROM. The only exception are 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 frequency inverter.

The memory module (external EEPROM) can be pre-parametrised independently of the frequency inverter 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		

3.1 Control and parametrisation options

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

Parametrisation units also provide a facility for accessing the parametrisation of the device and adapting it.

Designation		Part 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 0-10V	275274700	TI 275274700
SK TIE4-SWT	Switch "L-OFF-R""	275274701	TI 275274701
Control and parametrisation boxes (Handheld)			
SK CSX-3H	SimpleBox	275281013	BU0040
SK PAR-3H	ParameterBox	275281014	BU0040

3.1.1 Control and Parametrisation Boxes / Software

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

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

The connection between the SimpleBox or the ParameterBox and the device is made with an RJ12-RJ12 cable.

Figure 7: SimpleBox, handheld, SK CSX-3H

Figure 8: ParameterBox, handheld, SK PAR-3H

Module	Description	Data
SK CSX-3H (handheld SimpleBox)	Used for commissioning, parameterisation, configuration and control of the device [1].	4-digit, 7-segment LED display, membrane keyboard IP20 RJ12-RJ12 cable (connection to the device [1])
SK PAR-3H (handheld ParameterBox)	Used for commissioning, parameterisation, configuration and control of the frequency inverter and its options (SK xU4-…). Entire parameter data sets can be stored.	2-line backlit LCD-display, membrane keyboard Stores up to 5 complete parameter data sets IP20 RJ12-RJ12 cable (connection to device) USB cable (connection to PC)
1) does not apply to optional modules such as bus interfaces		

Connection

1. Remove diagnostics glass of RJ12 socket.
2. Connect the RJ12-RJ12 cable between the control unit and the frequency inverter.

   When a diagnostics glass or a blind plug is open, take care that no dirt or moisture enters the device.
3. After commissioning, the **diagnostics glass or blind plugs must be screwed back in again** and it must be ensured that they are **tightly sealed** before starting regular operation.

3.1.2 Potentiometer adapter, SK CU4-POT

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

The potentiometer (010 V) can be evaluated via an analogue input of the frequency inverter (if present) or via an I/O extension. An optional 24V module (SK xU4-24V-...) also provides the possibility of converting analogue setpoint values into proportional pulses (frequencies). These pulses can in turn be evaluated via one of the digital inputs 2 or 3 (P420 [02]/[03] = 26/27) of the frequency inverter in the form of a setpoint (P400 [-06]/[-07]).

Module		SK CU4-POT	Connection: Terminal No.			Function
			SK 2x0E	SK 2x5E		
Pin	Colour		FI	FI	Mains unit	
1	brown	24V- 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 10V	11		11	
6	blue	Analogue ground AGND	12		12	

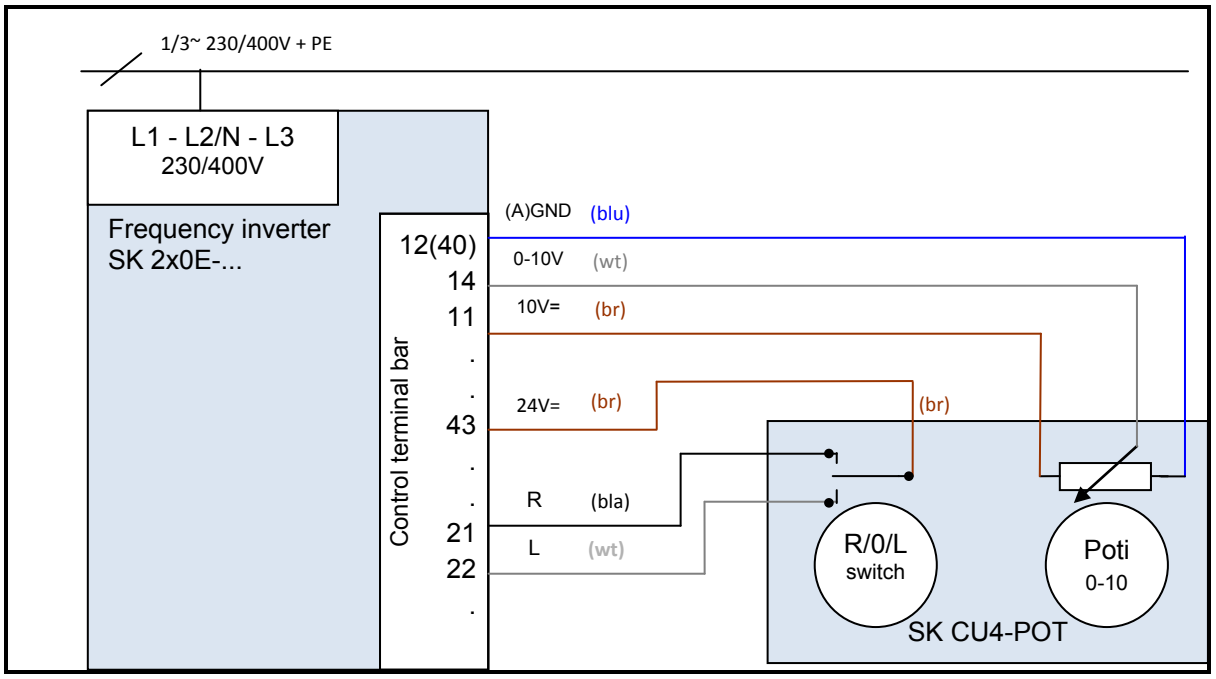


Figure 9: Connection diagram SK CU4-POT, example SK 2x0E

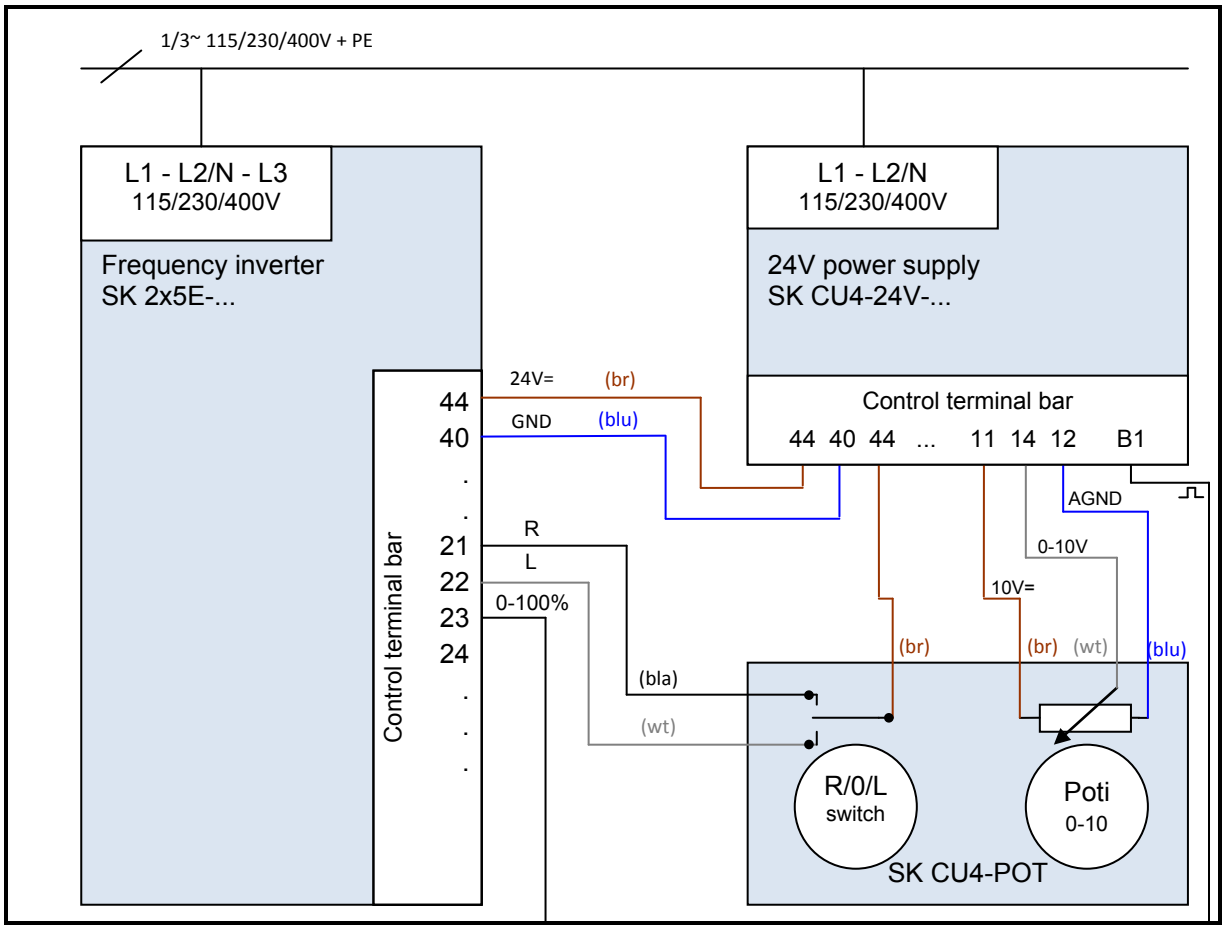


Figure 10: Connection diagram and parametrisation of SK CU4-POT, example SK 2x5E

DIP switch settings (S1:):	DIP3 = off, DIP4 = on, DIP5 = off (please see chapter 4.2.2.2 "DIP switches (S1)" on page 59)	
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 drive unit into motion. This may cause an unexpected movement of the drive unit and the machine which is connected to it. This unexpected movement may cause severe or fatal injuries and/or material damage.

Unexpected movements may be due to several causes, e.g.

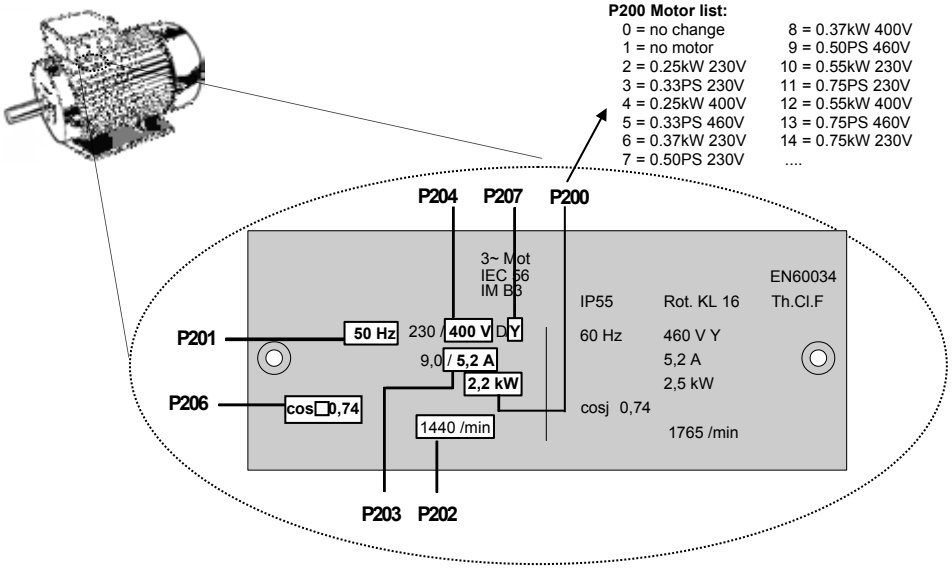
- Parameterisation of an "automatic start",
- Incorrect parameterisation,
- Control of the device with an enabling signal from a higher level control unit (via IO or bus signals),
- Incorrect motor data,
- Incorrect encoder connection,
- Release of a mechanical holding brake,
- External influences such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

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

4.1 Factory settings

All frequency inverters supplied by Getriebebau NORD are pre-programmed with the default setting for standard applications with 4 pole standard motors (same voltage and power). For use with motors with other powers or number of poles, the data from the rating plate of the motor must be input into the parameters **P201**...**P207** under the menu item >Motor data<.

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



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

Motor data for IE2 and IE3 motors are provided via the **NORD CON** software. With the aid of the "Import motor parameter" function (also refer to the manual for the **NORD CON** software BU 0000), the required data record can be selected and imported into the frequency inverter.

Information — DIN 2 and DIN 3 double allocation

The digital inputs DIN2 and DIN3 are used for 2 different functions:

1. For digital functions which can be parameterised (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 if an incremental encoder is connected, it must be ensured that the digital functions are disabled (Parameter (P420 [-02] and [-03]) or via DIP switch (please see chapter 4.2.2.2 "DIP switches (S1)" on page 59)).

Information — DIP switch priority

It must be noted that DIP switch settings at the frequency inverter (**S1**) have priority over the parameter settings.

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

4.2 Starting up the device

The frequency inverter can be commissioned in various ways:

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

   In this configuration the plug-in EEPROM is not required.

b) By means of parameter adaptations using the control and parametrisation box (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. As of firmware **V1.3**, the data is automatically saved in the internal EEPROM if no EEPROM is plugged in.

   As of firmware **V1.4 R2**, the data will generally be stored in the internal EEPROM. The 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 permanently save changed parameter values.

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

For commissioning standard applications, a limited number of the frequency inverter 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, after the device has been attached to the motor or the wall mounting kit, the power and motor lines must be connected to the relevant terminals (📖 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 24 V control voltage that is required can be implemented by means of an integrated (SK CU4-24V-…) or external (SK TU4-24V-…) optional mains 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 with the by means of the integrated 8-pole DIP switch (S1).

Information **Configuration via DIP switch**

Mixing of DIP switch configuration and (software) parameterisation should be avoided.

4.2.2.1 Parameterisation

The use of a ParameterBox (SK CSX-3H / SK PAR) or the NORD CON 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 rating plate	
	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 frequency inverter
Control terminals	P400, P420	Analogue and digital inputs	

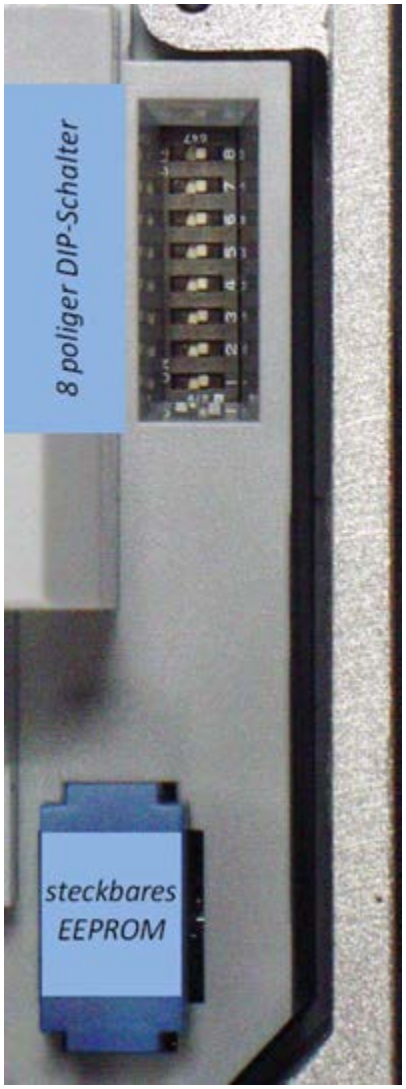
Information **Factory settings**

Prior to commissioning, it should be ensured that the frequency inverter 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)

The DIP switches make it possible to carrying out commissioning without additional control units. Further settings are made using the potentiometer on the top of the frequency inverter (P1 / P2, SK 2x5E only).



No. Bit	DIP switch (S1)		
8 2^7	**Int R_{Brake}** Internal brake resistor	0	Internal brake resistor not existing
		I	Internal brake resistor existing (📖 Section 2.2.1)
7 2^6	**60Hz** [1] 50/60Hz operation	0	Motor data corresponding to the rated power of the FI in kW relative to 50 Hz, fmax = 50 Hz
		I	Motor data corresponding to the rated power of the FI 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 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	
		I I	
3 2^2	**BUS** Source control word and setpoint value	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 1*	
		0 0	Corresponding to P515 and P514 [32, 250kBaud]
		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 mains 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!**

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

Information **IO bit factory settings:**

For controlling the frequency inverter 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 analogue 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 freq1" =5Hz (P465[01])	P420 [04]* {05} "Fixed freq2" =10Hz (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" =10Hz (P465[02])	{52} "F Arr Bit2" =20Hz (P465[03])	{53} "F Arr Bit3" =35Hz (P465[04])	{05} "F max"	{15} "Ramp"
off	off	on	The functions of the digital inputs are inactive (control via system bus), however, the settings made in parameters (P420 [01 … 04]) result in the activation of the correspondingly parametrised input, for the functions designated with ..² in the function list (e.g.: {11}²= "Quick stop).				P400 [01] {01} "F setpoint"	P400 [02] {15} "Ramp"
			P420 [01] no function	P420 [02] no function	P420 [03] {04} "Fixed freq1" =5Hz (P465[01])	P420 [04] {05} "Fixed freq2" =10Hz (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" =10Hz (P465[02])	{52} "F Arr Bit2" =20Hz (P465[03])	{53} "F Arr Bit3" =35Hz (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)

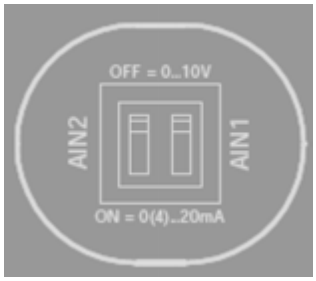
DIP			Functions as per the list of digital functions (P420)				Functions as per the list of digital outputs (P434)			
5	4	3	ASi In1	ASi In2	ASi In3	ASi In4	ASi Out1	ASi Out2	ASi Out3	ASi Out4
off	off	off	P480 [01]* {01} "Enable R“	P480 [02]* {02} "Enable L“	P480 [03]* {04} "Fixed freq. 1" =5Hz (P465[01])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

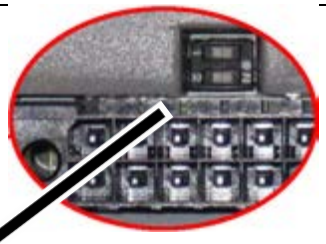
4.2.2.3 DIP switches, analogue input (only SK 2x0E)

The analogue 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 fail-safe signals in case of cable breaks (2-10 V / 4-20 mA) is made via parameters (P402) and (P403).

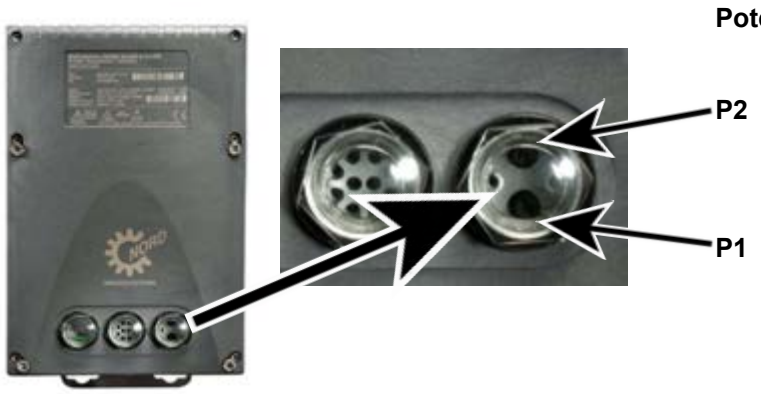


Access to DIP switches

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 the integrated potentiometer P1. Adjustment of the start-up 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

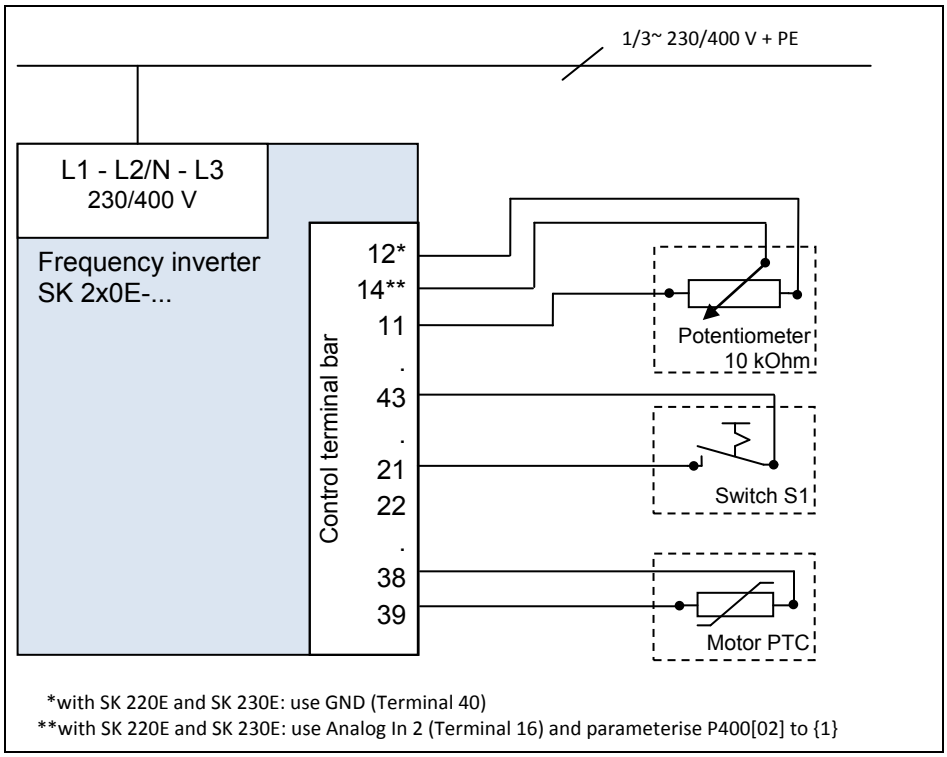
The function of P1 and P2 depends on DIP 4/5. The meaning changes according to the setting.
As standard, P1 sets the setpoint value of 0-100 % and P2 sets the ramp from 0.2-7 sec.

4.2.3 Commissioning examples

All SK 2xxE models can be operated as delivered. Standard motor data for a 4-pole standard asynchronous motor of the same power is parameterised. The PTC input must be bypassed, if a motor with PTC is not available. Parameter (P428) must be changed if an automatic startup with "Mains On" is required.

4.2.3.1 SK 2x0E - Minimal Configuration

The frequency inverter provides all the necessary low voltages (24 V_{DC} / 10 V_{DC}).

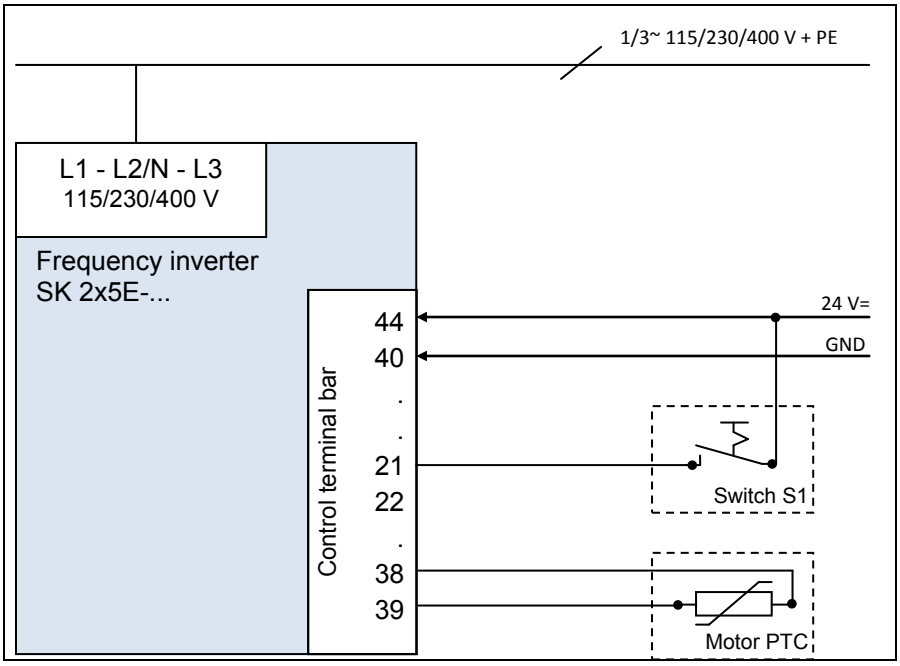


Function	Setting
Setpoint	External 10 kΩ potentiometer
Controller enable	External switch S1

4.2.3.2 SK 2x5E - Minimal Configuration

Minimal configuration without options

The frequency inverter must be provided with a 24V control voltage.



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

Minimal configuration with options

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

Information — **Convert analogue signal**

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

Test operation

The frequency inverter versions SK 2x0E in size 4 and SK 2x5E may be commissioned without any auxiliary equipment for testing purposes.

In order to do this, after making the electrical connection (please see chapter 2.3 "Electrical Connection"), set DIP switches S1: 1 to 5 of the frequency inverter to position "0" ("OFF") (please see chapter 4.2.2.2 "DIP switches (S1)")and hard-wire digital input DIN1 (terminal 21) to a 24 V control voltage.

Enabling is carried out as soon as the inverters own setpoint potentiometer (Potentiometer P1, Section) 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 frequency inverter into "Standby" status.

Stepwise adjustment of the 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 start with mains".

In order to use this function, it is essential that parameter (P428) "Automatic Start" is set to the function "ON". Adjustment of parameters is possible with the aid of a ParameterBox (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 drive unit into motion. This may cause an unexpected movement of the drive unit and the machine which is connected to it. This unexpected movement may cause severe or fatal injuries and/or material damage.

Unexpected movements may be due to several causes, e.g.

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

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

WARNING **Unexpected movement due to 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 Start" or **P420** "Digital inputs" or the "Release Brake" 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 frequency inverter is not enabled.
- During parametrisation 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 due to extremely steep acceleration ramps (Parameter **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, the parameter (**P219**) must remain in the factory (**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 parametrisation tool (e.g. NORD CON software or control and parametrisation unit, see also (📖 Section 3.1.1 "Control and Parametrisation Boxes / Software") 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.

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

Devices of type SK 2x0E must be equipped with a power supply that generates the 24 V DC control voltage that is required for this purpose by applying the mains voltage.

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 the hardware configuration (DIP - switches) has priority over configuration via software (parametrisation).**

Every frequency inverter 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 influenced using the supervisor parameter **P003**.

Information — Incompatibility

In the software change of version **V1.2 R0** of the frequency inverter, 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 is was subdivided into two arrays((P417) [-01] and [-02]).

When plugging an EEPROM (memory - module) from a frequency inverter with an earlier software version into a frequency inverter 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 frequency inverter 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 frequency inverter.

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 frequency inverter treats the external EEPROM with a higher priority. This means that as son 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 in the following. Explanations for parameters which concern the field bus options or the special functionality of the POSICON, for example, can be obtained from the respective supplementary manuals.

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
Operating displays	(P0--)	Display of parameters and operational values
Basic parameters	(P1--)	Basic device settings, e.g. on/off switching behaviour
Motor data	(P2--)	Electrical settings for the motor (motor current or start voltage (start-off voltage))
Speed control	(P3--)	Setting of current and speed controllers and settings for rotary encoders (incremental encoders) and settings for the integrated PC.
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 settings P523

The factory setting 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 were changed earlier and could therefore influence the operating behaviour of the drive in an undesirable way.

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.

To save the current device settings, these can be transferred to a ParameterBox memory beforehand (see 🕮 BU0040).

5.1 Parameter overview

Operating displays

P000 Operating display	**P001** Selection of display value	**P002** Display factor
P003 Display factor		

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 Option monitoring		

Motor data

P200 Motor list	**P201** Nominal frequency of motor	**P202** Nominal speed
P203 Nominal current	**P204** Nominal voltage of motor	**P205** Nominal power of motor
P206 Cos phi	**P207** Motor circuit	**P208** Stator resistance
P209 No load current	**P210** Static boost	**P211** Dynamic boost
P212 Slip compensation	**P213** Amplification Isd control	**P214** Torque precontrol
P215 Boost precontrol	**P216** Time boost prectrl.	**P217** Oscillation damping
P218 Modulation depth	**P219** Auto. Magn. adaptation	**P220** Par.-identification
P240 EMK 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 res.	**P310** Speed controller P
P311 Speed controller I	**P312** Torque current controller P	**P313** Torque current controller I
P314 Torque current controller limit	**P315** Field curr. ctrl. P	**P316** Field curr. ctrl. I
P317 Field curr. ctrl. lim.	**P318** Field weakening controller P	**P319** Field weakening controller I
P320 Weak border	**P321** Speedctr. I brake off	**P325** Function encoder
P326 Ratio encoder	**P327** Speed slip error	**P328** Speed slip delay
P330 Rotor starting position detection	**P331** Switch over freq. CFC ol	**P332** Hyst. Switchover CFC ol
P333 Flux feedback CFC ol	**P334** Encoder offset PMSM	**P350** PLC functionality
P351 PLC setpoint selection	**P353** Bus status via PLC	**P555** PLC integer setpoint
P356 PLC long setpoint	**P360** PLC display value	**P370** PLC status

Control terminals

P400	Function Setpoint inputs	**P401**	Analogue input mode	**P402**	Adjustment: 0%
P403	Adjustment: 100%	**P404**	Analogue input filter	**P410**	Min. freq. Auxiliary setpoint
P411	Max. Freq. Auxiliary setpoint	**P412**	Nom. val. process ctrl.	**P413**	PI control P comp.
P414	PI control I comp.	**P415**	Limit process ctrl.	**P416**	Ramp time PI setpoint
P417	Offset analogue output	**P418**	Funct. analogue output	**P419**	Standard analogue output
P420	Digital inputs	**P426**	Quick stop time	**P427**	Emerg. stop Fault
P428	Automatic starting	**P434**	Digital output function	**P435**	Dig. out scaling
P436	Dig. out. hysteresis	**P460**	Watchdog time	**P464**	Fixed frequency mode
P465	Fixed freq. Array	**P466**	Minimum freq. process control	**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				

Extra parameters

P501	Inverter name	**P502**	Master function value	**P503**	Leading function output
P504	Pulse frequency	**P505**	Absolute minimum freq.	**P506**	Auto. Fault acknowledgement
P509	Control word source	**P510**	Setpoint source	**P511**	USS baud rate
P512	USS address	**P513**	Telegram timeout	**P514**	CAN bus baud rate
P515	CAN bus address	**P516**	Skip frequency 1	**P517**	Skip freq. area 1
P518	Skip frequency 2	**P519**	Skip freq. area 2	**P520**	Flying start
P521	Flying start Resolution	**P522**	Flying start Offset	**P523**	Factory setting
P525	Load control max	**P526**	Load control min	**P527**	Load monitoring Freq.
P528	Load monitoring delay	**P529**	Mode Load control	**P533**	Factor I^2t
P534	Torque shutoff lim.	**P535**	I^2t motor	**P536**	Current limit
P537	Pulse disconnection	**P539**	Output monitoring	**P540**	Mode phase sequence
P541	Set relays	**P542**	Set analogue out	**P543**	Bus - Actual value
P546	Function Setpoint Bus value	**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 type	**P558**	Flux delay
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**	Encoder type	**P605**	Absolute encoder
P607	Ratio	**P608**	Reduction ratio	**P609**	Offset Position
P610	Setpoint Mode	**P611**	Position controller P	**P612**	Pos. window
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	Present Operating status	**P701**	Last fault	**P702**	Freq. last error
P703	Current. last error	**P704**	Volt. last error	**P705**	Dc.lnk volt. last er.
P706	P set last error	**P707**	Software version	**P708**	Status of digital in.
P709	Analogue input voltage	**P710**	Analogue output volt.	**P711**	State of relays
P714	Operating time	**P715**	Running time	**P716**	Current frequency
P717	Current speed	**P718**	Present Setpoint frequency	**P719**	Actual current
P720	Present 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 current	**P737**	Usage rate brake res.
P738	Usage rate motor	**P739**	Heatsink temperature	**P740**	Process data Bus In
P741	Process data Bus Out	**P742**	Data base version	**P743**	Inverter ID
P744	Configuration				
P747	Inverter Volt. Range				
P748	CANopen status	**P749**	Status of DIP switches	**P750**	Stat. Overcurrent
P751	Stat. Overvoltage	**P752**	Stat. Mains fault	**P753**	Stat. Overtemp.
P754	Stat. Param. loss	**P755**	Stat. System error	**P756**	Stat. Timeout
P757	Stat. Customer error	**P760**	Current mains current	**P799**	Op.-time last error

Parameter list - inverter functions (selection)

Parameter	Description	Factory setting	Settings / functions (selection)
P102 Acceleration time	Start-up time (acceleration ramp) is the time corresponding to the linear frequency rise from 0Hz to the set maximum frequency (P105).	[2.00]	Note: Values < 0.1 must be avoided
P103 Deceleration time	The braking time (braking ramp) is the time corresponding to the linear frequency reduction from the set maximum frequency (P105) to 0Hz.	[2.00]	Note: Values < 0.1 must be avoided
P104 Minimum frequency	The minimum frequency is the frequency supplied by the FI as soon as it is enabled and no additional setpoint is set.	[0]	
P105 Maximum frequency	Is the frequency provided by the FI 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 preset 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 rating plate must be entered here.	[xxx]	Data according to rating plate
P220 Parameter identification	The motor data is automatically determined by the FI 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= Analogue function (DIN2/3 only)
P428 Automatic starting	Inverter enable with "Mains On"	[0]	0= Off (enable with edge) 1= On (enable with level) **Note:** a digital input must be programmed for enable and set!
P465 Fixed frequency /Fixed frequency array	Definition of fixed frequency values *Selection:* Fixed frequency 1 (P465, [-01]) Fixed frequency 2 (P465, [-02])	[xxx]	
P509 Control word source	Selection of the interface via which the FI is controlled.	[0]	00= Control terminals or keyboard 01= Only control terminals 03= System bus
P523 Factory setting	Frequency inverter 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 Present operating status	Display of current messages for the actual operating status of the frequency inverter such as faults, warnings or the cause of a switch-on block. *Selection:* Actual fault (P700, [-01]) Actual warning (P700, [-02]) Reason for switch-on block (P700, [-03])	Error group: 1 / 2 = Overtemperature of inverter / motor 3 / 4 = Overcurrent error 5 = Overvoltage error 16 = Motor phase monitoring 19…= Parameter identification error
P701 Last error	Displays the last 5 frequency inverter faults. *Selection:* Last fault (P701, [-01]) Second to last 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 analogue input	Displays the measured analogue 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.

Start disabled, “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 ParameterBox.

Warning messages → (P700 [-02])

Warning messages are generated as soon as a defined limit is reached. However this does not cause the frequency inverter 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 frequency inverter has gone into a fault state with an error message.

Error messages → (P700 [-01])

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

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

- Switching the mains off and on again,
- 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 status of the FI is indicted by integrated status LEDs, which are visible from the outside in the state as delivered. According to the type of FI, this is a two-colour LED (DS = DeviceState) or two single-colour LEDs (DS DeviceState and DE = DeviceError).

Meaning:	**Green** indicates readiness and the present of mains voltage. In operation, the level of overload at the FI output is shown with an increasingly rapid flashing code.
	Red Signals the presence of an error by flashing according to the number code of the error. This flashing code (e.g.: E003 = 3x flashing) indicates the error groups.

SimpleBox - display

The SimpleBox displays an error with its number and the prefix "E". In addition, the current fault can be displayed in array element [-01] of parameter (P700). The last error messages are stored in parameter P701. Further information on inverter status at the time that the error occurs can be found in parameters P702 to P706 / P799.

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

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

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

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

ParameterBox display

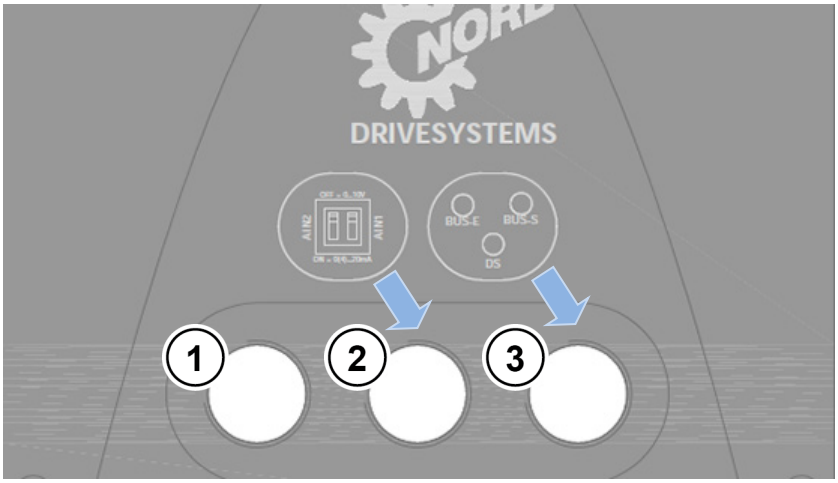
The ParameterBox displays the messages in plain text.

6.2 Diagnostic LEDs on device

The device generates operating status messages. These messages (warnings, errors, switching statuses, measurement data) can be displayed with parametrisation tools (📖 Section 3.1.1 "Control and Parametrisation Boxes / Software") (Parameter group **P7xx**).

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

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



1 RJ12,
RS 232, RS 485

2 DIP switch AIN1/2

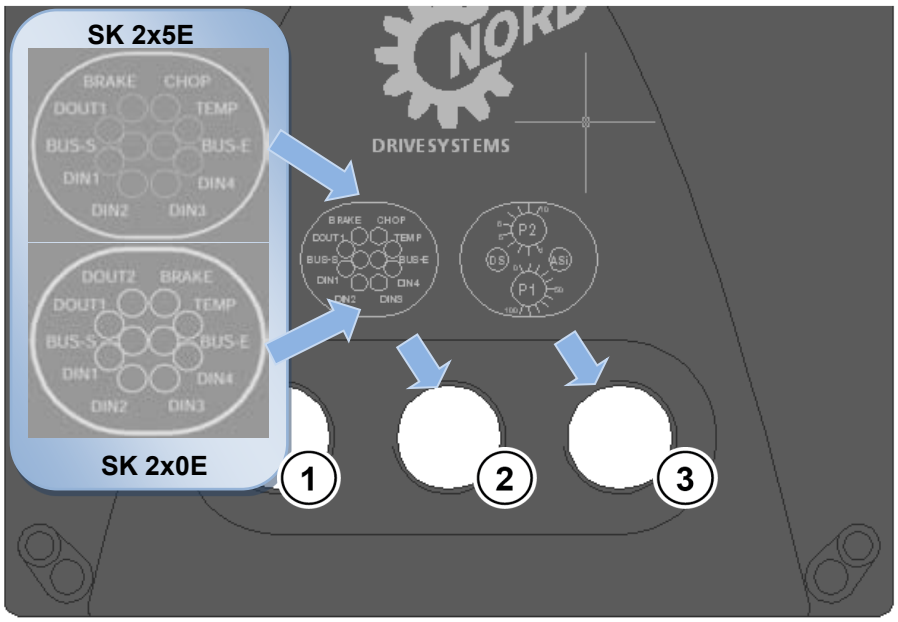
3 Diagnostic LEDs

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

Diagnostic LEDs

LED			Signal status		Meaning
Name	**Colour**	**Description**			
BUS-S	green	System bus Status	off		No process data communication
			Flashing	4 Hz	"BUS Warning"
			on		Process data communication active → Reception of at least 1 telegram / s → SDO data transfer is not displayed
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 a module error (E10.3)
			on		System bus in state “BUS off”
DS	dual red/green	FI status	off		FI not ready for operation, → no mains or control voltage
			green on		FI is enabled (inverter running)
			green flashing	0.5 Hz	FI is in standby or not enabled
				4 Hz	FI is in switch-on block
			red/green alternating	4 Hz	Warning
				1…25 Hz	Degree of overload of switched-on FI
			red flashing		Error, flashing frequency → Error number

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



1 RJ12, RS 232, RS 485

2 Diagnostic LEDs

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

Figure 12: Diagnostic opening SK 2x0E (size 4) and SK 2x5E

Status LEDs

LED			Signal		
Name	**Colour**	**Description**	**Status**		**Meaning**
DS	dual red/green	FI status	off		FI not on standby, → no mains and control voltage
			green on		FI is enabled (inverter running)
			green Flashing	0.5 Hz	FI is in standby or not enabled
				4 Hz	FI is in switch-on block
			red/green Alternating	4 Hz	Warning
				1…25 Hz	Degree of overload of switched-on FI
			green on + red flashing		FI not ready for operation, → control voltage present, but no mains voltage
			red flashing		Error, flashing frequency → Error number
AS-I	dual red/green	AS-i status			Details (📖 BU 0200)

Diagnostic LEDs

LED			Signal	
Name	**Colour**	**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	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 → Reception of at least 1 telegram / s → SDO data transfer is not displayed
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 SimpleBox / ControlBox		Fault Text in the ParameterBox	Cause • Remedy
Group	**Details in P700 [-01] / P701**		
E001	**1.0**	**Overtemp. Inverter** *"Inverter overtemperature"* (inverter heat sink)	Inverter temperature monitoring measurements are outside of the permissible temperature range, i.e. the error is triggered if the permissible lower limit is undershot or the permissible upper temperature limit is exceeded. • Depending on the cause: Reduce or increase the ambient temperature • Check the FI fan / control cabinet ventilation • Check the FI for dirt
	1.1	**Overtemp. FI internal** *"Internal FI overtemperature"* (interior of FI)	
E002	**2.0**	**Overtemp. Motor PTC** *"Overtemperature motor thermistor "*	Motor temperature sensor (PTC) has triggered • Reduce motor load • Increase motor speed • Use external motor fan
	2.1	**Overtemp. Motor I²t** *"Motor overtemperature I²t"* Only if I^2t motor (P535) is programmed.	I^2t motor has triggered (calculated overtemperature of motor) • Reduce motor load • Increase motor speed
	2.2	**Overtemp. Brake r.ext** *"Overtemperature of external brake resistor "* Overtemperature via digital input (P420 […])={13}	Temperature monitor (e.g. brake resistor) has activated • Digital input is Low • Check connection, temperature sensor

E003	**3.0**	**I^2t overcurrent limit**	a.c. inverter: I^2t limit has triggered, e.g. > 1.5 x I_n for 60s (also note P504) • Continuous overload at inverter 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 60s (please also pay attention to P554, if present, and P555, P556, P557) • Avoid overcurrent in brake resistance
	3.2	**IGBT overcurrent** 125% monitoring	De-rating (power reduction) • 125% overcurrent for 50ms • Brake chopper current too high • for fan drives: enable flying start circuit (P520)
	3.3	**IGBT overcurrent fast** 150% monitoring	De-rating (power reduction) • 150% overcurrent • Brake chopper current too high
E004	**4.0**	**Overcurrent module**	Error signal from module (short duration) • Short-circuit or earthing fault at FI output • Motor cable is too long • Use external output choke • Brake resistor faulty or resistance too low **→ Do not shut off P537!** **The occurrence of a fault can significantly shorten the service life of the device, or even destroy it.**
	4.1	**Overcurrent measurement** *"Overcurrent measurement"*	P537 (pulse current switch-off) was reached 3x within 50 ms (only possible if P112 and P536 are disabled) • FI is overloaded • Drive sluggish, insufficiently sized • Ramps (P102/P103) too steep -> Increase ramp time • Check motor data (P201 … P209)

E005	**5.0**	**Overvoltage UZW**	Link circuit 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**	Mains voltage is too high • See technical data (📖 Section 7)
E006	**6.0**	**Charging error**	Link circuit voltage is too low • Mains voltage too low • See technical data (📖 Section 7)
	6.1	**Mains undervoltage**	Mains voltage too low • See technical data (📖 Section 7)
E007	**7.0**	**Mains phase error**	Error at terminal connection side • a network phase is not connected • network is non-symmetrical
E008	**8.0**	**Parameter loss** (maximum EEPROM value exceeded)	Error in EEPROM data • Software version of the stored data set not compatible with the software version of the FI. **NOTE:** Faulty parameters are automatically reloaded (default data). • EMC interferences (see also E020)
	8.1	**Inverter type incorrect**	• EEPROM faulty
	8.2	**Reserved**	
	8.3	**EEPROM KSE error** (Customer interface incorrectly identified (customer's interface equipment))	The upgrade level of the frequency inverter was not correctly identified. EEPROM with a firmware status of version 1.2 or above plugged in to an FI with older firmware status → **Loss of parameters!** (see also *Information* in section 5) • Switch mains voltage off and on again.
	8.4	**Internal EEPROM error** (Database version incorrect)	
	8.7	**EEPR copy not the same**	
E009	**---**	**Reserved**	

E010	**10.0**	**Bus Timeout**	Telegram time-out / Bus off 24V int. CANbus • Data transfer is faulty. Check P513. • Check physical bus connections • Check bus protocol program process. • Check Bus Master. • Check 24V 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**	Initialisation 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 analogue output
	10.9	**Module missing / P120**	The module entered in parameter (P120) is not available. • Check connections

E011	**11.0**	**Customer interface**	Error in analog-digital converter • 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. • Earth the devices and shields well.
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** *"Drive 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** *„Analogue In minimum“*	Switch-off due to undershooting of the 0% adjustment value (P402) with setting (P401) "0-10V with switch-off on error 1" or "....2"
	12.9	**AI maximum** *„Analogue In maximum“*	Switch-off due to overshooting of the 100% adjustment value (P402) with setting (P401) "0-10V with switch-off on error 1" or "....2"

E013	**13.0**	**Encoder error**	No signal from encoder • Check 5V sensor if present. • Check supply voltage of encoder.
	13.1	**Speed slip error** *"Speed slip error"*	The slip speed error limit was reached. • Increase setting in P327.
	13.2	**Shut-down monitoring**	The slip error monitoring has triggered; the motor could not follow the setpoint. • Check motor data P201-P209! (Important for the current controller) • Check motor circuit. • In servo mode, check the encoder setting P300 and check the following • Increase setting value for torque limit in P112. • Increase setting value for current limit in P536. • Check deceleration time P103 and extend if necessary
	13.5	**Reserved**	Error message for POSICON → see supplementary instructions
	13.6	**Reserved**	Error message for POSICON → see supplementary instructions
E014	**---**	**Reserved**	Error message for POSICON → see supplementary instructions
E015	**---**	**Reserved**	
E016	**16.0**	**Motor phase error**	A motor phase is not connected. • Check P539 • Check motor connection
	16.1	**Magnetisation current monitoring** *"Magnetisation 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 identification** *"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 Perform determination of rotor position (initial enable after a "Mains on" only with motor stationary (P330)
	19.1	**Star / Delta circuit 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. • FI must be very well earthed.
	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	**Program 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	**Userstack overflow**	
E022	**---**	**Reserved**	Error message for PLC → see supplementary instructions BU 0550
E023	**---**	**Reserved**	Error message for PLC → see supplementary instructions BU 0550
E024	**---**	**Reserved**	Error message for PLC → see supplementary instructions BU 0550

Warning messages

Display in the SimpleBox / ControlBox		Warning Text in the ParameterBox	Cause • Remedy
Group	**Details in P700 [-02]**		
C001	**1.0**	**Overtemp. Inverter** *"Inverter overtemperature"* (inverter heat sink)	Inverter temperature monitoring Warning: permissible temperature limit reached. • Reduce ambient temperature • Check the FI fan / control cabinet ventilation • Check the FI for dirt
C002	**2.0**	**Overtemp. Motor PTC** *"Overtemperature motor thermistor "*	Warning from motor temperature sensor (triggering threshold reached) • Reduce motor load • Increase motor speed • Use external motor fan
	2.1	**Overtemp. Motor I²t** *"Motor overtemperature I²t"* Only if I^2t 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	**Overtemp. Brake r.ext** *"Overtemperature of external brake resistor "* Overtemperature via digital input (P420 […])={13}	Warning: Temperature monitor (e.g. brake resistor) has activated • Digital input is Low
C003	**3.0**	**Overcurrent, I^2t limit**	Warning: Inverter: I^2t limit has triggered, e.g. > 1.3 x I_n for 60s (please also note P504) • Continuous overload at FI output
	3.1	**Overcurrent, chopper I^2t**	Warning: I^2t limit for the brake chopper has triggered, 1.3x value attained for 60s (also note P554, if present, as well as P555, P556, P557) • Avoid overload of 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 measurement** *"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) • FI 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** *"Drive 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).

Switch-on block messages

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 function "disable voltage"is parameterised, input (P420 / P480) is at Low • Set "input High" • Check signal cable (broken cable)
	0.2	**IO fast stop**	If the function "fast stop"is parameterised, input (P420 / P480) is at Low • Set "input High" • Check signal cable (broken cable)
	0.3	**Block voltage from bus**	• For bus operation (P509): control word Bit 1 is "Low"
	0.4	**Bus fast stop**	• For 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 initialisation phase (after mains "ON", or control voltage "ON"). Or electrical phase is missing. • Only issue enable signal after completion of initialisation (i.e. when the FI 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 frequency inverter switches to "Ready for switching on" status
	0.9	**Left direction blocked**	
I006 [1]	**6.0**	**Charging error**	Charging relay not energised, because: • Mains / link voltage too low • Mains failure • Evacuation run activated ((P420) / (P480))
I011	**11.0**	**Analog Stop**	If an analog input of the frequency inverter or a connected IO extension is configured to detect cable breaks (2-10V signal or 4-20mA signal), the frequency inverter 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 parameterised to function "0" ("no function"). • Check connections
I014 [1]	**14.4**	**Reserved**	Error message for POSICON → see supplementary instructions
I018 [1]	**18.0**	**Reserved**	Information message for "Safe Stop" function → see supplementary instructions

1) Indication of operating mode (message) on the *ParameterBox* 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 mains voltage or wrong mains 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 edge)	• Reset enable • Change over **P428** if necessary: "0" = device expecting a 0→1 edge for enable / "1" = device reacts to "Level" → ***Danger:*** *Drive can start up independently!* • Check control connections • Check **P509**
Motor will not start in spite of enable being present	• Motor cables not connected • Brake not ventilating • No setpoint specified • Incorrect setpoint source setting	• Check connections and supply cables • Check control elements • Check **P510**
Device switches off without error message when load increases (increased mechanical load / speed)	• Mains phase missing	• Check connections and supply cables • Check switches / fuses
Motor rotating in wrong direction	• Motor cable U-V-W interchanged	• Motor cable Switch 2 phases • Alternatively: – Switch parameter **P420** right / left enable functions – Switch 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	• Analogue input function set to "Frequency additions" and another setpoint is present	• Check **P400** • Check setting of integrated potentiometer (**P1**) (SK 2x5E only) • **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 round by encoder (for speed feedback) • Incorrect encoder resolution setting • Encoder power supply missing • Encoder faulty	• Check encoder connections • Check **P300, P301** • Monitor via **P735** • Check encoder
Intermittent communication error between FI and option modules	• System bus terminating resistor not set • Poor connection contacting • Interference on system bus line • Maximum system bus length exceeded	• First and last subscriber only: Set DIP switches for terminating resistance • Check connections • Connect GND of all FI connected to system bus • Pay attention to routing regulations (separate routing of signal and control cables and mains and motor cables) • Check cable lengths (system bus)

Table 8: FAQ operational problems

7 Technical data

7.1 General data for frequency inverter

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 details (including UL values) for individual devices and operating modes, see (📖 BU 0200) ATEX: -20…+40°C (chapter 2.4)
Storage and transport temperature	-25°C … +60/70°C
Long-term storage	(chapter 9.1)
Protection class	IP55, optional IP66 (chapter 1.8)
Max. installation altitude above sea level	*Up to 1000 m* No power reduction *1000...2000 m:* 1 %/ 100 m power reduction, overvoltage category 3 *2000...4000 m:* 1 % / 100 m power reduction, overvoltage category 2, external overvoltage protection required at mains input
Ambient conditions	*Transport (IEC 60721-3-2):* Mechanical: 2M2 *Operation (IEC 60721-3-3):* Mechanical: 3M7 Climatic: 3K3 (IP55) 3K4 (IP66)
Environmental protection	*Energy-saving function* (📖 BU 0200), see P219 *EMC* (📖 BU 0200) *RoHS* (chapter 1.5)
Protective measures against	Overtemperature of the frequency inverter Over and under-voltage Short-circuit, earth 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 curve, VFC open-loop , CFC open-loop, CFC closed-loop
Wait time between two mains switch on cycles	60 s for all devices in normal operating cycle
Interfaces	*Standard* RS485 (USS) (for parameterisation boxes only) RS232 (Single Slave) System bus *Optional* AS-I on board (📖 BU 0200) 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 frequency inverter, such as

- EMC
- Derating
- Standardisation of setpoint / target values

can be found in the main instructions for the frequency inverter

9 Maintenance and servicing information

9.1 Maintenance Instructions

NORD frequency converters are *maintenance free* provided that they are properly used (please see chapter 7 "Technical data").

Dusty environments

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

Long-term storage

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

If this is not carried out, 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 an adjustable transformer before normal connection to the mains.

Long-term storage for 1 - 3 years

- 30 min with 25 % mains voltage
- 30 min with 50 % mains voltage
- 30 min with 75 % mains voltage
- 30 min with 100 % mains voltage

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

- 120 min with 25 % mains voltage
- 120 min with 50 % mains voltage
- 120 min with 75 % mains voltage
- 120 min with 100 % mains 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 mains 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) likewise.

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 type (rating plate/display), accessories and/or options, the software version used (P707) and the series number (name plate) at hand.

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

NORD Electronic DRIVESYSTEMS GmbH
Tjüchkampstraße 37
D-26605 Aurich, Germany

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 — **Reason for return**

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 — **Possible Consequential Damage**

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

Contacts (Phone)

Technical support	During normal business hours	+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.

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