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Quick commissioning:
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GB

BU 0200

NORDAC SK 200E

Frequency inverter manual

NORD
DRIVESYSTEMS

N O R D A C SK 200E frequency inverters

Safety and operating instructions for drive power converters

(as per: Low Voltage Directive 2006/95/EEC)

1. General

During operation, drive power converters may, depending on their protection class, have live, bare, moving or rotating parts or hot surfaces.

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

Further information can be found in this documentation.

All transportation, installation, initialisation and maintenance work must be carried out by **qualified personnel** (compliant with IEC 364, CENELEC HD 384, DIN VDE 0100, IEC 664 or DIN VDE 0110, and national accident prevention regulations).

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.

2. Proper use in Europe

Drive power converters are components intended for installation in electrical systems or machines.

When installed in machines, the drive power converter cannot be commissioned (i.e. commencement of the proper use) until it has been ensured that the machine meets the provisions of the EC Directive 98/37/EEC (Machine Directive); EN 60204 must also be complied with.

Commissioning (i.e. implementation of the proper use) is only permitted if the EMC Directive (2004/108/EEC) is complied with.

The drive power converters meet the requirements of the Low Voltage Directive 2006/95/EEC. The harmonized standards stated in the Declaration of Conformity are used for the drive power converters.

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

The drive power converters may only be used for the safety functions which are described and for which they have been explicitly approved.

3. Transport, storage

Information regarding transport, storage and correct handling must be complied with.

4. Installation

The installation and cooling of the equipment must be implemented according to the regulations in the corresponding documentation.

The drive power converters must be protected against impermissible loads. Especially during transport and handling, components must not be deformed and/or insulation distances must not be changed. Touching of electronic components and contacts must be avoided.

Drive power converters have electrostatically sensitive components, which can be easily damaged by incorrect handling. Electrical components must not be mechanically damaged or destroyed (this may cause a health hazard!).

5. Electrical connections

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

The electrical installation must be implemented according to the applicable regulations (e.g. cable cross-section, fuses, ground lead connections). Further information is contained in the documentation.

Information about EMC-compliant installation – such as shielding, earthing, location of filters and installation of cables can be found in the drive power converter documentation. These instructions must be complied with even with CE marked drive power converters. Compliance with the limiting values specified in the EMC regulations is the responsibility of the manufacturer of the system or machine.

6. Operation

Where necessary, systems where drive power converters 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.

The parameterisation and configuration of the drive power converter must be selected so that no hazards can occur.

All covers must be kept closed during operation.

7. Maintenance and repairs

After the drive power converter is disconnected from the power supply, live equipment components and power connections should not be touched immediately, because of possible charged capacitors. Observe the relevant information signs located on the drive power converter.

Further information can be found in this documentation.

These safety instructions must be kept in a safe place!

Documentation

Designation: BU0200 GB

Part No.: 607 20 01

Device series: SK 205E, SK 215E, SK 225E, SK 235E

Device types: **SK 2xxE-250-112-O ... SK 2xxE-750-112-O,**
0.25 - 0.75kW, 1~ 100-120V, Output. 230V

SK 2xxE-250-123-A ... SK 2xxE-111-123-A, 0.25 - 1.1kW, 1~ 220-240V

SK 2xxE-250-323-A ... SK 2xxE-401-323-A, 0.25 - 4.0kW, 3~ 220-240V

SK 2xxE-550-340-A ... SK 2xxE-751-340-A, 0.55 - 7.5kW, 3~ 380-480V

Version list

Designation of previous versions	Software Version	Comments
BU 0200 GB, March 2009 Part No. 607 2001 / 1009	V 1.1 R1	First version based on BU 0500 DGB / 2008
BU 0200 GB, March 2010 Part No. 607 2001 / 1310	V 1.2 R0	Extensively revised version including: general correction of errors, adaptation of section structure, inclusion of parameters for software V 1.2 CSA-Filter (Section 2.4) Incremental encoder connection (Section 2.8.3) ATEX (Section 2.9) Options (incl. detailed description of I/O extension) (Section 3) Quick commissioning (5.1.1) KTY-84 Temperature measurement (Section 5.3) AS Interface (Section 5.4)

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Intended use of the frequency inverter

Compliance with the operating instructions is **necessary for fault-free operation** and the acceptance of possible warranty claims. **These operating instructions must be read** before working with the device!

These operating instructions contain **important information about servicing.** They must therefore **be kept close to the device**.

SK 200E frequency inverters are devices for industrial and commercial plants for operating three-phase asynchronous motors with squirrel-cage rotors. These motors must be suitable for operation with frequency inverters. Other loads must not be connected to the devices.

SK 200E frequency inverters are devices for fixed installation on motors or in systems in the vicinity of the motors to be operated. All details regarding technical data and permissible conditions at the installation site must be complied with.

Commissioning (commencement of the intended use) is not permitted until it has been ensured that the machine complies with the EMC Directive 2004/108/EEC and that the conformity of the end product meets the Machinery Directive 2006/42/EEC (observe EN 60204).

1 General information

The NORDAC SK 200E is based on the tried and tested NORD platform. These devices feature a compact design with optimum control characteristics.

These devices are provided with sensorless vector current control which in combination with asynchronous three-phase motor types constantly ensures an optimised voltage-to-frequency ratio. This has the following significance for the drive: Peak start-up and overload torques at constant speed.

This series of devices can be adapted to individual requirements by means of extension modules.

Due to the numerous setting options, these inverters are capable of operating all three-phase motors. The power range is from **0.25kW to 7.5kW** with an integrated mains filter.

This manual is based on the device software V1.2 R0 (see P707) of the SK 200E. If the frequency inverter used has a different version, this may lead to some differences. If necessary, you can download the current manual from the Internet (http://www.nord.com/).

For the SK 215E/225E/235E there are additional descriptions for functional safety (BU 0230), the integrated AS interface (BU 0200, Section 5.4) and the positioning system (BU 0210). These contain all the necessary additional information for start-up.

If a bus system is used for communication, a corresponding description (e.g. BU 0220 für PROFIBUS DP) is provided, or this can be downloaded from the Internet (http://www.nord.com/).

Typically, this series of devices is installed directly on a three-phase asynchronous motor. Alternatively, there are optional accessories for mounting the devices in the vicinity of the motor, e.g. on a wall or the frame of a machine.

In the simplest configuration, even without an EEPROM, there is the possibility of setting all important parameters via two potentiometers and eight DIP switches. LEDs are provided for the diagnosis of the operating status. The use of a control module is therefore not absolutely necessary.

In order to gain access to all parameters, the internal RS232 PC interface (RJ12) can be used, or an optional SimpleBox or ParameterBox may be used. In this case, the parameter settings which have been changed by the operator are stored in the plug-in EEPROM. The EEPROM must then always remain plugged in during operation.

ATTENTION

For changes to the frequency inverter software V 1.2 R0, the structure of individual parameters has been changed for technical reasons.

(E.g.: up to version V 1.1 R2, (P417) was a simple parameter. As of version V 1.2. R0 this has been divided into two arrays ((P417) [-01] and [-02]))

When plugging an EEPROM from a frequency inverter with an earlier software version into a frequency inverter with a software version higher than V 1.2, the stored data is automatically adapted to the new format. the new parameters are saved in the default settings. Correct functioning is therefore ensured.

However, it is not permissible to plug an EEPROM with a software version higher than V 1.2 into a frequency inverter with a lower software version, as this may lead to a complete loss of data.

1.1 Overview

Features of the basic device **SK 205E**:

- High starting torque and precise motor speed control setting with sensorless current vector control
- Can be installed directly on, or near to the motor.
- Permissible ambient temperature range -25°C to 50°C (refer to the technical data)
- Integrated EMC mains filter for limit curve A Category C2 or C3 (not for 115V devices)
- Automatic measurement of the stator resistance for precise determination of motor data
- Programmable direct current braking
- External 24V supply voltage
- Integrated brake chopper for 4 quadrant operation, optional brake resistors (internal/external)
- 4x digital inputs (DIN1-4), 1x digital output (DO1), temperature sensor input (TF+/TF-)
- Evaluation of an incremental encoder possible via digital inputs
- NORD System bus for connection of additional modules
- Electromagnetic brake control (MB+/MB-)
- Four separate online switchable parameter sets
- 2x potentiometers and 8x DIP switches for minimal configuration
- LEDs for diagnosis
- RS232/RS485 interface via RJ12 plug
- Plug-in EEPROM data storage
- Integrated PosiCon positioning control (Manual BU 0210)
- CANopen absolute value encoder via the NORD System bus

Additional features of the **SK 215E** compared with the SK 205E:

- Integrated Safe Pulse Block (Manual BU 0230)
- However, only 3 free digital inputs available

Additional features of the **SK 225E** compared with the SK 205E:

- AS1, integrated AS interface (4I/4O)

Additional features of the **SK 235E** compared with the SK 205E:

- Integrated Safe Pulse Block (Manual BU 0230)
- However, only 3 digital inputs
- AS1, integrated AS interface (4I/4O)

NOTE: The features of the particular basic devices are different for the series SK 205E/215E/225E/235E. These differences will be pointed out in the course of this description, Section 2.8.1.

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 Scope of supply

Standard version:	IP55 (optionally IP66)
	Integrated brake chopper
	Integrated EMC mains filter for limit curve A Category C2 or C3 (not for 115V devices)
	Operating instructions as pdf file on CD ROM including NORD CON, PC parameterisation software
Available accessories:	Braking resistor, required for energy feedback Section 2.3
	Matching RJ12 to SUB-D9 adapter cable to connection to a PC
	SK CSX-3H, SimpleBox, 4-digit 7-segment LED display
	SK PAR-3H, ParameterBox, plain text LCD display
Expansion module:	
internal	**SK CU4-IOE**, internal I/O extension
	SK CU4-PBR, internal Profibus module
	SK CU4-CAO, internal CANopen module
	SK CU4-DEV, internal DeviceNet module
	SK CU4-24V-123-B, internal 24V mains unit 1~ 230V
	SK CU4-24V-140-B, internal 24V mains unit 1~ 400V
	SK CU4-POT, potentiometer adapter: internal potentiometer/switch module
external	**SK TU4-IOE**, external I/O extension
	SK TU4-PBR, external Profibus module
	SK TU4-CAO, external CANopen module
	SK TU4-DEV, external DeviceNet module
	SK TU4-24V-123-B, external 24V mains unit 1~ 230V
	SK TU4-24V-140-B, external 24V mains unit 1~ 400V
	SK TU4-POT-123-B, external 24V and potentiometer/switch module 1~ 230V
	SK TU4-POT-140-B, external 24V and potentiometer/switch module 1~ 400V
	SK TI4-TU-BUS or **NET**, connection unit TU4
	SK TIE4-WMK-TU, wall-mounting kit TU4

NOTE: Details for the use of the relevant bus systems can be found in the applicable supplementary bus manual.
> www.nord.com <

1.4 Safety and installation information

NORDAC SK 200E frequency inverters are devices for use in industrial high voltage systems and are operated at voltages that could lead to severe injuries or death if they are touched.

- Installation and other work may only be carried out by qualified electricians and with the device disconnected from mains. The operating instructions must always be available to these persons and must be strictly observed.
- Local regulations for the installation of electrical equipment and accident prevention must be complied with.
- The equipment continues to carry hazardous voltages for up to 5 minutes after being switched off at the mains.
- For single phase operation (115/230V) the mains impedance must be at least 100µH for each conductor. If this is not the case, a mains choke must be installed.
- For safe isolation from the mains, all poles of the supply cable to the frequency inverter must be able to be disconnected.

- Even during motor standstill (e.g. caused by an electronic block, blocked drive or output terminal short circuit), the line connection terminals, motor terminals and braking resistor terminals may still conduct hazardous voltages. A motor standstill is not identical to electrical isolation from the mains.
- **Warning**, with certain settings, the frequency inverter/motor can start up automatically after the mains are switched on.
- The frequency inverter is only intended for permanent connection and may not be operated without effective earthing connections which comply with the local regulations for large leakage currents
  (> 3.5mA). VDE 0160 stipulates the installation of a second earthing conductor or an earthing conductor cross-section of at least 10 mm^2.
- Normal **FI-circuit breakers** are not suitable as the sole protection for three-phase frequency inverters if the local regulations do not permit a possible DC proportion in the fault current. According to EN 50178 / VDE 0160, the FI circuit breaker must be an all-current sensitive FI circuit breaker (type B).
- In normal use, NORDAC SK 200E frequency inverters are maintenance free. The cooling surfaces must be regularly cleaned with compressed air if the ambient air is dusty.

CAUTION

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

When mounting, sufficient distance from neighbouring components must be maintained. When working on the components, allow sufficient cooling time beforehand

Protection against accidental contact may need to be provided.

ATTENTION

DANGER TO LIFE!

The frequency inverter can carry voltages for up to 5 minutes after being switched off at the mains. Inverter terminals, motor cables and motor terminals may carry voltage!

Touching open or free terminals, cables and equipment components can lead to severe injury or death!

Work may only be carried out by qualified specialist electricians and with the electrical supply to the equipment disconnected!

CAUTION

Children and the general public must be kept away from the equipment!

The equipment may only be used for the purpose intended by the manufacturer. Unauthorised modifications and the use of spare parts and additional equipment which has not been purchased from or recommended by the manufacturer of the device may cause fire, electric shock and injury.

Keep these operating instructions in an accessible location and give them to all operators!

WARNING

This product intended for use in an industrial environment and is subject to sales restrictions according to IEC 61800-3. In a domestic environment, this product can cause high frequency interference, in which case the user may be required to take appropriate measures.

An appropriate measure would be the inclusion of a recommended mains filter.

1.5 Certifications

1.5.1 European EMC Directive

If the NORDAC SK 200E is installed according to the recommendations in this instruction manual, it meets all EMC Directive, requirements, as per the EMC product standard for motor-operated systems EN 61800-3. (see also Section 9.3, Electromagnetic Compatibility [EMC].)

1.5.2 Approval for UL and cUL

UL Approval - File No. E171342

"Suitable For Use On A Circuit Capable Of Delivering Not More Than 100000 rms Symmetrical Amperes, 120 Volts maximum (SK 2xxE-xxx-112), 240 Volts maximum (SK 2xxE-xxx-323) or 500 Volts maximum (SK 2xxE-xxx-340) and when protected by RK5 class or faster fuses as indicated."

Suitable for use with mains with a maximum short circuit current of 100,000A rms (symmetrical), 120V maximum (SK 2xxE-xxx112), 240V maximum (SK 2xxE-xxx323), or 500V maximum (SK 2xxE-xxx340), and with protection with a Class RK5 or faster fuse as described in Section 8.3.5.

"Suitable For Use On A Circuit Capable Of Delivering Not More Than 10000 rms Symmetrical Amperes, 120 Volts maximum (SK 2xxE-xxx-112), 240 Volts maximum (SK 2xxE-xxx-323) or 500 Volts maximum (SK 2xxE-xxx-340) and when protected by Circuit Breaker (inverse time trip type) in accordance with UL 489", current and voltage ratings according to instruction manual."

Suitable for use with mains with a maximum short circuit current of 10,000A rms (symmetrical), 120V maximum (SK 2xxE-xxx112), 240V maximum (SK 2xxE-xxx323), or 500V maximum (SK 2xxE-xxx340) and with protection via a UL Category DIVQ circuit breaker (thermal and electromagnetic trigger) in accordance with UL 489. For current and voltage ratings, please refer to Section 8.3.5.

NORDAC SK 200E frequency inverters include protection against motor overload. Further technical details can be found in Section 8.3.5.

cUL Approval - File No. E171342

"cUL only in combination with SK CIF-340-30 or SK CIF-340-60 for 380-500V models and SK CIF-323-20 or SK CIF-323-40 for 3 phase 200-240V rated models". The recognized transient surge suppression filter board has to be connected between supply and the input of the drive according to the instruction manual.

Remarks:

- *cUL approval for 110-120V models provided without filter board"*

cUL compliant, only in combination with SK CIF-340-30 orr SK CIF-340-60 for 380-500V types and SK CIF-323-20 or SK CIF-323-40 for 200-240V types. The appropriate voltage limitation filter (SK CIF xxx xx) must be connected between the power input and the frequency inverter (input) according to the instructions for use.

Remarks:

- **cUL conformity applies for 100-120V types without voltage limitation filter**

“Suitable For Use On A Circuit Capable Of Delivering Not More Than 5000 rms Symmetrical Amperes, 120 Volts maximum (SK 2xxE-xxx-112), 240 Volts maximum (SK 2xxE-xxx-323) or 500 Volts maximum (SK 2xxE-xxx-340) and when protected by RK5 class or faster fuses as indicated.”

Suitable for use with mains with a maximum short circuit current of 5,000A rms (symmetrical), 120V maximum (SK 2xxE-xxx112), 240V maximum (SK 2xxE-xxx323), or 500V maximum (SK 2xxE-xxx340), and with protection with a Class RK5 or faster fuse as described in Section 8.3.5.

“Suitable For Use On A Circuit Capable Of Delivering Not More Than 5000 rms Symmetrical Amperes, 120 Volts maximum (SK 2xxE-xxx-112), 240 Volts maximum (SK 2xxE-xxx-323) or 500 Volts maximum (SK 2xxE-xxx-340) and when protected by Circuit Breaker (inverse time trip type) in accordance with UL 489”, current and voltage ratings according to instruction manual.”

Suitable for use with mains with a maximum short circuit current of 5,000A (symmetrical), 120V maximum (SK 2xxE-xxx112), 240V maximum (SK 2xxE-xxx323), or 500V maximum (SK 2xxE-xxx340) and with protection via a UL Category DIVQ circuit breaker (thermal and electromagnetic trigger) in accordance with UL 489. For current and voltage ratings, please refer to Section 8.3.5.

NORDAC SK 200E frequency inverters include protection against motor overload. Further technical details can be found in Section 8.3.5.

1.5.3 C-Tick labelling

NORD SK 200E series frequency inverters fulfil all the relevant regulations in Australia in New Zealand.

N 23134

1.5.4 RoHS compliance

SK 200E series frequency inverters are designed to be RoHS compliant according to Directive 2002/95/EU.

1.6 Nomenclature / type codes

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:

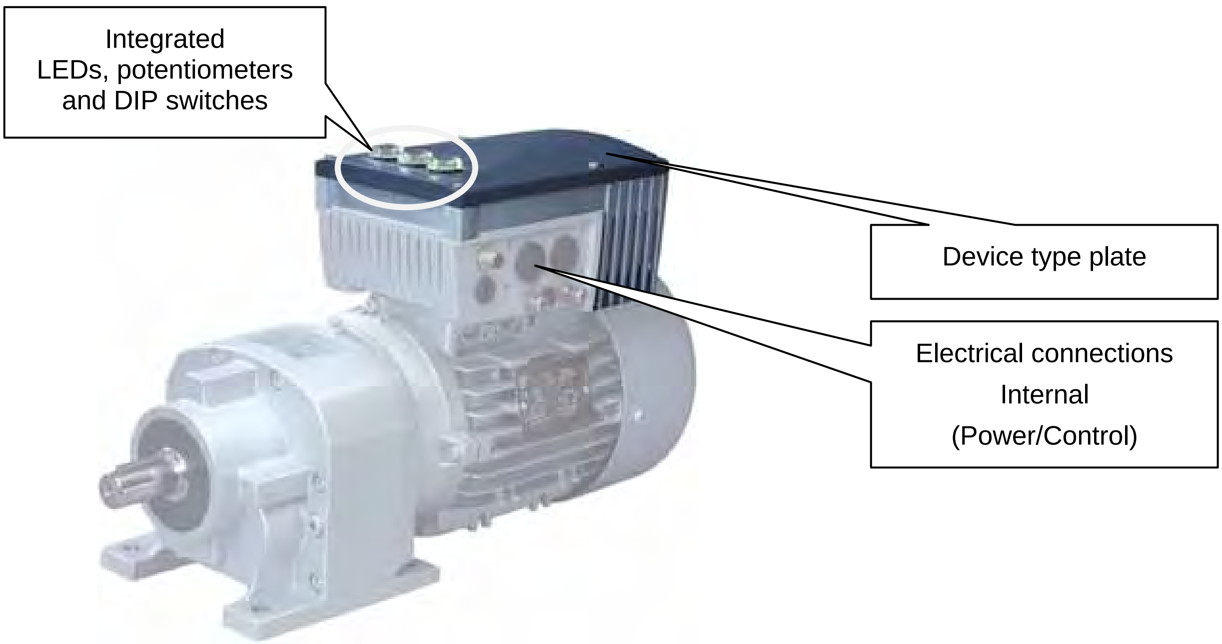
Group	Example of type code
Frequency inverter - basic device	SK 205E-550-323-A (-C)
Adapter unit - frequency inverter	SK TI4-1-205-1 (-C-WMK-1)
Connection unit - Technology Unit	SK TI4-TU-BUS (-C-WMK-TU)
Optional modules	SK TU4-CAO (-C-M12)
Extension modules	SK TIE4-M12-CAO

1.6.1 Type codes / Frequency inverter - basic device

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

IP protection class: *Standard* = IP55, C = “coated“ IP66
Radio interference filter: O = without, **A** = Class **A1**, B = Class B1
Mains voltage: x12 = 115V, x**23** = **230**V, x40 = 400V
Number of mains phases: 1xx = single phase, **3**xx = **3**-phase
Digits before decimal point for power: **0** = **0**.xx, 1 = 0x.x0, 2 = 0xx.0
Device nominal power: 250 = 0.25kW, **37**0 = 0.**37kW**, ... 751 = 7.5kW
Device series: **SK 205E**, SK 215E, SK 225E, SK 235E

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



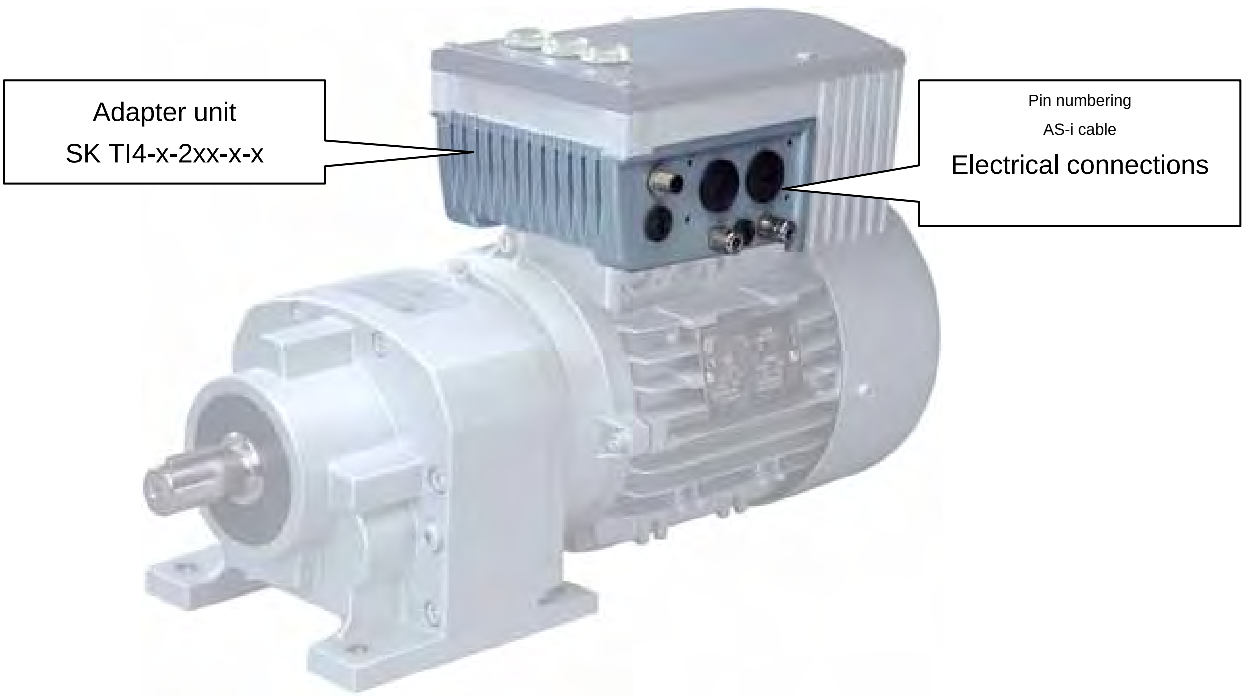
1.6.2 Type codes / Adapter unit - frequency inverter

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

- Wall mounting kit: -1 = S I + II, -2 = S III
- IP protection class: *Standard* = IP55, C = “coated“ IP66
- Mains connection: **1** = **1~ 115/230V***, 3 = 3~ 230/400V*
- Suitable device types: **205** = **SK 205E**, 215 = SK 215E, 225 = SK 225E, 235 = SK 235E
- Size: **1** = **S I**, 2 = S II, 3 = S III
- Device series: **SK TI4** = Adapter unit SK TI4

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

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

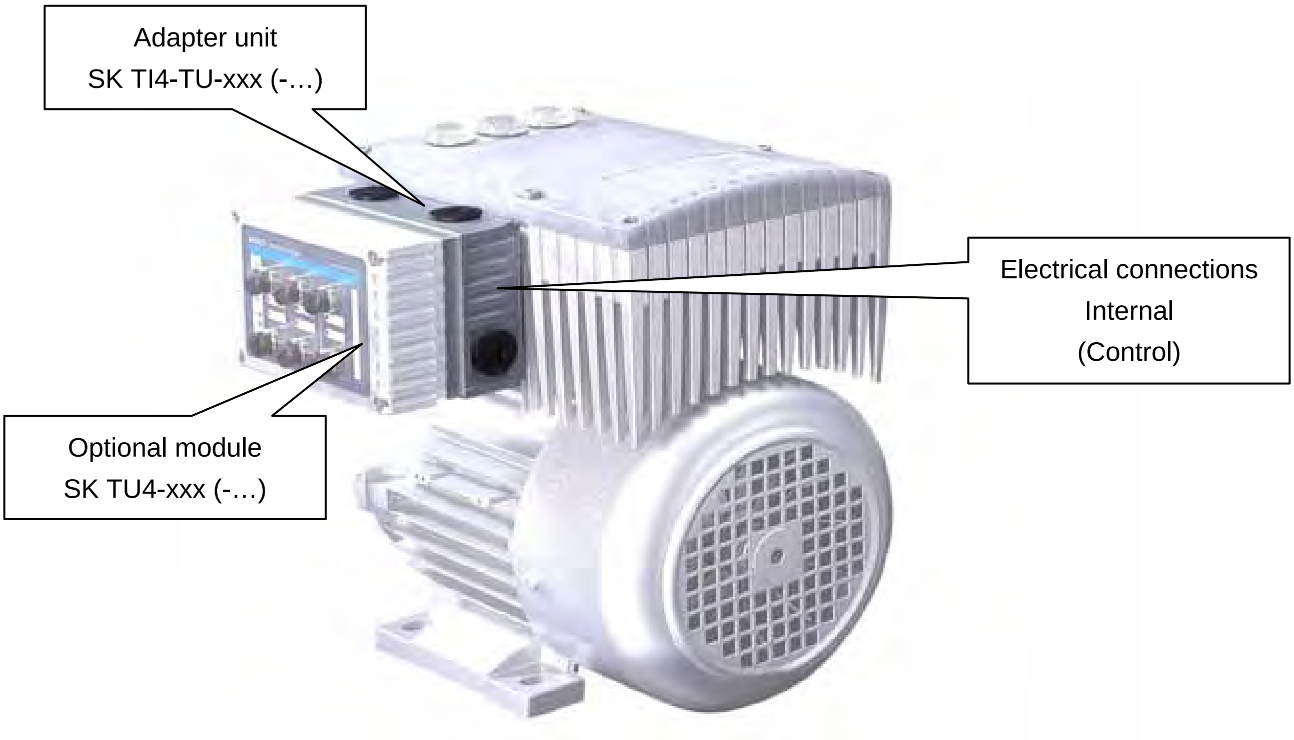


1.6.3 Type codes / Adapter unit - Technology Unit

SK TI4-TU-BUS (-C-WMK-TU)

- Wall mounting kit: -1 = S I + II, -2 = S III
- IP protection class: *Standard* = IP55, C = "coated" IP66
- Suitable device types: NET = optional net module (e.g. TU4-24V-…)
  BUS = **optional bus module** (e.g. CANopen: TU4-CAO)
- Group: **TU** = **Technology unit**
- Device series: **SK TI4** = **Adapter unit SK TI4**

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



1.6.4 Type codes / Optional modules

For bus module or I/O extension

SK TU4-CAO (-C-M12)

- M12 system connector: only TU4, alternative to terminals
- IP protection class: *Standard* = IP55, C = "coated" IP66
- Option type: **CAO** = **CANopen**, PBR = Profibus, DEV = DeviceNet, IOE = I/O extension
- Option series: **TU4** = **external Technology Unit**, CU4 = internal Customer Unit

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

For mains unit or potentiometer modules "PotentiometerBox"

SK TU4-24V-123-B (-C)

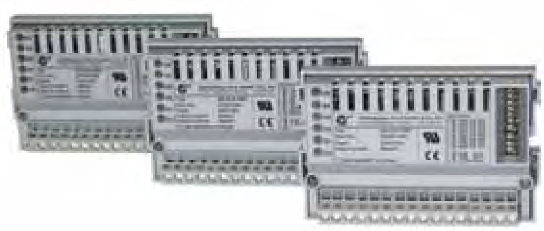
- IP protection class: *Standard* = IP55, C = "coated" IP66
- Radio interference filter: **B** = **Class B1**
- Mains connection: **123** = **1~ 230V***, 140 = 1~ 400V*
- Option type: **24V** = **24V mains unit**, POT = potentiometer/switch module
- Option series: **TU4** = **external Technology Unit**, CU4 = internal Customer Unit

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

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

Optional external
Technology Unit, SK TU4-…

Optional internal
Customer Unit, SK CU4-…



1.7 Version with protection class IP55 / IP66

NORDAC SK 200E frequency inverters and the additional modules are available in all sizes and in the protection classes IP55 (standard) or IP66 (optional).

Protection class <u>IP66</u> must always be stated when ordering!

There are no restrictions or differences to the scope of functions in either protection class. In order to differentiate the protection classes, modules with protection class IP66 are given an extra "**-C**" (**c**oated → coated PCBs) in their type designation.

e.g. SK 205E-750-340-A-**C**

<u>IP55 version</u>:

The IP55 version of the SK 200E is the **standard** version. Both versions (motor-mounted, mounted on the motor or wall-mounted on a wall bracket) are available. In addition, all adapter units, technology units and customer units are available for this version.

<u>IP66 version</u>:

In contrast to the IP55 version the IP66 version is a modified **option**. Both variants (motor-integrated, close to motor) are also available. The modules available for the IP66 version (adapter units, technology units and customer units) have the same functionalities as the corresponding modules for the IP55 version.

NOTE

The modules for the IP66 design are identified by an additional "-**C**" and are modified according to the following **special measures** listed below.

Special measures:

Impregnated PCBs, painted housing

Diaphragm valve for pressure compensation on 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 to be retro-fitted, i.e. the drive unit (inverter mounted on the motor) is not completely obtained from NORD, the membrane valve is supplied in the bag supplied with the frequency inverter. The valve must be correctly fitted on site by the plant constructor (Note: the valve must be mounted as high as possible, in order to avoid contact with standing moisture (e.g.: standing moisture due to condensation).

NOTE

For all versions, <u>care must be taken</u> that the cable and the cable gland are carefully matched. This is the only way to ensure permanent compliance with the required protection class.

2 Assembly and installation

2.1 Installation and assembly

NORDAC SK 200E frequency inverters are available in various sizes depending on their output. Connection of the SK 200E to the motor or the wall-mounting unit is made by means of the suitable size of connection unit SK TI4-… The frequency inverter is mounted by means of integrated plug contacts.

The devices require adequate ventilation to protect against overheating. For further details, please refer to Section 8 “Technical Data”.

Motor-mounted version: Here, the ventilation of the motor is integrated into the cooling concept of the FI. Mounting must therefore always be carried out as shown in the illustration. For permanently low motor speeds and self-ventilated motors, a reduction in power similar to the wall-mounted version must be taken into account.

Wall-mounted version: In continuous operation (S1), mounting away from the motor causes a reduction in the power of the FI by one power level. This means that relative to the motor, the FI must be selected one power level larger.

NOTE

For further details of the power reduction and the possible ambient temperatures, please refer to the technical data in Section 7.

2.1.1 Mounting the adapter unit

For the supply of a complete drive unit (gear unit + motor + frequency inverter) the SK 200E frequency inverter and the SK TI4-... adapter unit are always completely assembled and tested. The adapter unit can also be ordered separately for subsequent mounting on an existing motor or to replace a different motor-mounted frequency inverter.

NOTE

The IP66 compliant SK 200E must be mounted by NORD as special measures must be implemented. IP66 components retrofitted on site cannot ensure that this protection class is guaranteed.

The “Adapter unit SK TI4” includes the following components:

- Cast housing, seal (already glued in) and insulation plate
- Power terminal block, corresponding mains connection
- Control terminal block, corresponding SK 200E version
- Screw kit, for mounting on the motor and the terminal bars
- Pre-fabricated cable for motor and PTC connections

<u>Procedures:</u>

1. If necessary, remove the original terminal box from the NORD motor, so that only the base of the terminal box and the terminal strip remain.
2. Set the bridges for the correct motor circuit and connect the pre-fabricated cables for motor and PTC connections to the respective connection points on the motor.
3. Mount the cast housing on the terminal box base using the existing screws and seal. Position the cast housing with the dome facing the A-side of the motor (looking towards the A bearing cover). Check the adaptability for different motor manufacturers.
4. Attach the insulating plate above the terminal strip. Screw on the power terminal block above this using the 2 M4x8 screws and the plastic washers.
5. Connect the motor cables U, V, W to the power terminal block and the PTC cable TF+, TF- to the control terminal block 38, 39.

2.1.2 Adapters for Different Motors

In some cases, the terminal box attachments are different for different sizes of motor. Therefore, it may be necessary to use an adapter to mount the frequency inverter.

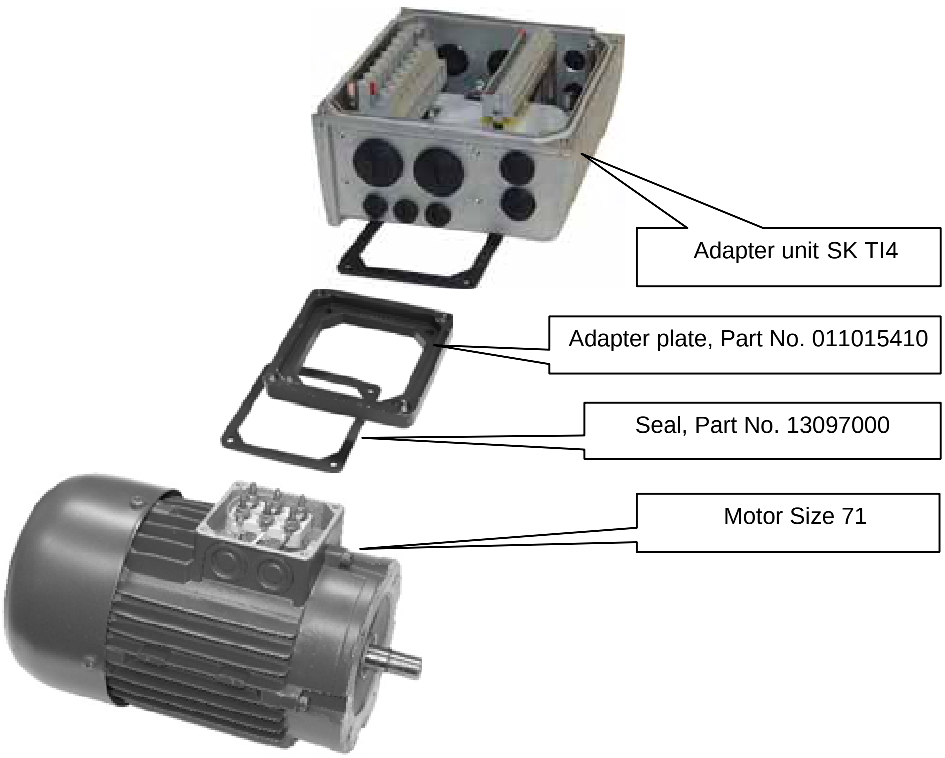
In order to guarantee the maximum protection class IP55 / IP66 of the entire unit, motor must also have a corresponding protection class.

For NORD motors, as of size 80, the adapter unit can be directly mounted on the motor as standard. For motors larger than sizes 63-71 it is necessary to use an additional adapter plate and seal. Also, for certain device configurations with motor sizes 80 - 112 it may be necessary to use an adapter plate and seal.

NORD motor sizes	Mounting of SK 200E S I	Mounting of SK 200E S II	Mounting of SK 200E S III
Size 63 - 71	**Mounting with adapter kit I**	not possible	not possible
Size 80 - 112	direct mounting	direct mounting	**Mounting with adapter kit II**
Size 132	not possible	not possible	direct mounting

Overview of adapter kits

Name	Mounting of SK 200E S I	Part No.	
Adapter Kit I	Mounting with adapter plate, size 63 – 71	011015410	
	Additional terminal box frame seal	013097000	
Adapter Kit II	Mounting with adapter plate, size 80 – 112	013035490	
	Additional terminal box frame seal	013097060	



Important!
The adaptability of motors from other manufacturers must be checked in individual cases!

2.1.3 Installation of the SK 200E

In order to carry out the electrical connection of the SK 200E, this may need to be removed from the connection unit. To do this, remove the 4 fastening screws, so that the frequency inverter can be lifted off vertically.

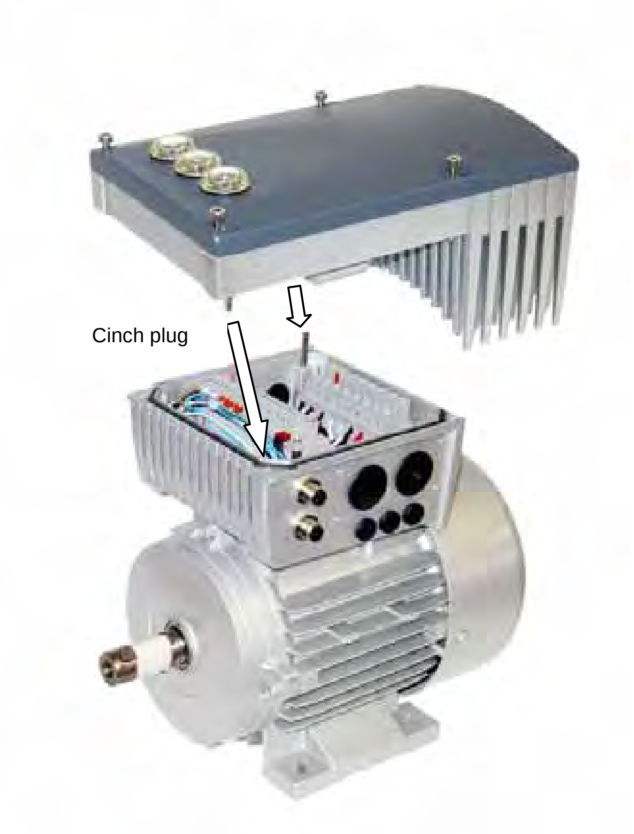
After the electrical connection of the power cables has been made, the frequency inverter can be replaced. This must be carried out in a vertical direction relative to the connection unit without tilting. The PE cinch plug can be used in order to ensure correct guidance.

In order to achieve the maximum protection class IP55/IP66, care must be taken that all frequency inverter fixing screws are gradually tightened diametrically oppositely, with the torques stated in the table below.

For the cable gland of the connecting cable, appropriate screwed connections for cable cross-section must be used.

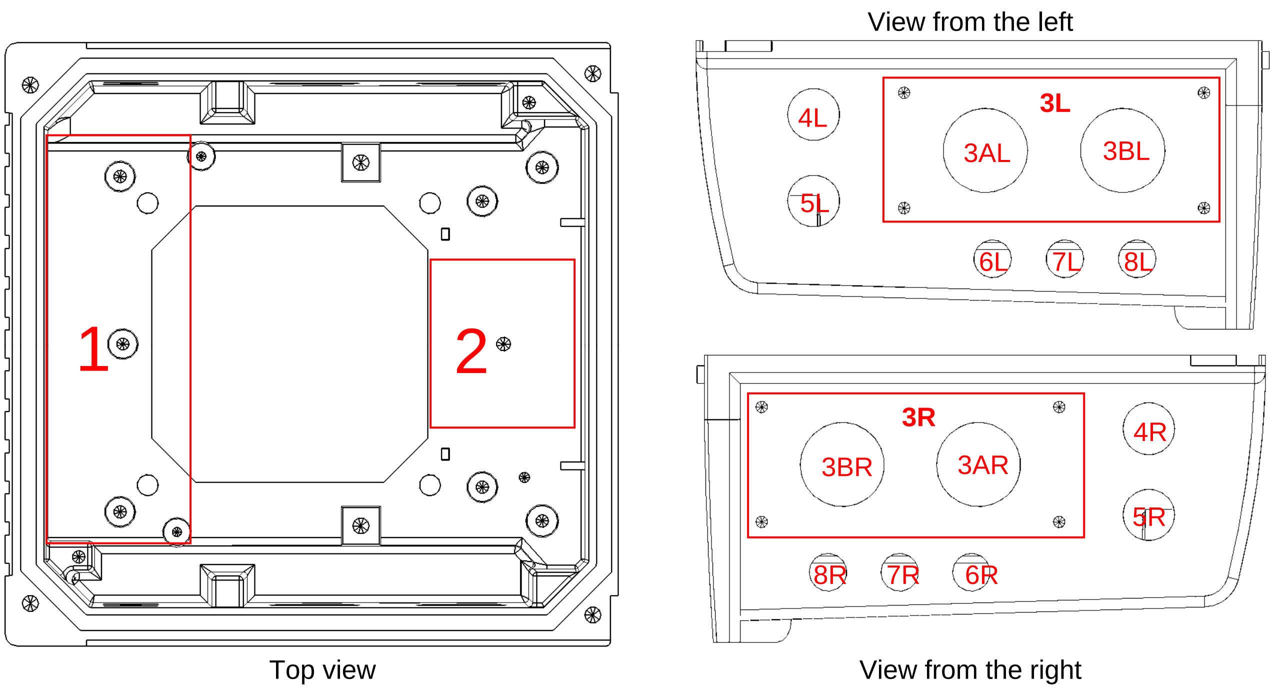
Dissipation of heat generated by the inverter occurs by means of convection. This is assisted by the airflow of the motor. Because of this, a reduction in power for unventilated motors or wall-mounted devices must be taken into account (for further details see Section 8, Technical Data).

Heat dissipation must not be hindered by severe contamination.



Frequency inverter size	Screw size	Tightening torque
Size I	M5 x 45	3.5Nm ± 20%
Size II	M5 x 45	3.5Nm ± 20%
Size III	M5 x 45	3.5Nm ± 20%

2.1.4 Optional locations for the "SK TI4-…" adapter unit



The drawing above shows the various mounting locations for the optional modules. Option location 1 is used for the mounting of an internal bus module or internal mains unit. Option location 2 can be used to mount an internal braking resistor. External bus modules, 24V mains units or potentiometer modules can be mounted at option location 3L or 3R. The same apples for external braking resistors. Option locations 4 and 5 are for the mounting of M12 sockets or plugs. Locations 6, 7 and 8 require additional extensions from M12 to M16 in order for M12 sockets and plugs to be mounted. Of course, only one option can be mounted at a single option location. The preferred location for M12 sockets or plugs should be 4L or 4R.

2.2 Dimensions: SK 200E

2.2.1 Power rating / Motor size

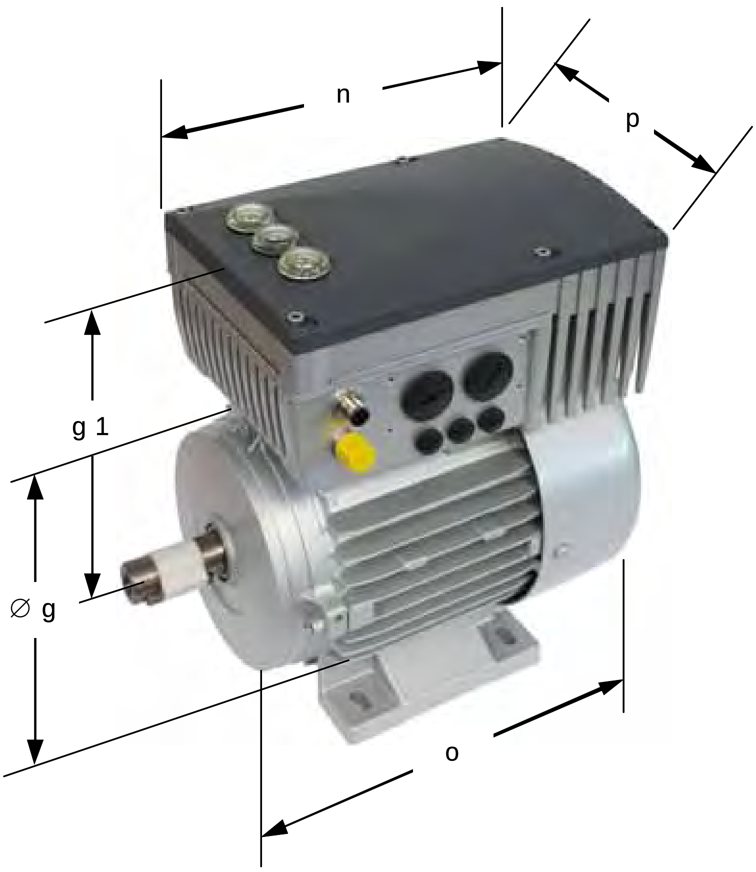
Size	Mains/power matching: SK 200E			
	1~ 110-120V	**1~ 200-240V**	**3~ 200-240V**	**3~ 380-480V**
Size I	0.25 ... 0.37kW	0.25 ... 0.55kW	0.37 ... 1.1kW	0.55 ... 2.2kW
Size II	0.55 ... 0.75kW	0.75 ... 1.1kW	1.5 ... 2.2kW	3.0 ... 4.0kW
Size III	-	-	3.0 ... 4.0kW	5.5 ... 7.5kW

2.2.2 SK 200E mounted on motor

Size		Housing dimensions SK 200E / Motor					Weight: SK 200E without motor
FI	**Motor**	**∅ g**	**g 1**	**n**	**o**	**p**	Approx. [kg]
Size I	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 II	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 III	Size 100	201	251	330	306	218	6.9
	Size 112	228	261		326		
	Size 132 S / M	266	262		373 / 411		

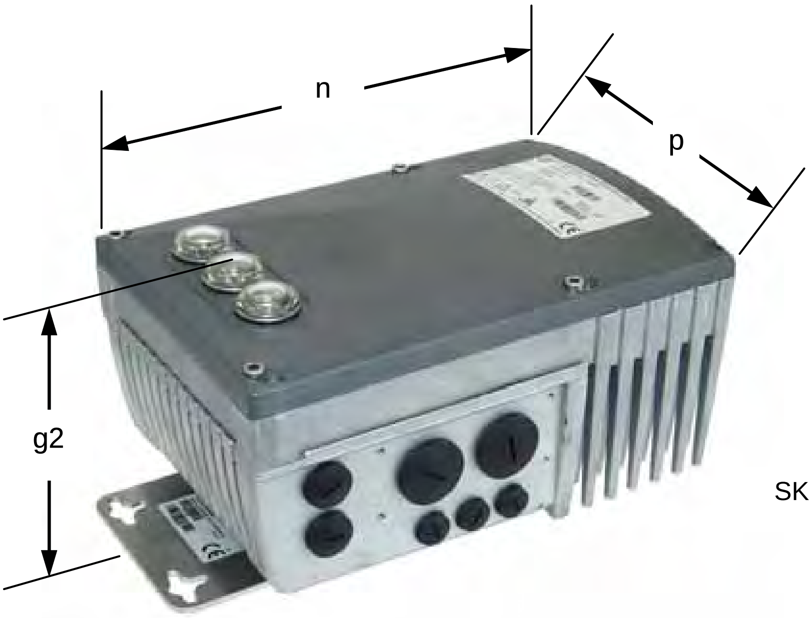
All dimensions in [mm]

*) including additional adapter and seal (11015410, 13097000)

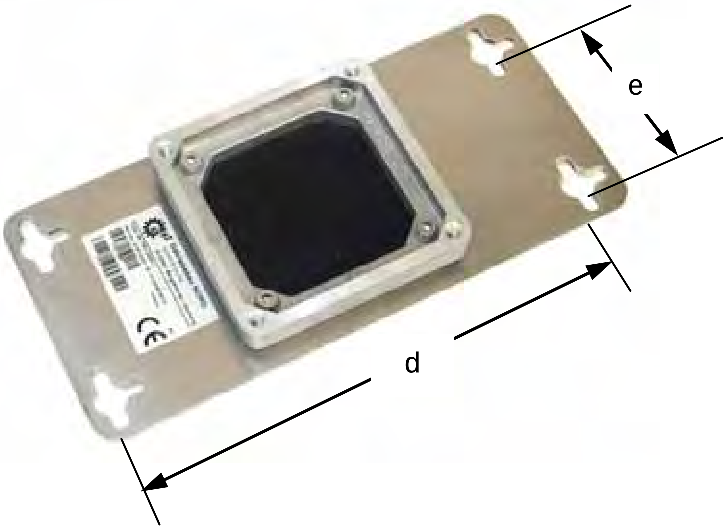


2.2.3 SK 200E Wall-mounting

Device type Size	Housing dimensions			Wall mounting SK TIE4-WMK-1/-2			Total weight Approx. [kg]
	g2	**n**	**p**	**d**	**e**	∅	
Size I → SK TIE4-WMK-1 Part No. 275 274 000	130.5	236	156	180	64	5.5	3.1
Size II → SK TIE4-WMK-1 Part No. 275 274 000	137.5	266	176				4.2
Size III → SK TIE4-WMK-2 Part No. 275 274 001	154.5	330	218	210.5	74	5.5	7.0
	All dimensions in [mm]						



SK 200E with wall mounting kit



SK TIE4-WMK-...

2.3 Brake resistor (BR)

During dynamic braking (frequency reduction) of a three phase motor, electrical energy is returned to the frequency inverter. In order to avoid switch-off of the FI due to excess voltage and internal or external braking resistor can be used. With this, the integrated brake chopper (electronic switch) pulses the link circuit voltage (switching threshold approx. 420V/720V DC, according to the mains voltage) into the braking resistor. Here the excess energy is converted into heat.

CAUTION

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

When mounting, sufficient distance from neighbouring components must be maintained. When working on the components, allow sufficient cooling time beforehand

2.3.1 Internal brake resistor SK BRI4-…

The internal brake resistor can be used if only slight, short braking phases are to be expected.

NOTE

With the use of internal resistors, the DIP switch 8 must be set to “On”. This is important in order to activate a limitation of the peak power of the brake resistor. Otherwise, the brake resistor may be damaged during operation.

Alternatively, a suitable power limit can also be set in P555, P556 and P557. However, this is only effective if DIP 8 is set to the “Off” position.

2.3.2 External brake resistor SK BRE4-…

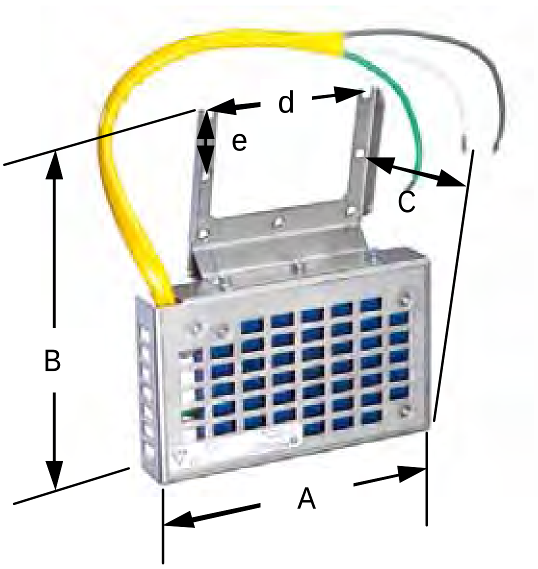
The external brake resistor is intended for the feedback of energy, such as occurs in cyclical drives or lifting equipment. Here, it may be necessary to plan for the exact brake resistor required.

For installation, an M20 screw connection with an adapter for M25 are supplied. The connecting wires for the brake resistor are fed through this into the connection unit.

The brake resistor is attached to the side of the connection unit using 4 suitable M4 x 10 screws.

2.3.3 External brake resistor dimensions

Resistor type	Size	A	B	C	Fixing dimensions		
					d	e	∅
SK BRE4-1-100-100 SK BRE4-1-200-100 SK BRE4-1-400-100	**Size I**	150	178	61	83	32	4.3
SK BRE4-2-100-200 SK BRE4-2-200-200	**Size II**	255	178	61	83	32	4.3
							All dimensions in mm



2.3.4 Brake resistor, electrical data

Internal

Brake resistor size		Resistor type	Resistance	Max. continuous output / limit**	Energy consumption*	Connecting cable or terminals
Size I	**Internal brake resistor (DIP 8 = on)**	**SK BRI4-1-100-100** Part No. 275272005	100 Ω	100 W / 20%	1.0 kWs	Silicon flex 2x 0.75mm^2 approx. 275mm
		SK BRI4-1-200-100 Part No. 275272008	200 Ω	100 W / 20%	1.0 kWs	
		SK BRI4-1-400-100 Part No. 275272012	400 Ω	100 W / 20%	1.0 kWs	
Size II		**SK BRI4-2-100-200** Part No. 275991115	100 Ω	200 W / 20%	2.0 kWs	Silicon flex 2x 1.0mm^2 approx. 275mm
		SK BRI4-2-200-200 Part No. 275272108	200 Ω	200 W / 20%	2.0 kWs	
		*)Maximum once within 10s** **In order to prevent impermissible heating of the connection unit, the continuous power is limited to 1/5 of the BR rated power. This also has a limiting effect on the power consumption.				

External

Brake resistor size		Resistor type	Resistance	Max. continuous power	Energy consumption*	Connecting cable or terminals
Size I	**External brake resistor**	**SK BRE4-1-100-100** Part No. 275273005	100 Ω	100 W	2.2 kWs	FEP flex 2x 1.9mm^2 AWG 14/19 approx. 350mm
		SK BRE4-1-200-100 Part No. 275273008	200 Ω	100 W	2.2 kWs	
		SK BRE4-1-400-100 Part No. 275273012	400 Ω	100 W	2.2 kWs	
Size II		**SK BRE4-2-100-200** Part No. 275273105	100 Ω	200 W	4.4 kWs	FEP flex 2x 1.9mm^2 AWG 14/19 approx. 500mm
		SK BRE4-2-200-200 Part No. 275273108	200 Ω	200 W	4.4 kWs	
		*)Maximum once within 120s				

2.4 Voltage limitation filter SK CIF

2.4.1 General information

Modules **SK CIF-323-20, SK CIF-323-40, SK CIF-340-30 and SK CIF-340-60** are voltage limitation filters corresponding to CSA 22.2 No. 14-5 / UL508C Section 48 for the reduction of a 5kV surge impulse (rising flank 1,2µs / falling flank 50µs) to a maximum of 300% of the amplitude of the rated voltage (230Vac for SK CIF 323-20/40 and 3x400Vac/460Vac/480Vac/500Vac for SK CIF-340-30/60).

ATTENTION

The modules SK CIF-323-x0 may **only be used in combination with a suitable mains choke** (L_{min} = 3 x 0,73 mH) (see connection plan).
With SK CIF-340-x0 modules, the use of a mains choke is not essential, but is recommended.

Note

With the use of a mains choke, the effective input currents of the frequency inverter are reduced to approximately the values of the output currents. Several frequency inverters may be connected to a choke - filter combination. In this case, the sum of the input currents must not exceed the rated current of the filter.

2.4.2 Type code

SK CIF-323-20

Rated current:	**20 = 20A**, 30 = 30A, 40 = 40A, 60 = 60A
Mains voltage:	**x23 = 230V**, x40 = 400V
Number of mains phases:	3 = 3-phase
Device series:	CIF = voltage limitation filter (CSA - Filter)

2.4.3 Installation

The modules are suitable for installation on a snap-on mounting rail, however, with the aid of plug-on fixing elements they may also be screwed directly to a plane surface (e.g. the rear wall of a switching cabinet). In all cases, the modules must be installed in a switching cabinet.

Type	Dimensions L x W x D [mm]
SK CIF-323-20 / 40	180.5 (204.5) x 126 (126) x 76.5 (62.5) (Wall-mounted)
SK CIF-340-30 / 60	180,5 (204.5) x 126 (126) x 71 (57) (Wall-mounted)

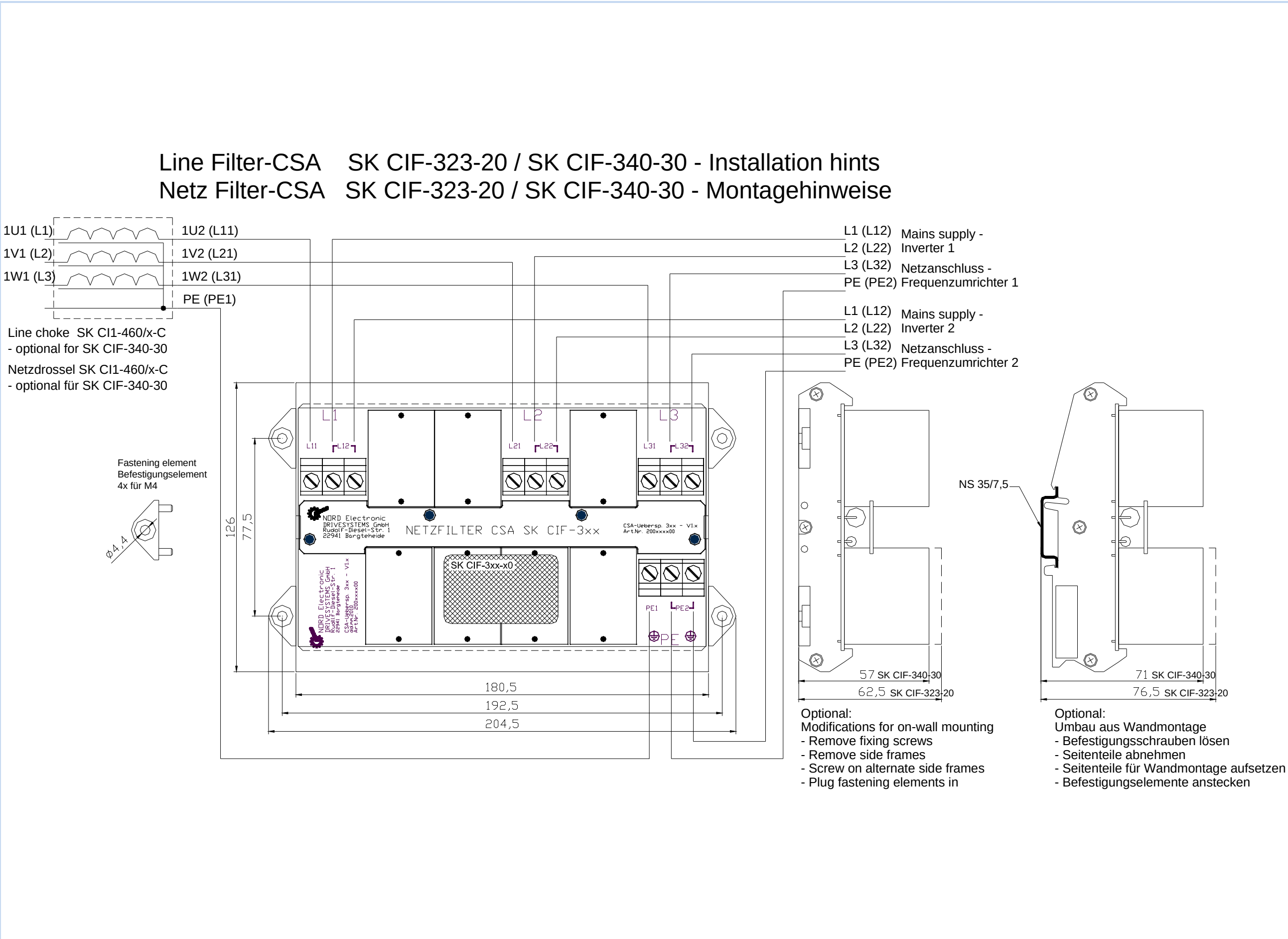
Fixing dimensions - wall-mounting 77.5 mm x 192.5 mm

2.4.4 Connection plan

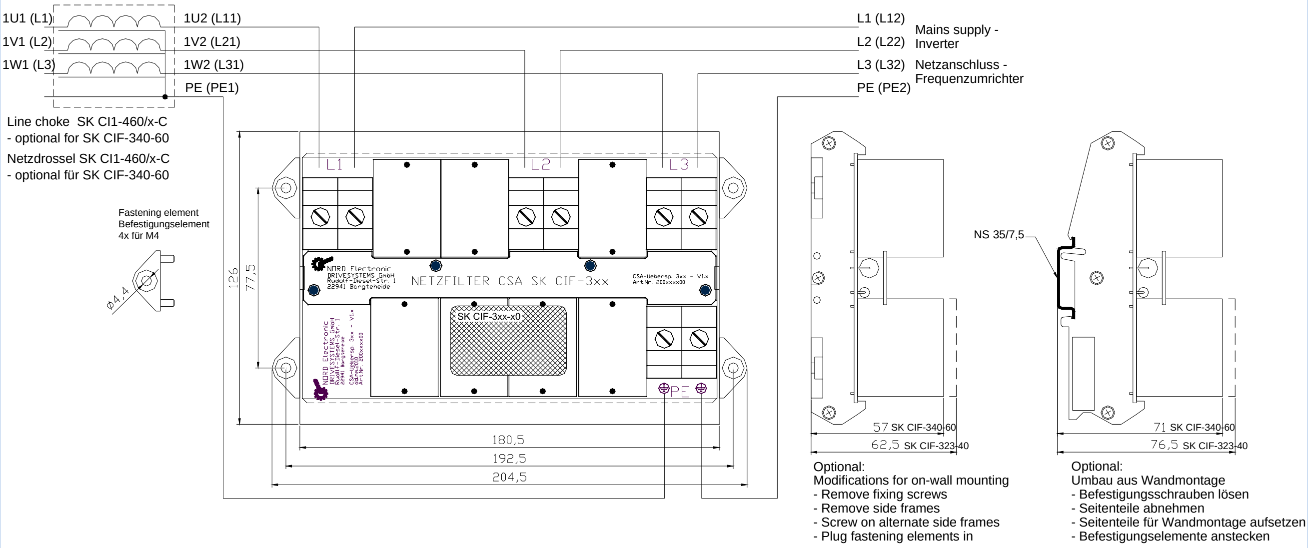
NOTE

For the use of a single phase 230 V frequency inverter (SK 2xxE-XXX-123-…) both L1 and L2/N must be equipped with a choke. A 2-phase (L_{min} = 2 x 0,73 mH) or a 3-phase input choke (L_{min} = 3 x 0,73 mH) can be used.

The connection of the frequency inverter and the choke to the filter is made via terminals L1 and L2/N.



Line Filter-CSA SK CIF-323-40 / SK CIF-340-60 - Installation hints
Netz Filter-CSA SK CIF-323-40 / SK CIF-340-60 - Montagehinweise



2.4.5 Technical data

	SK CIF-323-20	SK CIF-323-40
Mains phases	1/3 AC	
Mains voltage	1/3~200 … 240 V, ±10%, 47 …63 Hz	
Input/Output current	max. 20 A	max. 40 A
Max. mains fuse	25 A*	60 A*
Ambient temperature	0°C … +50°C	
Tightening torque for screw terminals	0.5 … 0.6 Nm	2.5 Nm
Connection facility (flexible)	0.2 … 4 mm²	0.5 … 25 mm²
Protection class	IP20	
Weight	0.61 kg	0.74 kg

*Class, type and size of the fuse according to the connected frequency inverters (Section 8.3.5)

	SK CIF-340-30	SK CIF-340-60
Mains phases	3 AC	
Mains voltage	3~380 V -20% … 500 V +10%, 47 …63 Hz	
Input/Output current	max. 30 A	max. 60 A
Max. mains fuse	100 A*	100 A*
Ambient temperature	0°C … +50°C	
Tightening torque for screw terminals	0.5 … 0.6 Nm	2.5 Nm
Connection facility (flexible)	0.2 … 4 mm²	0.5 … 25 mm²
Protection class	IP20	
Weight	0.57 kg	0.71 kg

*Class, type and size of the fuse according to the connected frequency inverters (Section 8.3.5)

2.5 Wiring guidelines

The frequency inverter has been developed for use in an industrial environment. In this environment, high levels of electromagnetic interference can influence the frequency inverter. 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 equipment in the control cabinet or field is securely earthed using short earthing cables which have large cross-sections and are connected to a common earthing point or earthing rail. It is especially important that all control devices connected to the frequency inverters (e.g. an automation device) are connected to the same earthing point as the inverter itself, using a short cable with large cross-section. Flat conductors (e.g. metal clamps) are preferable, as they have a lower impedance at high frequencies.

(2) The bonding cable of the motor controlled by the frequency inverter should be connected directly to the earthing terminal of the associated frequency inverter. 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. (See also Section 9.3 / 9.4 (EMC))

(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 analog setpoint cables should only be earthed on one side on the frequency inverter.

(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 and brake chokes in the cabinet are interference protected, either by RC circuits in the case of AC contactors, or by “free-wheeling” diodes for DC contactors, **whereby the interference protectors must be positioned on the contactor coils**. Varistors for over-voltage limitation are also effective. This interference suppression is particularly important when the contactors are controlled by the relay in the frequency inverter.

(6) Use screened or armoured cable for the load connections (motor cable) and earth the screening/armour at both ends, if possible to the frequency inverter bonding.

In addition, an *EMC-compliant cabling* must be ensured. (See also Section 9.3 / 9.4 (EMC)).

The safety regulations must be complied with under all circumstances when installing the frequency inverter!

NOTE

The control cables, line cables and motor cables must be laid separately. In no circumstances should they be laid in the same protective pipes/installation ducts.

The test for high voltage insulations must not be used on cables which are connected to the frequency inverter.

ATTENTION

With the use of a ParameterBox SK PAR-3H this must never be simultaneously connected to the frequency inverter and the PC, as potential shifts may cause damage, especially to the PC. (See also Manual BU0040)

2.6 Electrical Connection

WARNING 	THE DEVICES MUST BE EARTHED. Safe operation of the devices requires that is installed and commissioned by qualified personnel in compliance with the instructions provided in this Manual. 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. Dangerous voltages can be present at the motor connection terminals even when the inverter is switched off. Always use insulated screwdrivers on these terminal fields. Ensure that the input voltage source is not live before setting up or changing connections to the unit. Make sure that the inverter and motor are specified for the correct supply voltage.

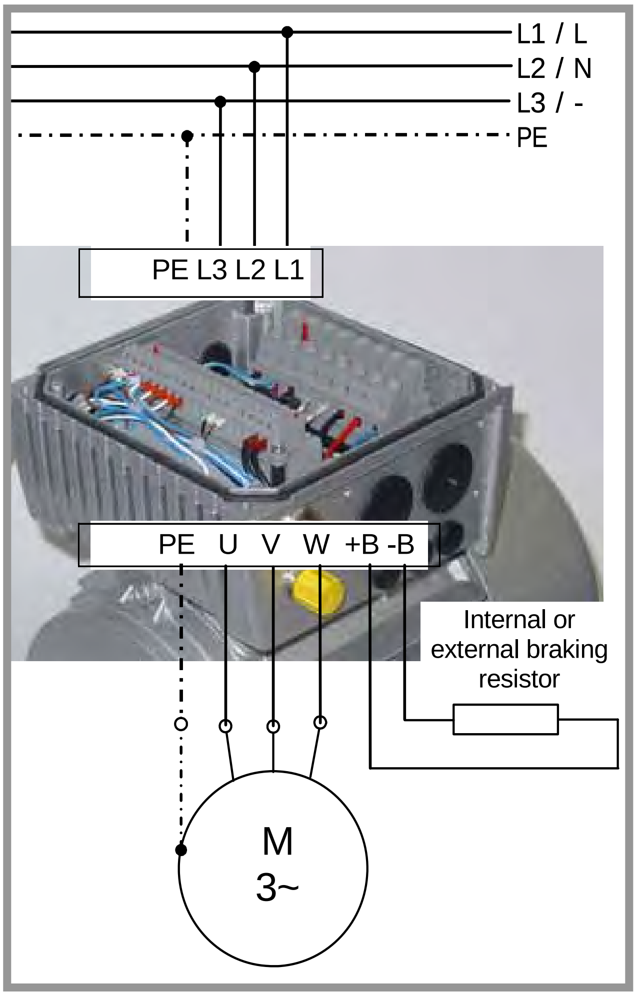
In order to access the electrical connections, the SK 200E must be removed from the SK TI4 connection unit. Proceed as follows:

1. Switch off the mains supply and if necessary check and observe the waiting period.
2. Loosen the 4 Allen screws (4mm).
3. Carefully lift the FI vertically off the connection unit.
4. The electrical connections and the option slots are now freely accessible.

To replace the FI, proceed in the opposite sequence:

5. Here, special care must be taken that the PE pins are correctly contacted.
   These are located diagonally in 2 corners of the FI and the connection unit.
6. The FI can only be placed on the SK T14 in one orientation.
7. Evenly tighten the Allen screws in a cross-wise direction.

2.7 Electrical connection of the power unit



All connection terminals are located in the connection unit of the frequency inverter.

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

The earthing connections (device earthing) are located on the base in the cast housing of the connection unit.

Before and while the device is connected, the following must be observed:

1. Ensure that the mains supply provides the correct voltage and is suitable for the current required (see Section 8 Technical Data).
2. Ensure that suitable circuit breakers with the specified nominal current range are installed between the voltage source and the inverter.
3. Connect the mains voltage directly to the terminals
   L_1-L_2/N-L_3 und **PE** (according to the device).
4. To connect the motor, three flexible wires **U-V-W** should be used when mounting the motor.
5. For wall-mounting a 4-conductor shielded motor cable (recommended) to the terminals **U-V-W** and **earth** should be used. In this case the cable shielding should be connected to a large area of the metallic screw connector.

NOTE: if certain **wiring sleeves** are used, the maximum connection cross-section can be reduced.

Screwdriver: Use a 5.5mm slot-head screwdriver to connect the power unit.

NOTE: If **synchronous machines** or **several motors** are connected in parallel to a device, the frequency inverter must be switched over to linear voltage/frequency characteristic curves, → P211 = 0 and P212 = 0.

NOTE: Only use copper cables with min. 75°C or 75°C/80°C or equivalent for connection. Higher temperature classes are permissible.

NOTE: The use of shielded cables is essential in order to maintain the specified radio interference suppression level. (See also Section 9.4 EMC limit value classes)

ATTENTION: This device produces high frequency interference, which may make additional suppression measures necessary in **domestic environments**. (Details in Section. 9.3 / 9.4 (EMC))

2.7.1 Mains connections (X1 - L1, L2, L3, EARTH)

No special safety measures are required on the mains input side of the frequency inverter. It is advisable to use normal mains fuses (see technical data) and a main switch or circuit breaker.

115V devices may only be used with a 110…120V (L/N = L1/L2) single phase supply.

230V devices may be ordered either for single phase (...-123-, L/N = L1/L2) or three phase (...-323-, L1/L2/L3) operation. It is essential to note the type designation!

400V devices are designed for three phase mains voltage 380...480V (L1/L2/L3).

For the exact specification, please refer to the technical data in Section 8.

Connection to the bonding is by means of screw terminals in the cast housing of the connection unit:

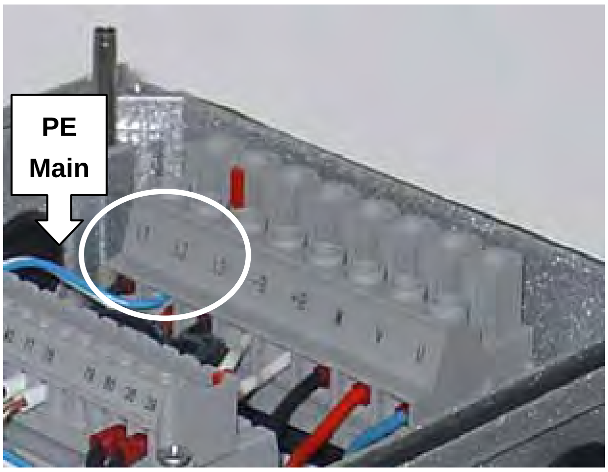
Connection cross-section:

0.5 ... 6mm^2 rigid/ flexible cable
AWG 20-10

For looping of the mains voltage, up to a cable cross-section of 2x 2.5mm^2 double wire end sleeves must be used.

Tightening torque:

1.2 ... 1.5Nm



Operation on an IT network

The use of this frequency inverter on an **IT network** is possible after modifications by means of jumpers. Further details in Section 2.7.4, 2.7.5 - 2.7.6 .

The operation of a frequency inverter in an IT network is only permissible if a brake resistor is connected, in order to prevent impermissible charging of the inverter link circuit in case of a mains fault (short-circuit to earth). The prerequisite for the control of the brake resistor is the presence of a 24V control voltage. Therefore, in case of an external (24VDC) frequency inverter control voltage supply, it is essential that this is always switched on ahead of the mains voltage or is switched off after disconnection from the mains.

ATTENTION

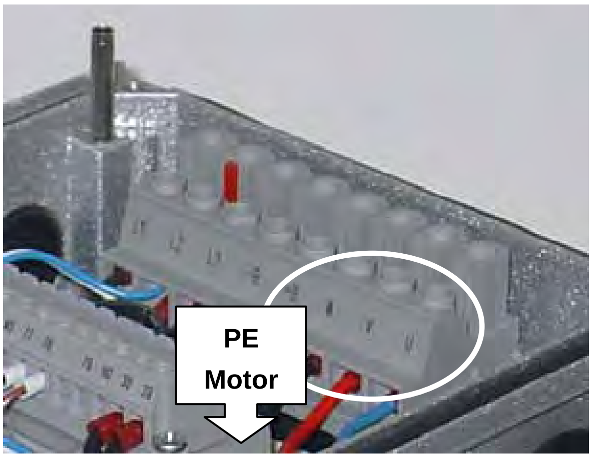
For the operation of the frequency inverter on an IT network, the mains voltage may only be connected to the frequency inverter if the control voltage (24V supply) is available to the frequency inverter. Otherwise there is a danger of destruction of the frequency inverter in case of a mains fault (short-circuit to earth).

2.7.2 Motor cable (X2 - U, V, W, earth)

The motor cable may have a **total length of up to 100m** if this is a standard cable. If a screened motor cable is used, or if the cable is laid in a well earthed metal conduit, the **total length should not exceed 20m**.

Note: Please also note Section 9.4 EMC limit value classes.

Note: For multiple motor use the total cable length consists of the sum of the individual cable lengths.



Connection cross-section:

0.5 ... 6mm^2 rigid/flexible cable
AWG 20-10

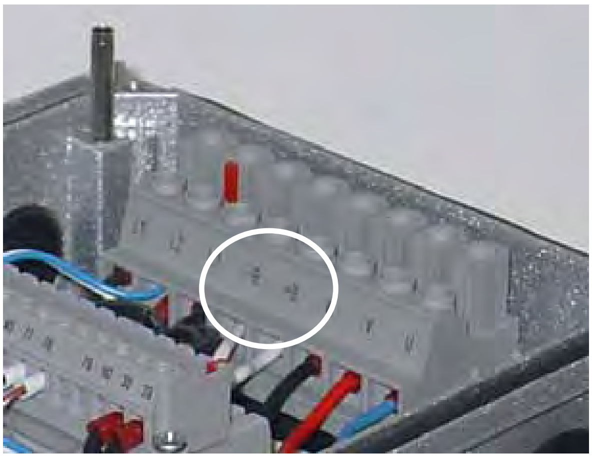
Tightening torque:

1.2 ... 1.5Nm

2.7.3 Brake resistor connection (X2 - +B, -B)

Terminals +B/ -B are intended for the connection of a suitable braking resistor. The connection should be as short as possible.

Note: The large amount of heat produced by the brake resistor must be taken into account.



Connection cross-section:

0.5 ... 6mm^2 rigid/ flexible cable
AWG 20-10

Tightening torque:

1.2 ... 1.5Nm

2.7.4 Electro-mechanical brake

An output voltage is generated by the frequency inverter on terminals 79 / 80 (MB+ / MB-) of the control terminal block for the control of an electromechanical brake (See also Section 2.8.1 and 2.8.2). This depends on the supply voltage of the frequency inverter. The assignment is as follows:

Mains voltage / Alternating current (AC)	Brake coil voltage (DC)
115 V ~	105 V =
230 V ~	105 V =
400 V ~	180 V =
460 V ~	205 V =
480 V ~	205 V =

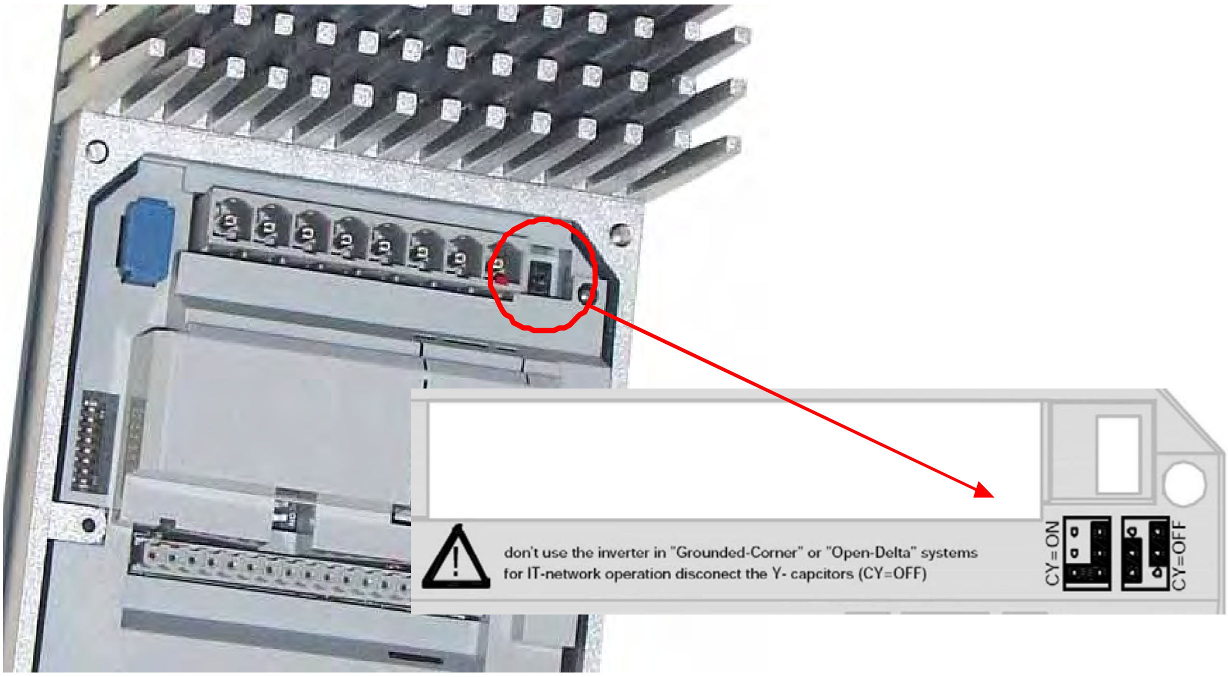
The assignment of the correct brake or brake coil voltage must be taken into account for the design related to the mains voltage of the frequency inverter.

2.7.5 Mains supply jumpers

These jumpers are used to adapt the SK 200E to various forms of mains supply (e.g. IT network). As supplied, a star configuration earthed mains supply must be used, with an earth conductor for single phase devices.

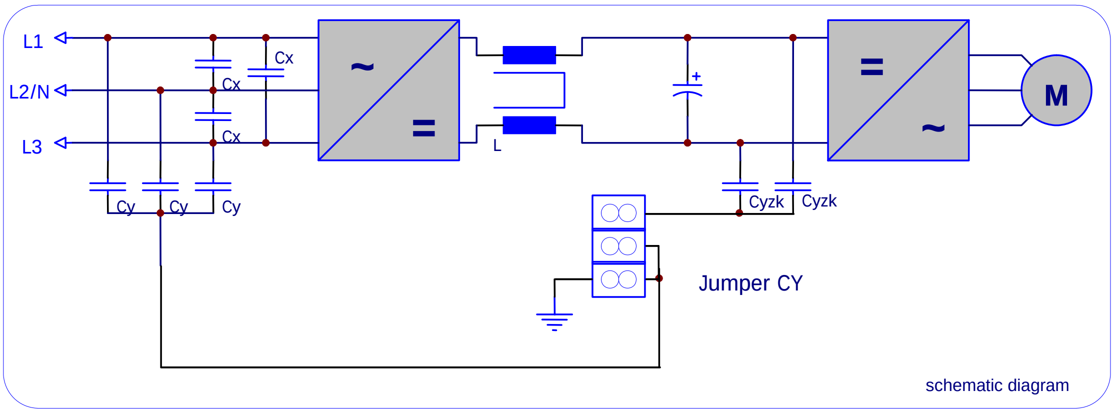
To adapt the SK 200E to an IT network, the capacitors C_y must be disconnected from earth. This is carried out by changing a jumper position as shown in the diagram.

Here it must be noted that the specified degree of radio interference suppression changes. Further details can be found in Section 9.3 EMC.



2.7.6 Internal jumper wiring

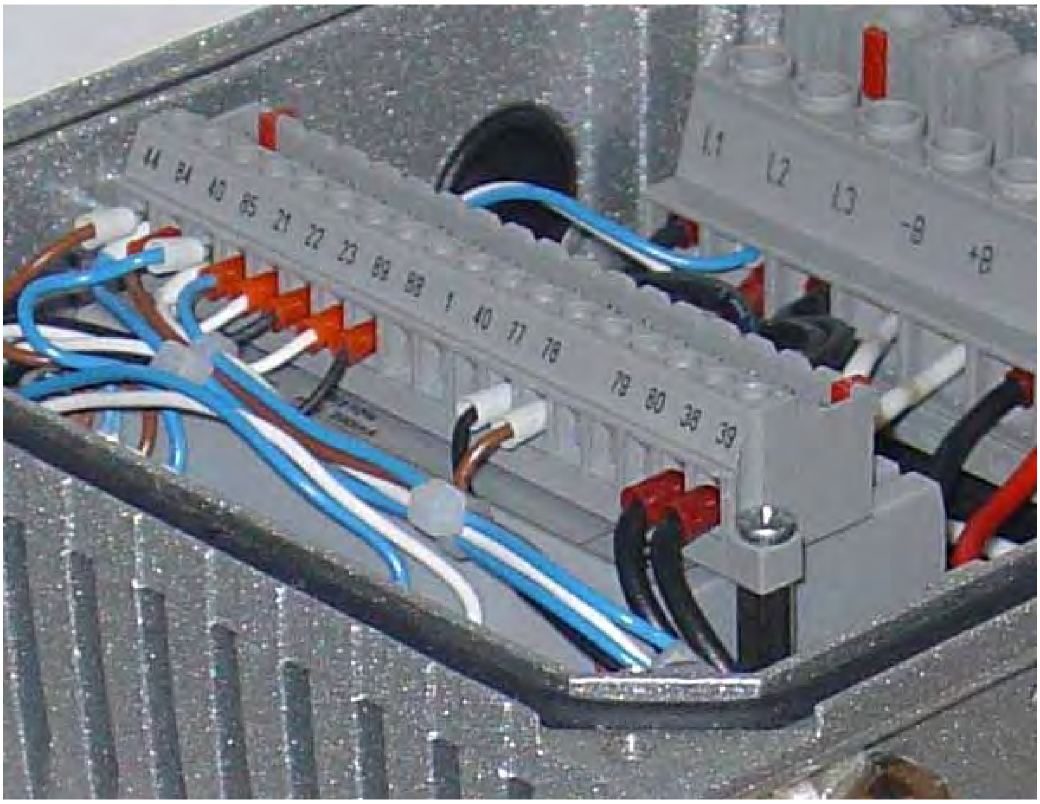
As supplied, the jumpers are set in the "normal position" (CY=ON). With this, the mains filter has its normal effect and results in a higher leakage current.



2.8 Electrical connection of SK 200E control unit

The control terminals are located on the inside of the frequency inverter connection unit. The connections differ according to the version (SK 205E, 215E, 225E, 235E).

Connection terminals:	Screw terminals, 3.5 mm slot-head screwdriver
Connection cross-section:	0.2 ... 2.5mm ^{2}, AWG 24-14, rigid or flexible, without wire end sleeves
Tightening torque:	0.5 ... 0.6Nm
Control cable:	Lay and shield separately from the mains/motor cables
Control voltages,	
External:	18…30V, min. 200mA, the current load increases according to the level of equipment. Used to supply the FI control unit and connected options.



NOTE

GND is a common reference potential for analogue and digital inputs.

The labelling of the control terminal bar differs according to the SK 200E version.

2.8.1 Control terminals, SK 2x5E versions

LABELLING, FUNCTION

SH:	"Safe stop" function'
AS:	Integrated AS interface
24V:	External 24V power supply
GND:	Reference potential for digital signals
DIN:	Digital input'
DO:	Digital output'
24V SH:	"Safe stop" input'
GND SH:	"Safe stop" reference potential'
SYS+/-:	System bus
MB+/-:	Electromagnetic brake control (105V, 180V, 205V)
TF+/-:	Motor PTC connection

CONNECTIONS AND FUNCTIONS DEPENDING ON THE SK 200E VERSION

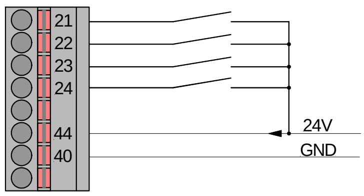
	FI type	SK 205E	SK 215E (SH)	SK 225E (AS1)	SK 235E (SH + AS1)
Pin	**Labelling**				
1	**44**	24V, external 24V FI supply*			
2	**44/84**	24V, external 24V FI supply		AS+, AS- Interface	
3	**40**	GND, reference potential for digital signals			
4	**40/85**	GND		AS- Interface	
5	**21**	DIN1 / digital input 1			
6	**22**	DIN2 / digital input 2			
7	**23**	DIN3, digital input 3			
8	**24/89**	DIN4, digital input 4	24V SH, "Safe stop"'	DIN4, digital input 4	24V SH, "Safe stop"'
9	**40/88**	GND	GND SH	GND	GND SH
10	**1**	DO 1, digital output 1			
11	**40**	GND			
12	**77**	SYS+, system bus			
13	**78**	SYS-, system bus			
14	**-**	---			
15	**79**	MB+, electromagnetic brake control			
16	**80**	MB-, electromagnetic brake control			
17	**38**	TF+, motor PTC connection			
18	**39**	TF-, motor PTC connection			

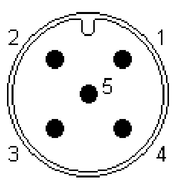
*With the use of the AS interface, terminal 44 provides an output voltage (24V, max. 60mA). In this case, no voltage sources may be connected to this terminal!

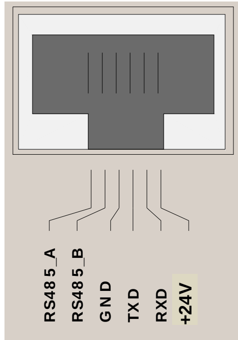
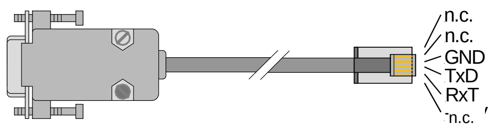
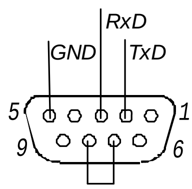
2.8.2 Details of the SK 2x5E control connections

Control voltage 24V external! Terminal 44. If the frequency inverter does not have an optional internal mains unit, it must be provided with an external 24V supply.

For devices in which the AS interface is used (SK 225E and SK 235E) the control voltage supply must be via the yellow AS interface cable. However, in this case, the frequency inverter must **not** be additionally supplied via terminal 44, in order to prevent damage to the mains unit or the AS-I bus.

Terminal/ Name	Function {Factory setting}	Data	Description / wiring suggestion	Parameter
SK 205E, SK 215E, SK 225E, SK 235E				
44 24V	external 24V supply	18VDC ... 30VDC -/+0% 200mA ... 800mA according to the FI load, the inputs and outputs and equipment with options 24VDC, max 60mA Output voltage with the use of the AS interface	External supply voltage for the FI control unit and the DO1 output For SK 225/235E and use of the AS-I (yellow cable), the SK 200E is supplied from the AS-I	-
40 GND	Reference potential for digital signals			-
21 DIN1	Digital input 1 {ON right}	Digital input as per EN 61131-2, Type 1 Low: 0 -5V (~ 9.5kΩ) High: 15-30V (~ 2.5-3.5kΩ) Input capacitance: Input 1 + 4 = 10nF Input 2 + 3 = 1.2nF Scanning time: 1ms Reaction time: ≥ 4ms	 Inputs 1 + 4 react slowly Inputs 2 + 3 react quickly	P420 [01]
22 DIN2	Digital input 2 {ON left}			P420 [02]
23 DIN3	Digital input 3 {fixed frequency 1, (P465[-01])}			P420 [03]
24 DIN4	Digital input 4 {fixed frequency 2, (P465 [-02])}			P420 [04]
1 DO1	Output 1 {Error}	Digital output 18-30V, each to VI 24V max. 200mA max. 100k Ωload	For evaluation in a control system. With SK 225/235E and the use of the AS-i (yellow cable) no load may be applied to DO1.	P434
38 TF+	PTC resistor input	-	For monitoring the motor temperature by PTC. For separate mounting of the motor and the FI (cable length), shielded cable must be used.	-
39 TF-	PTC resistor input			

Terminal/ Name	Function {Factory setting}	Data	Description / wiring suggestion	Parameter
77 SYS+	System bus	Up to four SK 200E can be operated on a system bus. Address = 32 / 34 / 36 / 38	Internal FI system bus for communication with optional modules and other frequency inverters. For further details see Section 9.7	P509/510 P514/515
78 SYS-	System bus			
79 MB+	Brake control	*Voltage:* Mains brake 115/230V 105V= 400V~ 180V= 460/480V~ 205V= *Current:*max. 0.5A	To control an electro-mechanical brake, the frequency inverter generates an output voltage at the terminals MB+/MB-. This depends on the supply voltage to the SK 200E. It is essential to take the correct brake coil voltage into account in the selection. (NOTE: this function is identical to P434=1)	P107, P114, P505
80 MB-	Brake control			
Additionally for SK 215E and SK 235E				
89 24V SH	24V input for the “Safe stop" function	18 … 30V at least 120-150mA	Fail-safe input	-
88 GND SH	Reference potential for the “Safe stop" function	0V digital Reference potential		
Additionally for SK 225E and SK 235E				
84 AS+	Actuator/ Sensor Interface	Simple setting by means of DIP switch 4 and 5 on the SK 200E	For the control of the SK 200E via the simple field bus level. Here, only the yellow AS interface cable can be used. An additional feed via the black cable is not possible.	P480 ... P483
85 AS-				
M12 optional	AS interface data:			
	Supply of AS interface connection, PWR connection (yellow cable)	26.5 – 31.6V, max. 290mA	**Connector PWR M12** 1 AS-I (+) 2 n.c. 3 AS-I (-) 4 n.c. 5 n.c. 	

Terminal/ Name	Function {Factory setting}	Data	Description / wiring suggestion	Parameter
all SK 200E, connector block RJ12, RS485/RS232				
1 RS485 A	Data cable RS485	Baud rate 9600…38400Baud The termination resistor R=120Ω must be installed on the final participant by the customer.	 RJ12: Pin No. 1 … 6 1: RS485_A 2: RS485_B 3: GND 4: RS232_TxD 5: RS232_RxD 6: +24V	P502 ...P513
2 RS485 B				
3 GND	Reference potential for Bus signals	0V digital		
4 232 TXD	Data cable RS232	Baud rate 9600…38400Baud		
5 232 RXD				
6 +24V	24V supply voltage from the FI	24V ± 20%		
All SK 200E, cable accessories				
optional	Adapter cable RJ12 to SUB-D9 ... for direct connection to a PC with NORD CON software	Length 3m RS 232 connections (RxD, TxD, GND) Part No. 278910240	 Pin2: RS232_TxD Pin3: RS232_RxD Pin5: GND 	

2.8.3 Colour and contact assignments for incremental encoders (HTL)

Function	**Wire colours, for incremental encoder**	**Assignment for SK 2x5E**
24V supply	brown / green	**44** 24V (VO)
0V supply	white / green	**40** 0V (GND)
Track A	brown	**22** DIN2
Track A inverse (A /)	green	--
Track B	grey	**23** DIN3
Track B inverse (B /)	pink	--
Track 0	red	--
Track 0 inverse	black	--
The cable shield	should be connected to a wide area of the frequency inverter housing	

Only the digital inputs DIN2 and DIN 3 of the frequency inverter are able to process the signals from an HTL encoder.

ATTENTION

When using DIN2 and DIN3 as rotary encoder evaluation, it is essential to set the functions of the digital inputs DIN2 and DIN3 (Parameter (P420 [-02, -03])) to “No Function”. (For using the DIP-switches of the frequency inverter for parametrisation, please lock at section 5.1.2 .)

NOTE: The data sheet accompanying the encoder should be observed.

RECOMMENDATION: For good reliability, especially with long connecting cables, an incremental encoder for 10-30V supply voltage should be used. Either an external or the internal 24V voltage can be used for the supply. 5V encoders should not be used! With the use of a type SK-xU4-24V... mains unit, the power restriction of the mains unit should be noted (Encoder current consumption: up to 150mA).

NOTE

The direction of rotation of the incremental encoder must correspond to that of the motor. Therefore, according to the direction of rotation of the encoder relative to the motor (this may be inverted) a positive or negative pulse number must be set in parameter (P301).

ATTENTION

It is essential to insulate unused wires (e.g. Track A inverse / B inverse).

Otherwise, contact between these wires or to the cable shielding may cause short circuits, which may interfere with the encoder signal or destroy the encoder.

2.9 ATEX Zone 22 for SK 2x5E

General information

With appropriate modification, the NORDAC SK 2x5E frequency inverter can be used in explosion hazard areas. For this it is important that all the safety information in the operating instructions is strictly complied with for the prevention of personal injury and material damage. This is essential to prevent injury and damage.

Qualified personnel

Qualified personnel must be used to carry out work involving the transport, assembly, installation, commissioning and maintenance. Qualified personnel are persons who due to their training, experience and instruction, and their knowledge of the relevant standards, accident prevention regulations and operating conditions are authorised to carry out the necessary activities for starting up the frequency inverter. This also includes knowledge of first aid measures and the local emergency services.

ATTENTION

All work must only be carried out with the power to the system switched off.

If the frequency inverter is connected to a motor and a gear unit, the EX labelling of the motor and the gear unit must also be observed.

Safety information

The increased danger in areas with inflammable dust demands the strict observation of the general safety and commissioning information. The drive unit must comply with the specifications in ***Planning Guideline No. 6052101***. 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.

It is essential that the person responsible for the use of motors and frequency inverters in explosion hazard areas is trained in their correct use.

ATTENTION

Before opening the frequency inverter for the connection of electric cables or other work, the mains voltage must always be switched off and secured against switching on again!

Temperatures may occur within the frequency inverter and the motor, which are higher than the maximum permissible surface temperature of the housing. The frequency inverter may therefore not be opened or removed from the motor in an atmosphere of explosive dust!

Impermissibly heavy dust deposits must not be permitted, as these impair the cooling of the frequency inverter!

All cable glands which are not used, must be closed with blind screw plugs which are approved for explosion hazard areas.

Only the original seals may be used.

The protective film covering the diagnostic LEDs in TU4 modules must not be damaged.

It must be ensured that the plastic housing cover cannot be electrostatically charged by streams of particles caused by the fan.

Repairs may only be carried out by Getriebebau NORD.

2.9.1 Modified SK 2x5E for compliance with Category 3D

For the operation of an SK 2x5E in ATEX Zone 22 only a modified frequency inverter is permissible. This adaptation is only made at the NORD factory. In order to use the frequency inverter in ATEX Zone 22, the standard cable glands are replaced with ATEX-approved brass cable glands, and the diagnostic connections are replaced with connections made from aluminium / glass and other seals. The housing cover is also coated with a UV-resistant paint.

II 3D Ex tD A22 IP55 T125 °C X

Categorisation:

- Protection with "housing"
- Procedure "A" Zone "22" Category 3D
- Protection class IP55 / IP66 (according to the device)
- Maximum surface temperature 125°C
- Ambient temperature -20°C to +40°C

Series SK 2x5E frequency inverters and the associated options are only designed for a degree of mechanical hazard corresponding to a low impact energy of 4J.

The frequency inverter must not be exposed to direct sunlight.

2.9.2 Options for ATEX Zone 22 3D

In order to ensure an ATEX-compliant NORDAC SK 2x5E frequency inverter, the approval of optional modules for explosion hazard areas must be observed. The following lists the various options with regard to their approval for use in ATEX Zone 22 3D.

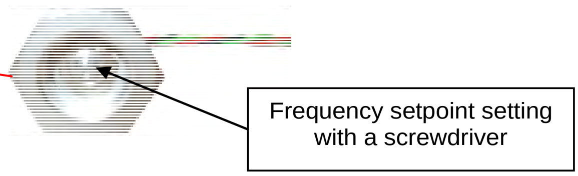
2.9.2.1 Technology Units for ATEX Zone 22 3D

Name	Part Number	Approved for ATEX Zone 22 3D	Not approved for ATEX Zone 22 3D
SK TI4-TU-BUS(-C)	275280000 / (275280500)	X	
SK TI4-TU-NET(-C)	275280100 / (275280600)	X	
SK TU4-PBR(-C)	275281100 / (275281150)	X	
SK TU4-CAO(-C)	275281101 / (275281151)	X	
SK TU4-DEV(-C)	275281102 / (275281152)	X	
SK TU4-IOE(-C)	275281106 / (275281156)	X	
SK TU4-24V-123-B(-C)	275281108 / (275281158)	X	
SK TU4-24V-140-B(-C)	275281109 / (275281159)	X	
SK TU4-POT-123-B(-C)	275281110 / (275281160)		X
SK TU4-POT-140-B(-C)	275281111 / (275281161)		X
SK TU4-PBR-M12(-C)	275281200 / (275281250)		X
SK TU4-CAO-M12(-C)	275281201 / (275281251)		X
SK TU4-DEV-M12(-C)	275281202 / (275281252)		X
SK TU4-IOE-M12(-C)	275281206 / (275281206)		X

2.9.2.2 Customer Units for ATEX Zone 22 3D

Name	Part Number	Approved for ATEX Zone 22 3D	Not approved for ATEX Zone 22 3D
SK CU4-PBR	275271000	x	
SK CU4-CAO	275271001	x	
SK CU4-DEV	275271002	x	
SK CU4-IOE	275271006	x	
SK CU4-POT	275271207		x
SK CU4-24V-123-B	275271108	x	
SK CU4-24V-140-B	275271109	x	
SK ATX-POT	275142000	x	

The SK 2x5E for Category 3D can be equipped with an ATEX-compliant potentiometer, which can be used to adjust a setpoint (e.g. speed) 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 removable screw closing cap, this component complies with ATEX requirements. Permanent operation may only be carried out with the cap closed.



Resistance of the potentiometer 10 kOhm

Wire colours on the potentiometer	Name	Terminal CU4-24V	Terminal CU4-IOE
Red	+10V reference	[11]	[11]
Black	AGND / 0V	[12]	[12]
Green	Analog input	[14]	[14] / [16]

NOTE: For the use of a potentiometer with frequency inverter SK 2x5E a Customer Unit CU4-24V-xxx-B or CU4-IOE is necessary.

2.9.2.3 Hand-held Technology Units for ATEX Zone 22 3D

All hand-held technology units are not approved for continuous use in the ATEX Zone 22 3D. The may therefore only be used during commissioning or for maintenance purposes, if it is ensured that no explosive dust atmosphere exists.

Name	Part Number	Approved for ATEX Zone 22 3D	Not approved for ATEX Zone 22 3D
SK CSX-3H	275281013		X
SK PAR-3H	275281014		X

ATTENTION

The diagnostic opening of the basic unit for the connection of a hand-held technology unit or a PC must not be opened in an atmosphere containing explosive dust.

2.9.2.4 Braking resistors

External braking resistors of type SK BRE4-x-xxx-xxx are not permitted for use in the ATEX Zone 22 3D.

Name	Part Number	Approved for ATEX Zone 22 3D	Not approved for ATEX Zone 22 3D
SK BRI4-1-100-100	275272005	X	
SK BRI4-1-200-100	275272008	X	
SK BRI4-1-400-100	275272012	X	
SK BRI4-2-100-200	275272105	X	
SK BRI4-2-200-200	275272108	X	
SK BRE4-1-100-100	275273005		X
SK BRE4-1-200-100	275273008		X
SK BRE4-1-400-100	275273012		X
SK BRE4-2-100-200	275273105		X
SK BRE4-2-200-200	275273108		X

ATTENTION

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. This is usually done by setting DIP switch 8 to "ON". Alternatively, parameters (P555), (P556) and (P557) can be parameterised with the appropriate values. Only the resistors assigned to the relevant inverter type may be used.

2.9.2.5 Other options

M12 sockets and plugs for installation in the terminal box of the basic device or in technology units may only be used of they are approved for use in ATEX Zone 22 3D.

Name	Part Number	Approved for ATEX Zone 22 3D	Not approved for ATEX Zone 22 3D
SK TIE4-WMK-1	275274000	x	
SK TIE4-WMK-2	275274001	x	
SK TIE4-WMK-TU	275274002	x	
SK TIE4-HAN10E	275274100		x
SK TIE4-HANQ5	275274110		x
SK TIE4-SWITCH	275274610		x
SK TIE4-M12-M16	275274510	x	
SK TIE4-M12-PBR	275274500		x
SK TIE4-M12-CAO	275274501		x
SK TIE4-M12-AS1	275274502		x
SK TIE4-M12-INI	275274503		x
SK TIE4-M12-IOL	275274504		x
SK TIE4-M12-SYSM	275274505		x
SK TIE4-M12-SYSS	275274506		x
SK TIE4-M12-POW	275274507		x

2.9.3 Maximum output voltage and torque reduction

As the maximum output voltage depends on the pulse frequency to be set, in some cases the torque which is stated in Planning Guideline 605 2101 must be reduced for values above the rated pulse frequency of 6 kHz.

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

Therefore the maximum torque must be reduced by 1% for each kHz pulse frequency above 6kHz. 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 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.

ATTENTION

At pulse frequencies above 6 kHz (400/500V devices) or 8 kHz (230V) 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.

2.9.4 Commissioning information

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

The motors are protected against overheating by means of the frequency inverter. This is carried out by the evaluation of the motor PTC by the frequency inverter. In order to ensure this function, the PTC must be connected to the intended input (Terminal 38/39 control terminal plug connector). 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. In addition, the frequency inverter must be parameterised so that the motor can be operated with a maximum speed of 3000 $^{1}/_{min}$. For a four-pole motor, the "maximum frequency" must be set to a value which is smaller or equal to 100Hz ((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 the necessary 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 the appropriate motor power	[0]	If a 4-pole NORD motor is used, the preset 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
P504 Pulse frequency	4kHz … 6kHz	[6]	For pulse frequencies above 6kHz a reduction of the maximum torque is necessary.
P533 Factor I2t 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 ***Planning Guideline No.: 605 2101***

2.9.5 EC declaration of conformity

Getriebebau NORD GmbH & Co. KG
Rudolf-Diesel-Str. 1, D-22941 Bargteheide, Germany
Telefon: +49 (0) 4532-401-0 Telefax: +49 (0) 4532-401-555 http://www.nord.com

NORD DRIVESYSTEMS

Declaration of EC-Conformity

in the sense of the directive 94/9/EC annex VIII

Getriebebau Nord GmbH & Co. KG herewith declares
that the inverters of the product range

- SK 205E-xxx, SK 215E-xxx, SK 225E-xxx, SK 235E-xxx -

and the options

- SK TU4-PBR-x, SK TU4-CAO-x, SK TU4-DEV-x, SK TU4-IOE-x, SK TU4-24V-xxx, SK TI4-TU-xxx -

in optional ATEX-design are according with the following regulation:

Directive on equipment and protective systems for use in explosive atmospheres	**94/9/EC**
Equipment marking in IP55 construction: (non-conductive dust)	**Ex II 3D Ex tD A22 IP55 T125°C X**
Equipment marking in IP66 construction: (conductive dust)	**Ex II 3D Ex tD A22 IP66 T125°C X**

Applied Standards:

EN 61241-0:2007	Electrical apparatus for use in the presence of combustible dust - Part 0: General requirements
EN 61241-1:2005	Electrical apparatus for use in the presence of combustible dust - Part 1: Protection by enclosures "tD"
EN 60529:2000	Degrees of protection provided by enclosures (IP code)

First CE marking started in 10.

Bargteheide, January 25, 2010.

U. Küchenmeister
General Manager

By proxy F. Wiedemann
Technical Manager Inverters

2.10 Outdoor installation

Under the following conditions, series SK 200E frequency inverters and technology units may be installed outdoors:

- IP66 version (See Special Measures, Section .1.7)
- UV-resistant blank screw caps. and inspection windows.

The UV-resistant blank screw caps and inspection windows are part of the ATEX Kit for the SK 200E. I.e. for the use of the ATEX option for IP66 (Section 2.9) all conditions for the outdoor installation of the frequency inverter are complied with.

NOTE	The membrane valve (bag enclosed with the IP66 version of the frequency inverter connection unit) enables the compensation of pressure differences between the inside of the frequency inverter and its environment and also prevents the entry of moisture. When fitting into an M12 screw connection of the connection unit of the frequency inverter, care must be taken that the membrane valve does not come into contact with standing moisture.

NOTE	If older versions of the devices are to be installed outdoors, replacement of the housing cover with a UV-resistant version may be necessary.

3 Options

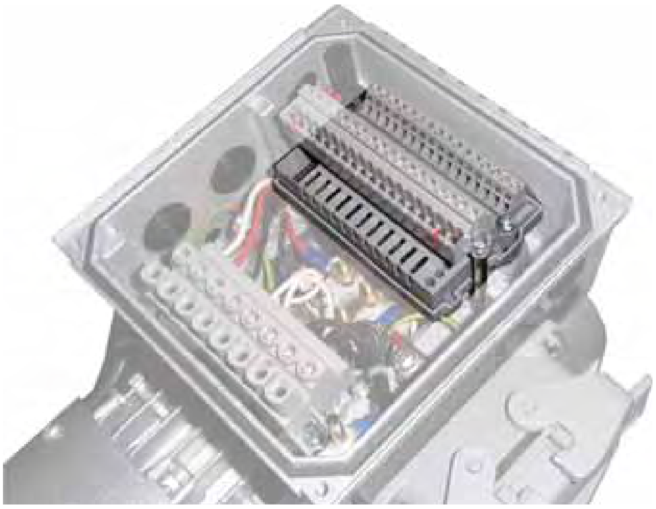
A series of optional extension modules are available for the SK 200E. These modules are preferably used for the production of the low voltage (24V control voltage) for the direct control or connection of the frequency inverter to a host field bus.

The options are available both as an internal version for integration (into the FI), the so-called customer unit SK CU4SK CU4-… or as an external version, the so-called technology unit SK TU4-… The differences between the internal and external options are merely limited to the number of additional IOs and the permissible current load of the connection terminals.

The **Customer Unit (SK CU4-…)** is integrated into the SK 200E. The electrical connection to the SK 200E is made via the internal system bus. This is equipped with screw terminals for connection to external peripherals. As an option, there is also the possibility of using 4/5-pin M12 plug connectors in the FI housing.

A special case is the potentiometer adapter SK CU4-POT, which is mounted on the connection unit of the frequency inverter and requires the use of an SK xU4-24V-…mains unit or an SK xU4-IOE IO module.

The **technology unit (Technology Unit, SK TU4-…)** is externally attached to the frequency inverter and is therefore easy to access. The electrical connection to the SK 200E is made via the internal system bus. External 4/5-pin plug connectors are available for use by the customer. A technology unit requires the use of a suitable SK TI4-TU-… connection unit. The optional wall mounting kit SK TIE4-WMK-TU also allows the technology units to be mounted close to the inverter.



SK TI4-... with integrated **SK CU4-...**

SK 200E with external **SK TU4-...**

An SK 200E frequency inverter is able to manage the following options via its system bus:

- 1 x CANopen absolute encoder and
- 1 x ParameterBox SK PAR-3H and (via an RJ12 connector)
- 1 x Field bus option (e.g. Profibus DP), internally <u>or</u> externally and
- 2 x I/O extensions (SK xU4-IOE-…), internally and / or externally
  (FI firmware V1.2 R0 or higher, otherwise only 1x)

Up to 4 frequency inverters with their appropriate options can belong to a field bus.

WARNING

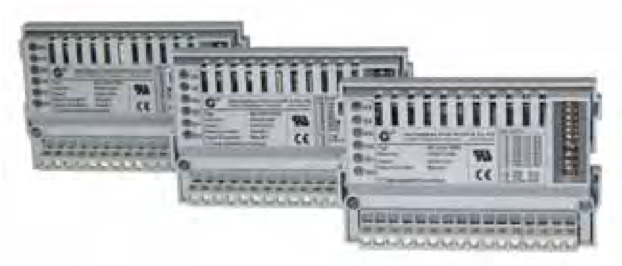
Modules must not be inserted or removed unless the device is free of voltage.

3.1 Overview of optional modules

3.1.1 Overview of internal customer units SK CU4-…

Internal customer units enable expansion of the range of functions of SK 200E frequency inverters without changing the physical size. Either a field bus module, a mains unit or an I/O extension can be selected. The frequency inverter provides one slot for the fitting of an appropriate option. External options (technology units) are available for additionally required optional modules (Section 3.1.2).

The bus modules require an external 24V supply, and are therefore also ready for operation if the frequency inverter is not connected to the mains supply.



Module	Description	Data
Profibus module **SK CU4-PBR** Part No. 275271000	This option enables the connection of up to four SK 200E to Profibus DP	Baud rate: 12 MBaud Protocol: DP-V1 2x digital inputs Low: 0-5V, High: 11-30V System bus
CANopen module **SK CU4-CAO** Part No. 275271001	This option enables the connection of up to four SK 200E to CANbus, using the CANopen protocol.	Baud rate: up to 1 MBit/s Protocol: DS301 / DSP402 2x digital inputs Low: 0-5V, High: 11-30V System bus
DeviceNet module **SK CU4-DEV** Part No. 275271002	This option enables the connection of up to four SK 200E to DeviceNet.	Baud rate: 500 KBit/s Protocol: AC-Drive 2x digital inputs Low: 0-5V, High: 11-30V System bus
I/O extension **SK CU4-IOE** Part No. 275271006	This internal I/O extension provides further digital and analog inputs and outputs. These are then available in addition to the digital inputs provided in the SK 200E (Section 3.4.3).	2x digital inputs Low: 0-5V, High: 11-30V 2x analog inputs 0-10V, -10-10V, 0-20mA, 4-20mA 1x analog output 0-10V, -10-10V, 0-20mA, 4-20mA System bus
Potentiometer/Switch **SK CU4-POT** Part No. 275271207	Internal potentiometer/switch This can only be used in connection with a 24V mains unit (SK CU4-24V, SK TU4-24V) or I/O extension (SK CU4-IOE, SK TU4-IOE).	ON R / OFF / ON L 0…100% setpoint potentiometer 10kΩ
Int. 24V mains unit 1~ 230V **SK CU4-24V-123-B** Part No. 275271108	Internal 24V mains unit for the SK 200E, for mains voltage of 1~ 100-240V, ±10%.	24V=, ±10%, 420mA 10V ref., ±0.2V, 5mA Analog input 0-10V 500Ω burden resistor for evaluation of 0/4-20mA
Int. 24V mains unit 1~ 400V **SK CU4-24V-140-B** Part No. 275271109	Internal 24V mains unit for the SK 200E, for mains voltage 1~ 380-500V, -20/+10%.	
For all modules except SK CU4-POT: Screw terminals, 16x 2.5mm^2, AWG 26-14		

3.1.2 Overview of external technology units SK TU4-…

External Technology Units enable the expansion of the scope of functions of SK 200E frequency inverters. Users have access to both communication modules and mains units or an I/O extension.

Modules with connection terminals or M12 system connectors are available as options.

According to the installation location, modules with protection class IP55 or IP66 are available. These can be installed directly on the SK 200E or independent of the SK 200E with an appropriate wall-mounting kit.

Each SK TU4-… Technology Unit requires a SK TI4-TU-… Connection Unit. The SK TI4-TU-BUS is available for bus modules or the I/O extension. The mains unit or potentiometer modules require an SK TI4-TU-NET Connection Unit.

For the bus modules or I/O extension with integrated system bus an RJ12 socket (behind a transparent screw-on cover) is also available. This enables communication with other modules or frequency inverters. With this linkage, all devices can be parameterised by means of a ParameterBox SK PAR-3H or with a PC and the NORD CON software.

The bus modules require an external 24V supply, and are therefore also ready for operation if the frequency inverter is not connected to the mains supply.

Bus modules

Bus Module	Description	Data
Profibus module* **SK TU4-PBR** Part No. 275281100 (IP55) Part No. 275281150 (IP66)	This option enables the control of up to four SK 200E via Profibus DP.	Protocol: DP-V1 Baud rate: 12 MBaud 4x digital inputs Low: 0-5V, High: 11-30V 2x digital outputs, 0/24V system bus
Profibus module with M12* **SK TU4-PBR-M12** Part No. 275281200 (IP55) Part No. 275281250 (IP66)	This option enables the control of up to four SK 200E via Profibus DP.	As SK TU4-PBR, but with 6x M12 sockets
CANopen module* **SK TU4-CAO** Part No. 275281101 (IP55) Part No. 275281151 (IP66)	This option enables the control of up to four SK 200E via the CANbus, using the CANopen protocol.	Protocol: DS301 / DS402 Baud rate: up to 1 MBit/s 4x digital inputs Low: 0-5V, High: 11-30V 2x digital outputs, 0/24V system bus
CANopen module with M12* **SK TU4-CAO-M12** Part No. 275281201 (IP55) Part No. 275281251 (IP66)	This option enables the control of up to four SK 200E via the CANbus, using the CANopen protocol.	As SK TU4-CAO, but with 6x M12 sockets
DeviceNet module* **SK TU4-DEV** Part No. 275281102 (IP55) Part No. 275281152 (IP66)	This option enables the control of up to four SK 200E via DeviceNet.	Protocol: AC-Drive Baud rate: 500 KBit/s 4x digital inputs Low: 0-5V, High: 11-30V 2x digital outputs, 0/24V system bus
DeviceNet module with M12* **SK TU4-DEV-M12** Part No. 275281202 (IP55) Part No. 275281252 (IP66)	This option enables the control of up to four SK 200E via DeviceNet.	As SK TU4-DEV, but with 6x M12 sockets
I/O extension* **SK TU4-IOE** Part No. 275281106 (IP55) Part No. 275281156 (IP66)	This option extends the SK 200E with additional digital and analog inputs and outputs.	4x digital inputs Low: 0-5V, High: 11-30V 2x analog inputs 0-10V, -10-10V, 0-20mA, 4-20mA 1x analog output 0-10V, -10-10V, 0-20mA, 4-20mA 2x digital outputs, 0/24V system bus
I/O extension with M12* **SK TU4-IOE-M12** Part No. 275281206 (IP55) Part No. 275281256 (IP66)	This option extends the SK 200E with additional digital and analog inputs and outputs.	As SK TU4-IOE, but with 6x M12 sockets
Connection Unit TU4 **SK TI4-TU-BUS** Part No. 275280000 (IP55) Part No. 275280500 (IP66)	The Connection Unit is always required in order to use an external Technology Unit. It implements the mechanical and electrical connection of the TU4 to the SK 200E or the wall mounting kit.	36x 2.5mm^2 AWG 24-14 Spring-loaded terminals
TU4 Wall-mounting kit **SK TIE4-WMK-TU** Part No. 275274002	Using the wall mounting kit, a Technology Unit can be used/installed separately from the SK 200E.	
		*) In order to use the TU4 modules, a suitable SK T14-TU-BUS Connection Unit must always be available.

Mains Unit modules

Mains Unit Module	Description	Data
External 24V mains unit 1~ 230V ** **SK TU4-24V-123-B** Part No. 275281108 (IP55) Part No. 275281158 (IP66)	External 24V mains unit to supply the SK 200E, using a mains voltage of 230V	24V, ±10%, 420mA 10V ref., ±0.2V, 5mA Analog input 0-10V 500Ω burden resistor for evaluation of 0/4-20mA Supply: 230 or 400V
External 24V mains unit 1~ 400V ** **SK TU4-24V-140-B** Part No. 275281109 (IP55) Part No. 275281159 (IP66)	External 24V mains unit to supply the SK 200E, using a mains voltage of 400V	
External 24V 1~ 230V, potentiometer / switch ** **SK TU4-POT-123-B** Part No. 275281110 (IP55) Part No. 275281160 (IP66)	The Potentiometer Box is used for the direct control of the frequency inverter, without the use of external components. The 24V mains unit supplies the SK 200E, using a mains voltage of 230V.	24V, ±10%, 420mA ON R / OFF, ON L 0…100% Setpoint Supply: 230 or 400V
External 24V 1~ 400V, potentiometer / switch ** **SK TU4-POT-140-B** Part No. 275281111 (IP55) Part No. 275281161 (IP66)	The Potentiometer Box is used for the direct control of the frequency inverter, without the use of external components. The 24V mains unit supplies the SK 200E, using a mains voltage of 400V.	
Connection Unit TU4 **SK TI4-TU-NET** Part No. 275280100 (IP55) Part No. 275280600 (IP66)	The Connection Unit is always required in order to use an external Technology Unit. It implements the mechanical and electrical connection of the TU4 to the SK 200E or the wall mounting kit.	18x 2.5mm^2 AWG 26-14 Spring-loaded terminals
TU4 Wall-mounting kit **SK TIE4-WMK-TU** Part No. 275274002	Using the wall mounting kit, a Technology Unit can be used/installed separately from the SK 200E.	
**) In order to use the TU4 modules, a suitable SK T14-TU-NET Connection Unit must always be available.		

3.2 Installation of optional modules

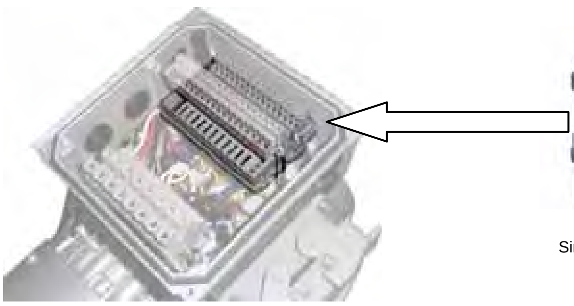
3.2.1 Installation of internal customer units SK CU4-…

WARNING	
	Installations should only be made by qualified personnel, in strict compliance with the warning and safety information. Modules must not be inserted or removed unless the device is free of voltage. The slots can only be used for the intended modules. The customer unit SK CU4-…**is** not intended for installation at a location away from the frequency inverter. This must be installed directly on the connection unit of the SK 200E.

The installation of Customer Units is carried out in the Connection Unit SK T14-… SK 200E underneath the control terminal block. The control terminal block of the frequency inverter and two bolts (bag enclosed with the customer unit) are used to fix this. Only one Customer Unit per FI is possible!

The pre-assembled cable necessary for connection to the frequency inverter (SK 200E) is enclosed in the bag provided with the customer unit. Connections are made according to the following table.

The bus modules require a 24V supply voltage.



Similar to illustration

Similar to illustration

SK TI4-… with integrated customer unit SK CU4-…

internal customer unit SK CU4-…

Bag enclosed with the internal customer unit

Allocation of the cable sets (bag enclosed with the customer unit)

	Purpose	Terminal designation		Cable colour
Field bus / IOE	Power supply (24V DC) (between the frequency inverter and the customer unit)	**44**	24V	Brown
		40	GND	Blue
	System bus	**77**	SYS+	Black
		78	SYS-	Grey
Mains unit	Power supply (24V DC) (between the frequency inverter and the customer unit)	**44**	24V	Brown
		40	GND	Blue
	Power supply (mains (AC)) (between the mains supply and the customer unit)	**L1**	L1	Brown
		L2	L2	Black
	Frequency output	**B1**	FOUT	Black

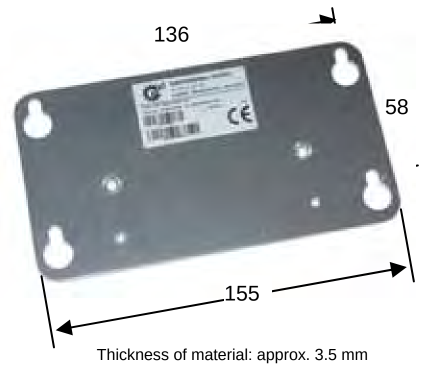
3.2.2 Installation of external technology units SK TU4-…

WARNING	Installations should only be made by qualified personnel, in strict compliance with the warning and safety information. Modules must not be inserted or removed unless the device is free of voltage. The slots can only be used for the intended modules. **Installation** of the technology unit at a location **away from** the frequency inverter **is possible with an additional wall-mounting kit** SK TIE4-WMK-TU.

Together with a connection unit SK TI4-TU-BUS(-C) or SK TI4-TU-NET(-C) the technology units SK TU4-…(-C) form a discrete functional unit. This can be screwed to the SK 200E frequency inverter or can be installed independently by means of an optional wall-mounting kit SK TIE4-WMK-TU. In order to ensure reliable operation, the length of the cable between the module and the frequency inverter should not exceed 30m.

3.2.2.1 Dimensions

As a functional unit in combination with an SK TI4-TU-… connection unit, the SK TU4-… has the following dimensions.



Thickness of material: approx. 3.5 mm

Fig.: **SK TIE4-WMK-TU wall-mounting kit**

* For SK TU4-…-M12 modules:
99 mm (without cover cap for M12 plug)
108 mm (with cover cap for M12 plug)

Fig.: **Functional unit SK TU4-… and SK TI4-TU-… with wall-mounting kit SK TIE4-WMK-TU**

3.2.2.2 Adapter unit SK TI4-TU-BUS(-C) and SK TI4-TU-NET(-C)

Various cable glands, protected with blank plugs are fitted to the sides of the housing of the BUS or mains adapter unit.

The following holes are available for the cable glands:

- 2 x 1 M20 x 1.5 (at side)
- 4 M16 x 1.5 (underside)
- 2 M25 x 15 (at rear, without blank plugs)

Example:
external BUS adapter unit SK TI4-TU-BUS

The transparent screw connection at the top right (M20 x 1.5) (only SK TI4-TU-BUS(-C)) is used for access to the diagnostic interface (RJ12 socket, interface RS232/RS485). The top left screw connector is not used.

3.2.2.3 Installing the SK TI4-TU-... on the SK 200E

The screw connectors and seals required for installation are enclosed with the modules or are fitted to the intended locations.

The **installation** of the Technology Units on the SK 200E is performed as follows:


Installation of the external Technology Unit on the SK 200E

1. Switch off the mains.
2. Remove the two M25 blank caps from the required side of the frequency inverter (right / left)
3. Removal of the PCB (with terminal bar) from the BUS adapter unit.
4. Fit the enclosed seal to the SK TI4-TU-… Adapter Unit and mount the unit on the SK 200E with the four enclosed bolts.
5. Screw in both of the reductions from M25 to M12 from the inner side of the Adapter Unit of the frequency inverter. (Purpose: to avoid damage to the internal wiring in the region of the transition from the SK TI4-TU-... (Adapter Unit of the external optional module) to the SK TI4-… (frequency inverter Adapter Unit)
6. Reinstall the PCB (See Item 3) and make the electrical connection.
7. Fit and screw on the SK TU4 module.


Technology Unit SK TU4-… (-M12)


BUS Adapter Unit SK TI4-TU-…


Wall-mounting kit SK TIE4-WMK-TU

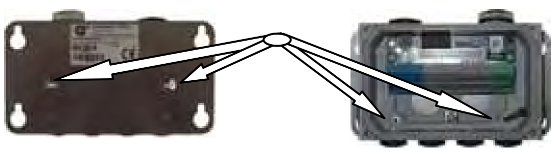
3.2.2.4 Wall-mounting of the SK TI4-TU-…

The screw connectors and seals required for installation (except anchor screws) are enclosed with the modules or are fitted to the intended locations.

The connecting cable between the Technology Unit and the SK 200E should not be longer than 30m.

Wall-mounting kit SK TIE4-WMK-TU with field bus Technology Unit

1. Install the Adapter Unit SK TI4-TU-… with the enclosed seal on the wall-mounting kit. To do this: insert the 2 flat head screws (enclosed with the wall-mounting kit) from the outside into the (countersunk) holes and screw the two components (BUS / NET adapter unit) tightly together with the two bolts (enclosed with the wall-mounting kit).



2. Make a suitable connection between the Technology Unit and the frequency inverter. Take care that there is appropriate screw fitting and sealing of the modules. The cable sets included with the BUS / NET Adapter Unit are not used.
3. Fit and screw on the SK TU4 module.

3.3 Control connections and configuration

The I/O and field bus option modules must be supplied with a control voltage of 24V DC (±20%). Wiring sleeves must be used for flexible cables.

Name	Data
Rigid cable cross-section	0.14 … 2.5mm²
Flexible cable cross-section	0.14 … 1.5mm²
AWG standard	AWG 26-14
Tightening torque (for screw terminals)	0.5 … 0.6Nm

Note

For CANopen and DeviceNet, because of the separate potential levels of the system bus and the field bus, both bus systems must have a separate supply (24V).

The data cables (e.g. CANopen, system bus) must be installed as short as possible and with the same length inside the terminal box (unshielded part of the wiring). Associated data cables (e.g.: Sys+ and Sys-) must be twisted together.

In case of EMC problems, a potential separation for the supply of the field bus, the digital inputs and system bus interfaces as well as the two additional digital outputs of the external Technology Unit should be provided.

Detailed information concerning the control connections can be found in Section 3.4, 3.5.

NOTE

The cable shield must be connected to the *functional earth* [1] (usually the electrically conducting mounting plate), in order to prevent EMC interference in the device.

In order to achieve this, with the field bus connection the metal, metric EMC screw connections for the connection of the cable shielding to the frequency inverter or the housing of the Technology Unit must be used. This ensures a large-area connection of the *functional earth*.

Configuration

The configuration is identical for all module versions (except for Mains Unit SK xU4-24V-…, where no configuration is necessary) All the necessary settings are made with the hardware via a DIP switch element (multiple switch block).

Customer Unit SK CU4-...

DIP switch element

Technology Unit SK TU4-...

[1] In systems, electrical equipment is usually connected to the ***functional earth***. This serves to conduct leakage and interference currents in order to ensure the EMC characteristics and must be connected in compliance with high-frequency methods.

3.4 Details of internal Customer Units SK CU4-…

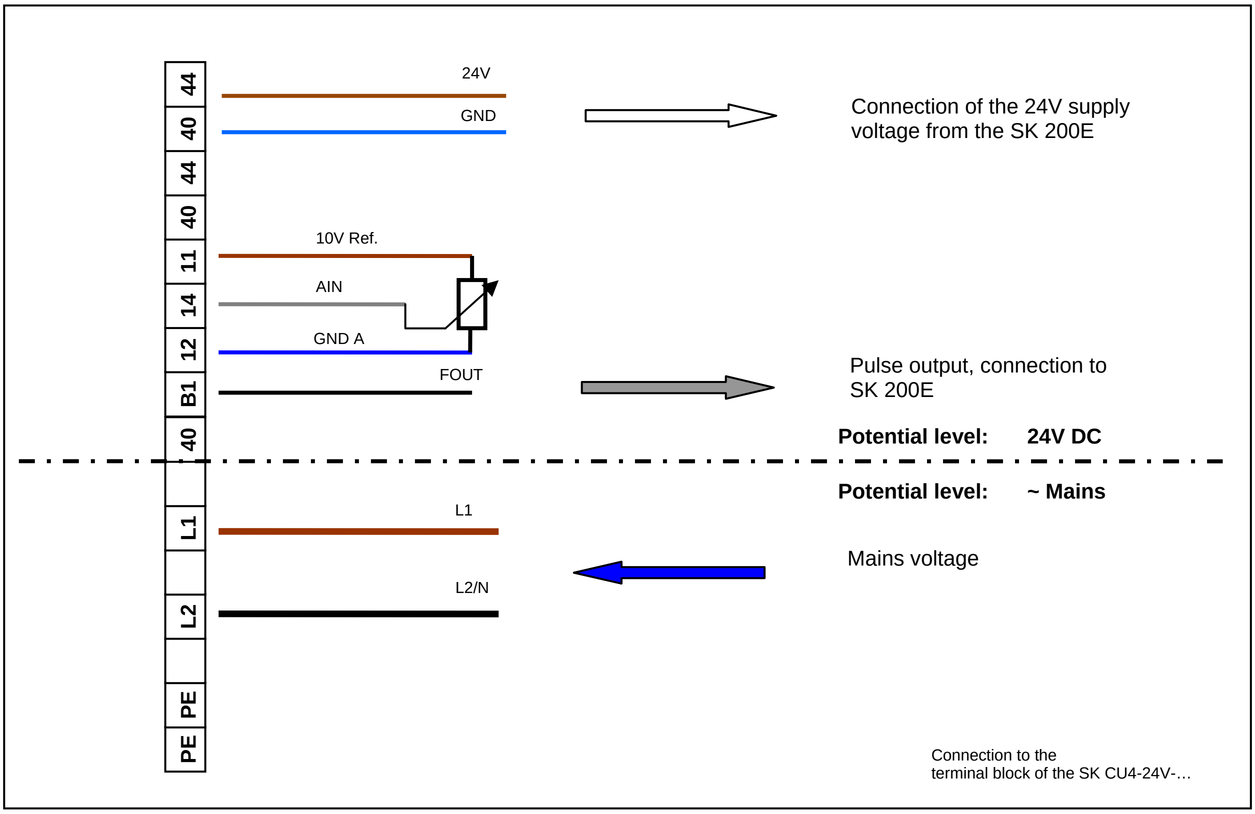
3.4.1 Mains Unit, SK CU4-24V-…

The Mains Unit is used for the production of the 24V control voltage for the FI from the available mains voltage (115V/ 230V/380V/500V). With this, a separate external 24V control voltage is not necessary.

An analog input is also available for the connection of the potentiometer adapter SK CU4-POT

- Mains unit for 100-240V, SK CU4-24V-123-B
- Mains unit for 380-500V, SK CU4-24V-140-B
- +24V- output voltage
- 1x analog input (e.g. Potentiometer Adapter)
- 1x pulse output
- Status LED = 24V
- Max. permissible continuous current: 420mA

The terminal block of the Customer Unit SK CU4-24V-… is divided into two potential levels.



To process current setpoint values, the enclosed bag contains a 500Ω resistor, for connection between terminals 11 and 14. Matching of the relevant input of the frequency inverter is made via parameter (P420).

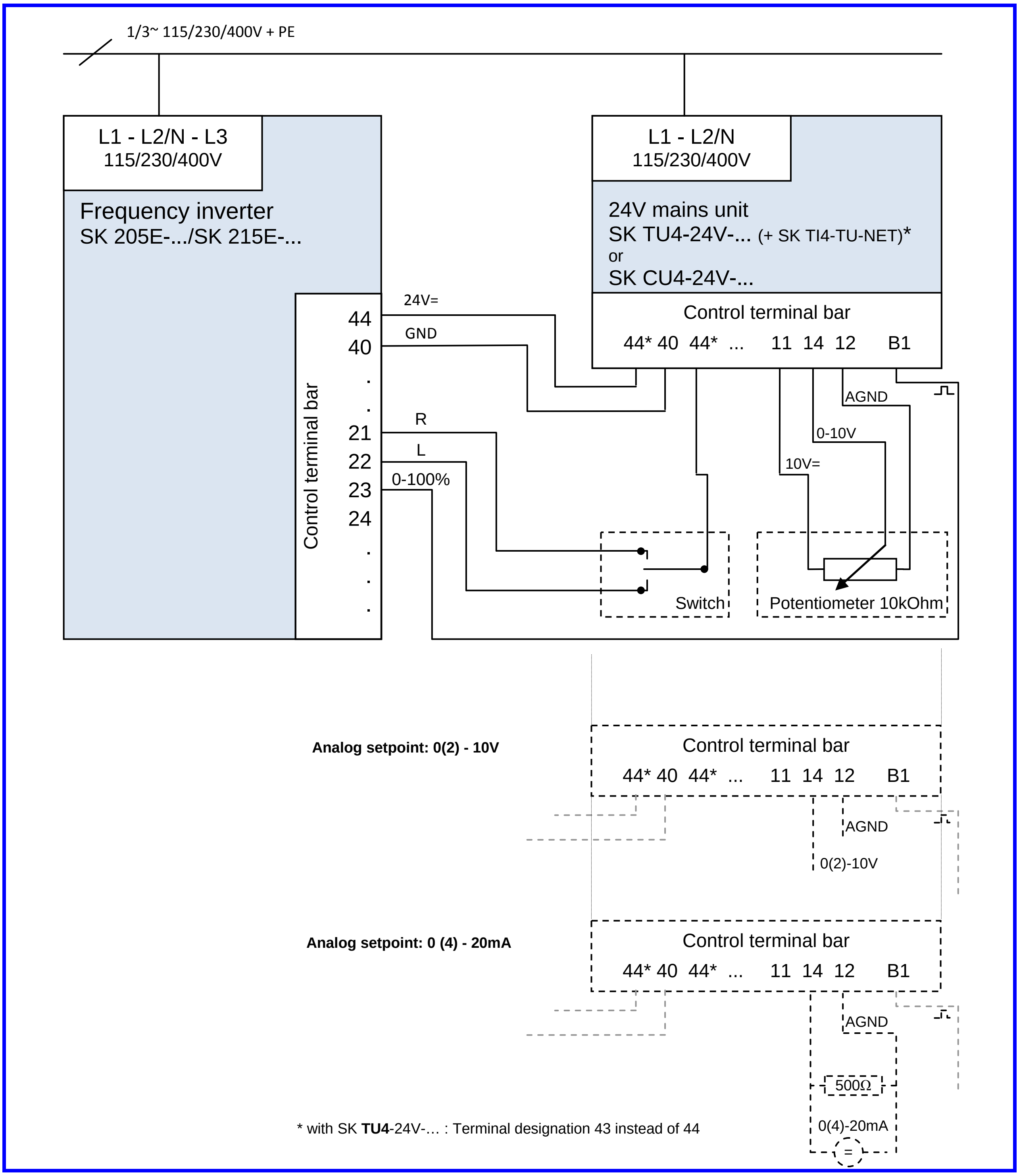
Setpoint	Parameter [Array]	Setting
0 … 20mA	P420 [-02] or [-03]	{26}
4 … 20mA	P420 [-02] or [-03]	{27}

Details of the control connections

<table>
<tr><th>Terminal/ Name</th><th>Function</th><th>Data</th><th>Description / wiring suggestion</th><th>Parameter</th></tr>
<tr><td>44 24V</td><td>24V supply</td><td rowspan="4">24VDC ±10%
max. 420mA (total)
integrated short-circuit monitoring, limited overtemperature and overload monitoring</td><td rowspan="4">Supply voltage (output) for the supply of an SK 200E or other module with 24V.

Can also be used as an input (in this case, do not connect L1 and L2), if the module is only to be used as a voltage or frequency converter (for the connection of a potentiometer).</td><td>-</td></tr>
<tr><td>40 GND</td><td>Reference potential</td><td>-</td></tr>
<tr><td>44 24V</td><td>24V supply</td><td>-</td></tr>
<tr><td>40 GND</td><td>Reference potential</td><td>-</td></tr>
<tr><td>11 +10V</td><td>10V
reference voltage</td><td>10V ± 0.2V
Max.
load 5mA</td><td rowspan="3">For connection of potentiometer 5 - 10kΩ.
A 500Ω burden resistor for the evaluation of 0/4 - 20mA signals is contained in the enclosed bag.</td><td>-</td></tr>
<tr><td>14 AIN+</td><td>Analog input
positive</td><td>0 … 10V,
Resolution: 8Bit
Accuracy: 0,2V</td><td>-</td></tr>
<tr><td>12 0V
GND analog</td><td>Analog Ground</td><td>Reference potential for analog signals</td><td>-</td></tr>
<tr><td>B1 FOUT</td><td>Frequency output</td><td>SPS compatible in compliance with EN61131-2
Low: 0V, High: 24V
Pulse frequency:
~ 1 - 32kHz</td><td>Impulses for evaluation via the digital input function P420 [02]/[03] = 26/27 and the analog meaning in P400 [-06]/[-07].</td><td>P420
P400</td></tr>
<tr><td>40</td><td>Reference potential</td><td></td><td></td><td>-</td></tr>
<tr><th colspan="5">Potential separation</th></tr>
<tr><td></td><td></td><td></td><td rowspan="5">Mains connection, 100 - 240V or 380 - 500V, depending on the module</td><td>-</td></tr>
<tr><td>L1</td><td>Mains connection
1. Phase</td><td></td><td>-</td></tr>
<tr><td></td><td></td><td></td><td>-</td></tr>
<tr><td>L2</td><td>Mains connection
2. Phase</td><td></td><td>-</td></tr>
<tr><td></td><td></td><td></td><td>-</td></tr>
<tr><td>PE</td><td>PE, Earth</td><td></td><td rowspan="2">As required, does not need to be connected.</td><td>-</td></tr>
<tr><td>PE</td><td>PE, Earth</td><td></td><td>-</td></tr>
</table>

Connection plan and parameterisation of SK xU4-24V-…, example



DIP switch settings: DIP3 = off, DIP4 = on, DIP5 = off (Section 5.1.2)

or

recommended parameter setting, DIP1-8 = off:

P400 [07] = 1   P420 [02] = 2
P420 [01] = 1   P420 [03] = 26 (for 0-10V / 0-20mA signals)
= 27 (for 2-10V / 4-20mA signals)

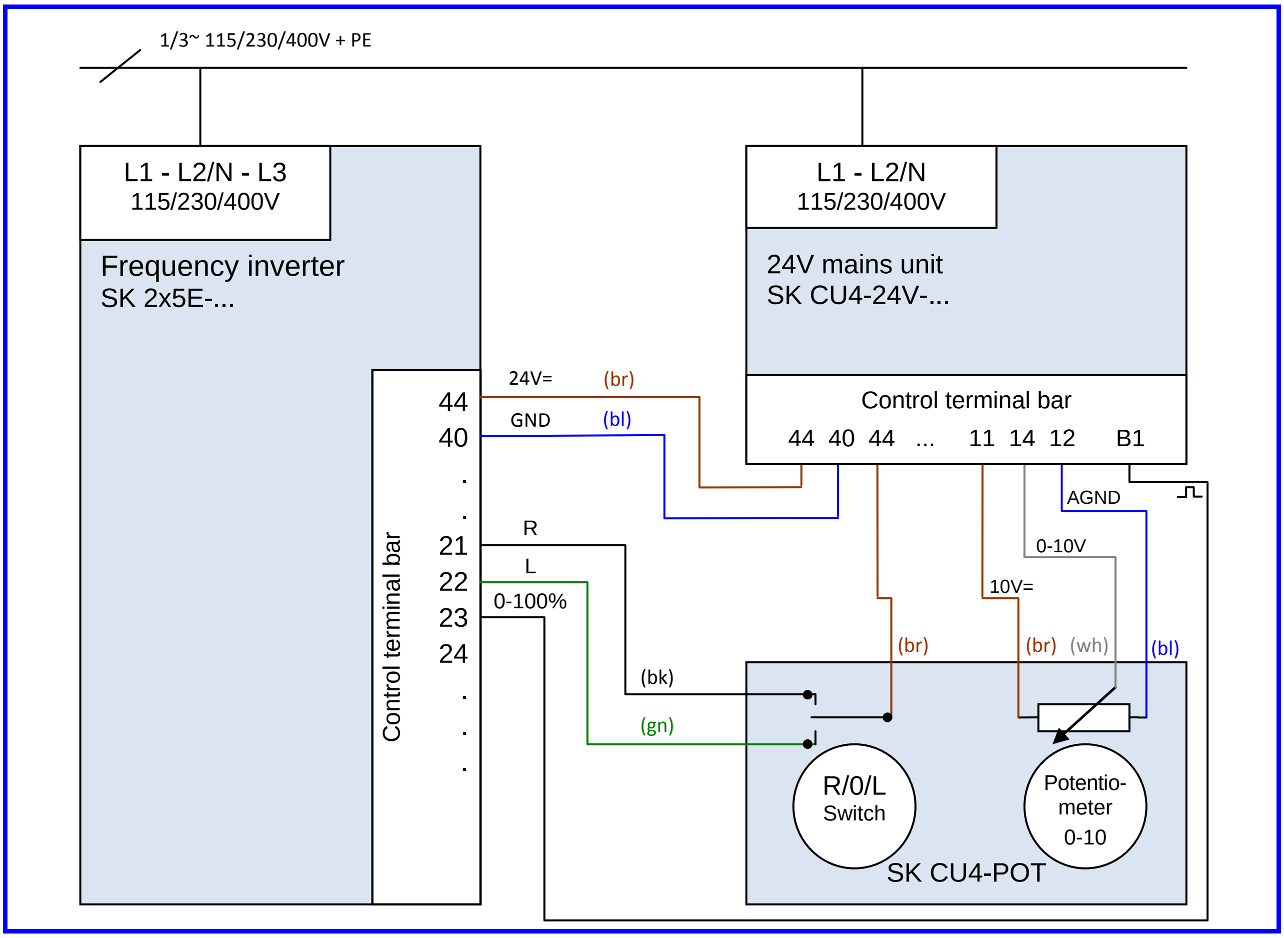
3.4.2 Potentiometer Adapter, SK CU4-POT

The digital signals R and L can be directly applied to the corresponding digital inputs 1 and 2 of the SK 200E.

The potentiometer (0-10) can be evaluated via a 24V module or I/O extension and converted to proportional impulses (frequency). These impulses can then be evaluated via the digital input 2 or 3 (P420 [02]/[03] = 26/27) of the SK 200E in the form of a setpoint value (P400 [-06]/[-07]).

	Module	SK CU4-POT	Connection: Terminal No.		
Pin	**Colour**		FI	Mains unit	**Function**
1	**Brown**	24V supply voltage		44	
2	**Black**	Enable R (e.g. DIN 1)	21		Rotary switch L - OFF - R
3	**White**	Enable L (e.g. DIN2)	22		
4	**White**	Access to AIN1+		14	
5	**Brown**	10V reference voltage		11	Potentiometer 10kΩ
6	**Blue**	Analog Ground AGND		12	

Connection plan and parameterisation of SK CU4-POT, example



DIP switch settings: DIP3 = off, DIP4 = on, DIP5 = off (Section 5.1.2)

or

recommended parameter setting, DIP1-8 = off:

P400 [07] = 1 P420 [02] = 2
P420 [01] = 1 P420 [03] = 26

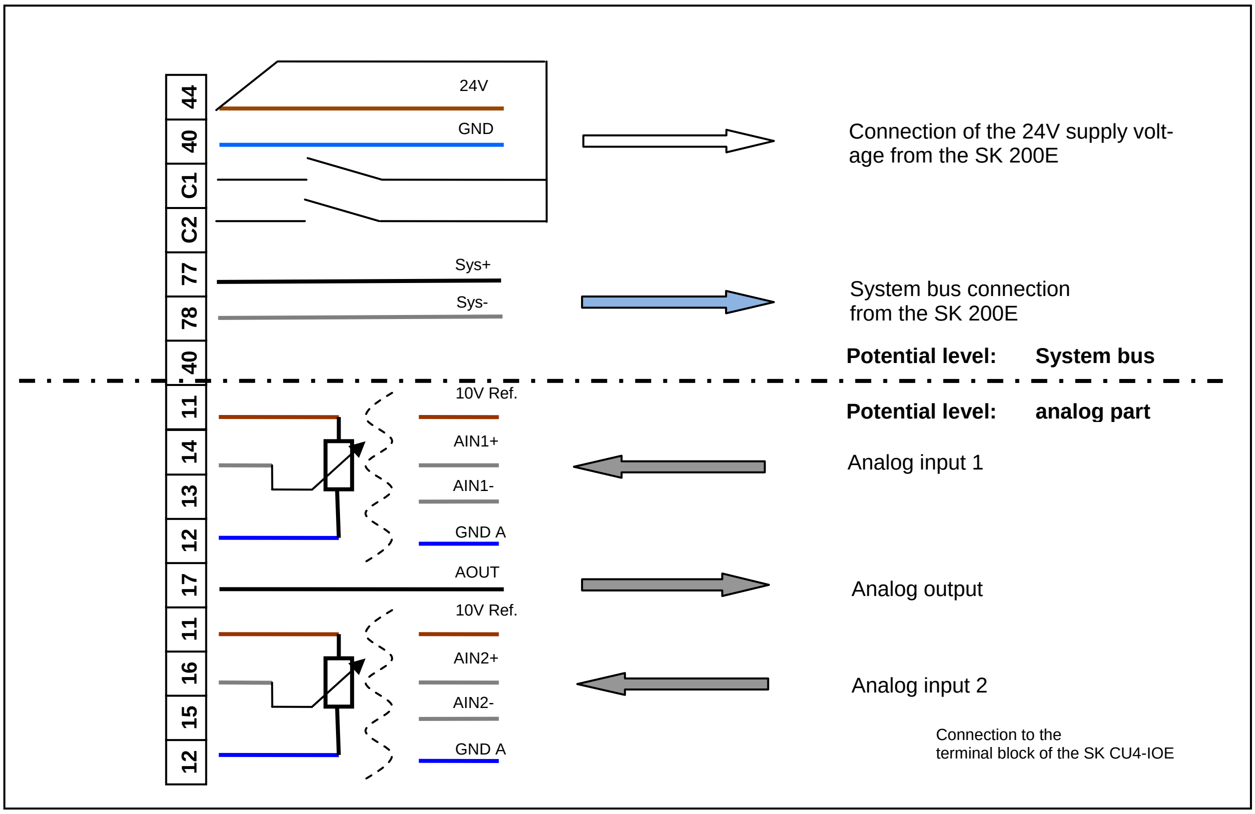
3.4.3 SK CU4-IOE-, I/O extension

The internal I/O units can record sensor and actuator signals. These can be used for a drive function or forwarded to a host bus system (e.g. Profibus or CANopen).

- 2x digital inputs
- 2x analog inputs
- 1x analog output
- Status LEDs: Module status, module error, Dig In 1, Dig. In 2
- DIP switches for selection
  0 - 10V, -10 - 10V, 0 - 20mA, 4 - 20mA
- DIP switches for: addressing, bus termination

Similar to illustration

The terminal block of the Customer Unit SK CU4-IOE… is divided into two potential levels.



NOTE

Looping of the 24V supply voltage **(terminals 44/40)** is in principle possible, however, a maximum current load of **2A** for the **SK CU4-IOE** must not be exceeded!

3.4.3.1 Details of the control connections

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
44 24V	external 24V supply Module	24VDC ±20% ≈ 110mA protected against reverse polarity Max. permissible current load: 2A	Connection for module supply voltage and 24V source for the digital inputs (DIN1 and DIN2)	-
40 GND	Reference potential for digital signals			-
C1 DIN1	Digital input 1 (I/O IO extension DIN1)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1 ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2, Type 1	P480 P174
C2 DIN2	Digital input 2 (I/O IO extension DIN2)			P480 P174
77 Sys+	System bus data cable +		System bus interface	-
78 Sys-	System bus data cable -			-
40 GND	Reference potential for digital signals			-
Potential separation				
11 +10V	10V reference voltage	10V ± 0.1V Max. load 20mA	Potentiometer supply voltage	-
14 AIN1+	Analog input 1 positive	Version as differential input Resolution: 12Bit Accuracy: 0,1V	Functions: 0V … 10V / -10V … +10V / 0mA … 20mA / 4mA … 20mA (selection via DIP switch)	P400 P176
13 AIN1-	Analog input 1 negative			-
12 0V GND analog	Analog Ground		Reference potential for analog signals	-
17 AOUT	Analog Out	Resolution: 10Bit Accuracy: 0.25V Max. load 5mA	Functions: 0V … 10V / 2V … 10V / 0mA … 20mA / 4mA … 20mA (selection via DIP switch)	P418 P176
11 +10 V	10V reference voltage	10V ± 0.1V Max. load 20mA	Potentiometer supply voltage	-
16 AIN2+	Analog input 2 positive	Version as differential input Resolution: 12Bit Accuracy: 0.1V	Functions: 0V … 10V / -10V … +10V / 0mA … 20mA / 4mA … 20mA (selection via DIP switch)	P400 P176
15 AIN2-	Analog input 2 negative			-
12 0V GND analog	Analog Ground		Reference potential for analog signals	-

3.4.3.2 Configuration

The configuration of the system bus settings and the functions of the analog inputs and outputs is made via a 12-part DIP switch element. Both analog inputs are differential inputs. The input voltage is simultaneously measured in a unipolar and bipolar manner. The evaluation is unipolar or bipolar, according to the DIP switch setting, with or without offset, as a current or voltage input.

Range	Function	DIP switch meaning (DIP No.)	DIP switch combinations BIT2	BIT1	BIT0	Signal allocation
Configuration of analog IOs	Mode Second - IOE	2nd IOE Mode ***(12)***			0 1	first SK-…-IOE on FI second SK-…-IOE on FI
	Analog output AOUT	Aout Mode Bit 1 ***(11)*** Aout Mode Bit 0 ***(10)***		0 0 1 0	0 1 0 1	0 … 10V 2 … 10V 0 … 20mA 4 … 20mA
	Analog input AIN2	Ain2 Mode Bit 2 ***(09)*** Ain2 Mode Bit 1 ***(08)*** Ain2 Mode Bit 0 ***(07)***	0 0 0 1 1	0 0 1 0 0	0 1 0 0 1	0 … 10V 2 … 10V -10 … 10V 0 … 20mA 4 … 20mA
	Analog input AIN1	Ain1 Mode Bit 2 ***(06)*** Ain1 Mode Bit 1 ***(05)*** Ain1 Mode Bit 0 ***(04)***	0 0 0 1 1	0 0 1 0 0	0 1 0 0 1	0 … 10V 2 … 10V -10 … 10V 0 … 20mA 4 … 20mA
Bus - Configuration	Addressing System bus	S-Bus Addr. Bit 1 ***(03)*** S-Bus Addr. Bit 0 ***(02)***		0 0 1 1	0 1 0 1	Address 20 (for FI0 Addr. 32)* Address 21 (for FI1 Addr. 34)* Address 22 (for FI2 Addr. 36)* Address 23 (for FI3 Addr. 38)*
	System bus termination resistor	S-Bus term. ***(01)***			0 1	not set set

*for DIP12 = ON: Address 10 … 13 instead of 20 … 23

NOTE

Up to hardware version V1.1 R1 and software version V1.0 R1 <u>of the I/O extension</u> the setpoint of the analog output could be inverted via DIP switch No. 12:

DIP12 setting "OFF": 100% setpoint = 10V 0% setpoint = 0V

DIP12 setting "ON": 100% setpoint = 0V 0% setpoint = 10V

With newer versions, this setting is made in parameter (P163) "Inversion AOut".

NOTE

The setting of the DIP switches is only read out during the initialisation phase. Changes made while running are therefore not taken into account.

The side of the DIP switch element corresponding to "ON" should be checked (see label on the DIP switch element) as for process reasons, this may vary during the manufacture of the module.

3.4.3.3 Signal status LEDs

The statuses shown by the LED can be read out with the aid of a parameterisation tool from Getriebebau Nord (NORDCON software, SimpleBox, ParameterBox) and of course via the information parameter (P173) "Module Status" (Section 6.3.2).

Displays specific to the module

The status of the Technology Unit or the system bus is indicated by the LEDs **DS** and **DE**.

LED (green) DS → **D**evice **S**tate	**LED** (red) DE → **D**evice **E**rror	**Meaning** ... slow flashing = 2Hz (0.5s cycle) ... quick flashing = 4Hz (0.25s cycle)
OFF	OFF	Technology Unit not ready, no control voltage
ON	OFF	Technology Unit ready, no error, at least one frequency inverter is communicating via the system bus
ON	Flashing 0.25s	Technology Unit ready, however →one or more of the connected frequency inverters is in error status
Flashing 0.25s	OFF	Technology Unit ready and at least one further participant is connected to the system bus, however, → there is no frequency inverter on the system bus (or the connection is interrupted) → Address error of one or more system bus participants
Flashing 0.25s	Flashing 0.25s Flashing interval **1** x - 1s pause	System bus is in "Bus Warning" status → Communication on the system bus faulty or → no other participant on the system bus
Flashing 0.25s	Flashing 0.25s Flashing interval **2** x - 1s pause	→ System bus is in "Bus Off" status or → the 24V voltage supply to the system bus has been interrupted during operation
Flashing 0.25s	Flashing 0.25s Flashing interval **3** x - 1s pause	→ no 24V voltage supply to the system bus (System bus is in "Bus Off" status)
Flashing 0.25s	Flashing 0.25s Flashing interval **4** x - 1s pause	Module fault → EEPROM fault
Flashing 0.25s	Flashing 0.25s Flashing interval **5** x - 1s pause	Module fault → AOUT error (analog output) → DIP switch configuration error
OFF	Flashing 0.25s Flashing interval **1...7** - 1s pause	System error, internal program execution fault → EMC interference (observe wiring guidelines!) → Module faulty

I/O displays

The status of the additional digital inputs on the I/O module SK CU4-IOE is indicated by the relevant LEDs.

I/O channel	Status display	Meaning
	LED (green)	
Digital input 1	**ON**	**High** potential on terminal ***C1***
D1	OFF	**Low** potential on terminal ***C1***
Digital input 2	**ON**	**High** potential on terminal ***C2***
D2	OFF	**Low** potential on terminal ***C2***

3.4.3.4 Termination resistor

Termination of the system bus is carried out at both of its physical ends by switching in the relevant termination resistors (DIP switches). If the IO module forms such an end, the relevant DIP switch "S-Bus term." must be set to "ON".

3.4.3.5 Addressing

Up to eight I/O modules can be used on a system bus. By assignment of a specific address and designation of the "first" or "second" or "second" module, up to two I/O modules can be assigned to each frequency inverter. Alternatively, there is also the possibility of making one or two I/O modules available to up to four frequency inverters in parallel (→ Broadcast mode).

It must be noted:

- Addresses: Setting exclusively via DIP switch (No.: 02 and 03) in binary code („S-Bus Addr. Bit 0“ and „S-Bus Addr. Bit 1“)
- Definition of 1st or 2nd I/O module: Setting exclusively via DIP switch (No.: 12) ("2nd IOE Mode")
- Changes of address: only become effective after switching the I/O module off and on again
- With the use of two I/O modules for each frequency inverter it does not matter whether these are two SK CU4-IOE modules, two SK TU4-IOE modules or one of each modules.
- Up to hardware version V1.1 R1 and firmware version V1.0 R1 of the I/O - extension and firmware version V1.1 R2 of the frequency inverter only the evaluation of one I/O - expansion per frequency inverter is possible.

NOTE

Care must be taken that each address is only assigned once. In a CAN-based network (See also Section 9.7), the double assignment of addresses may lead to misinterpretation of the data and therefore undefined activities in the system.

3.4.3.6 Assignment of functions

The assignment of functions for the digital and analog inputs and outputs is made in the following parameters of the frequency inverter.

Parameter	Function designation
P400	Setpoint input function
P401	External analog input mode
P402	External analog input matching 0%
P403	External analog input matching 100%
P417	Offset analog output
P418	Function analog output
P419	Standardisation, analog output
P480	Function of BUS IO In bits
P481	Function of BUS IO Out bits
P482	Standardisation of BUS IO Out bits
P483	Hysteresis of BUS IO Out bits

The parameters of the IO module are used exclusively for information and testing purposes. Exception:

- (P161) (→ Matching of the filter settings for the IO signals),
- (P162) (→ Toggling between normal and broadcast operation) and
- (P163) (→ Inversion of the analog output signal)

3.4.3.7 Broadcast operation

In "broadcast mode" (parameter (P162)) it is possible to make up to two I/O - modules available in parallel for a maximum of four frequency inverters. The prerequisite for this is that the FIs are on a common system bus and no frequency inverter address has been assigned more than once (see Section 5.1.1).

The frequency inverters therefore have common access to the I/Os and evaluate the input signals according to their own FI parameterisation. Output signals from these frequency inverters, which are sent to the common I/O module are subjected to an "OR" logic internally by the module. I.e. a digital output (SK TU4-IOE-…) is set as soon as one of the four frequency inverters accesses it. In addition, the highest analog value is available via the analog output of the I/O extension module.

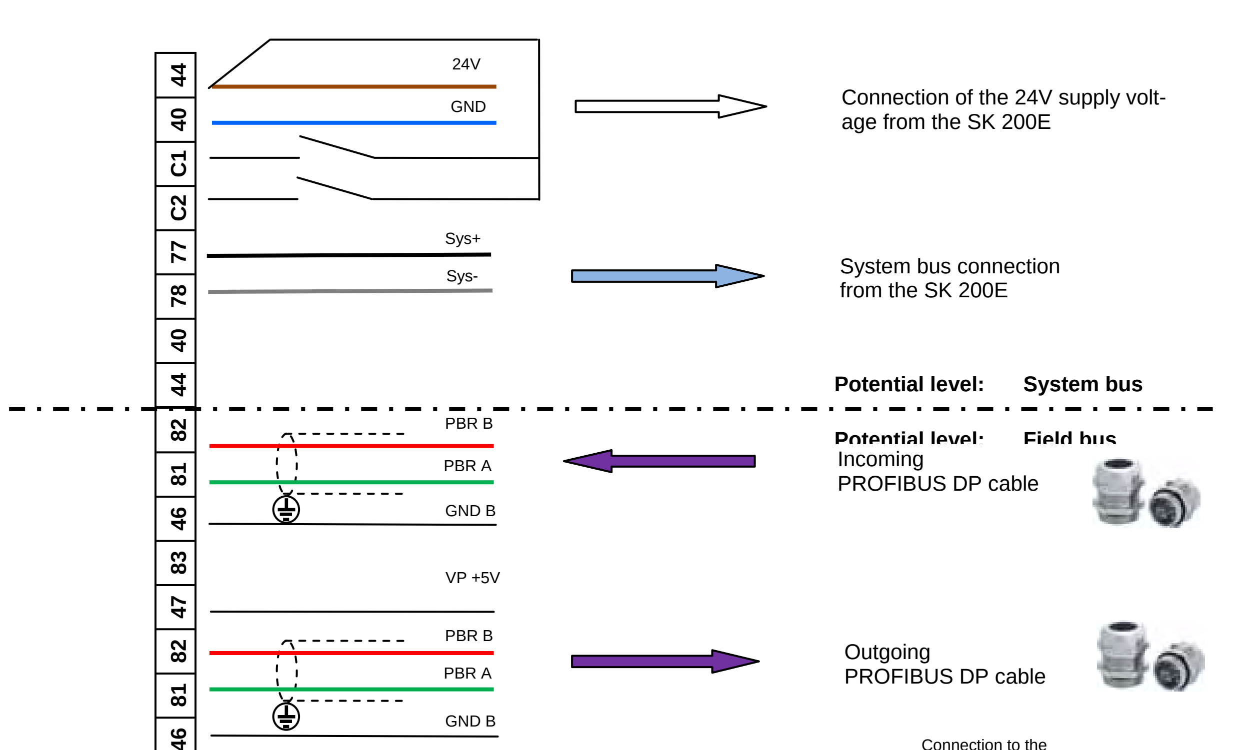
3.4.4 PROFIBUS DP, SK CU4-PBR

Up to four connected frequency inverters can be managed by the internal PROFIBUS DP module (control, status messages, parameterisation and diagnosis).

- Baud rate: max. 12 MBaud
- Protocol: DPV 0 and DPV 1
- 2x digital inputs
- Automatic detection: PPO type, baud rate
- DIP switches for: addressing, bus termination
- Status LEDs: Module status, module error, bus status, bus error, Dig. In 1, Dig. In 2

The terminal block of the Customer Unit SK CU4-PBR… is divided into two potential levels.

Up to 2 sensors can be connected via the terminal block (terminals C1 and C2).



Connection to the terminal block of the SK CU4-PBR

NOTE

Looping of the 24V supply voltage **(terminals 40/44)** is in principle possible, however, a maximum current load of **2A** for the **SK CU4-PBR** must not be exceeded!

Detailed information about operation via PROFIBUS DP can be found in the relevant supplementary manual BU0220.

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Details of the control connections

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
44 24V	external 24V supply (module, field and system bus level)	24VDC ±20% ≈ 90mA protected against reverse polarity Max. permissible current load: 2A	Connection for module supply voltage and 24V source for the digital inputs (DIN1 and DIN2)	-
40 GND	Reference potential for digital signals			-
C1 DIN1	Digital input 1 (I/O PROFIBUS DP DIN1)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1 ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2, Type 1	P174
C2 DIN2	Digital input 2 (I/O PROFIBUS DP DIN2)			P174
77 Sys+	System bus data cable +		System bus interface	-
78 Sys-	System bus data cable -			-
40 GND	Reference potential for digital signals	24VDC ±20% ≈ 90mA protected against reverse polarity Max. permissible current load: 2A	Connection for module supply voltage and source for the digital inputs (DIN1 and DIN2)	-
44 24V	external 24V supply (module, field and system bus level)			-
Potential separation				
82 PBR B (incoming)	Bus + (red wire) RxD/TxD-P	RS485 transfer technology	The use of a twisted, shielded two-wire cable / Profibus cable type A is strongly recommended	-
81 PBR A (incoming)	Bus - (green wire) RxD/TxD-N			-
46 GND PBR	Data ground Bus			-
83 RTS	Ready to send			-
47 +5V PBR	5V bus supply voltage	internal Profibus voltage supply	Note: Should not be used externally!	-
82 PBR B (outgoing)	Bus (red wire) RxD/TxD-P	RS485 transfer technology	The use of a twisted, shielded two-wire cable / Profibus cable type A is strongly recommended	-
81 PBR A (outgoing)	Bus (green wire) RxD/TxD-N			-
46 GND PBR	Data ground			-

3.4.5 CANopen, SK CU4-CAO

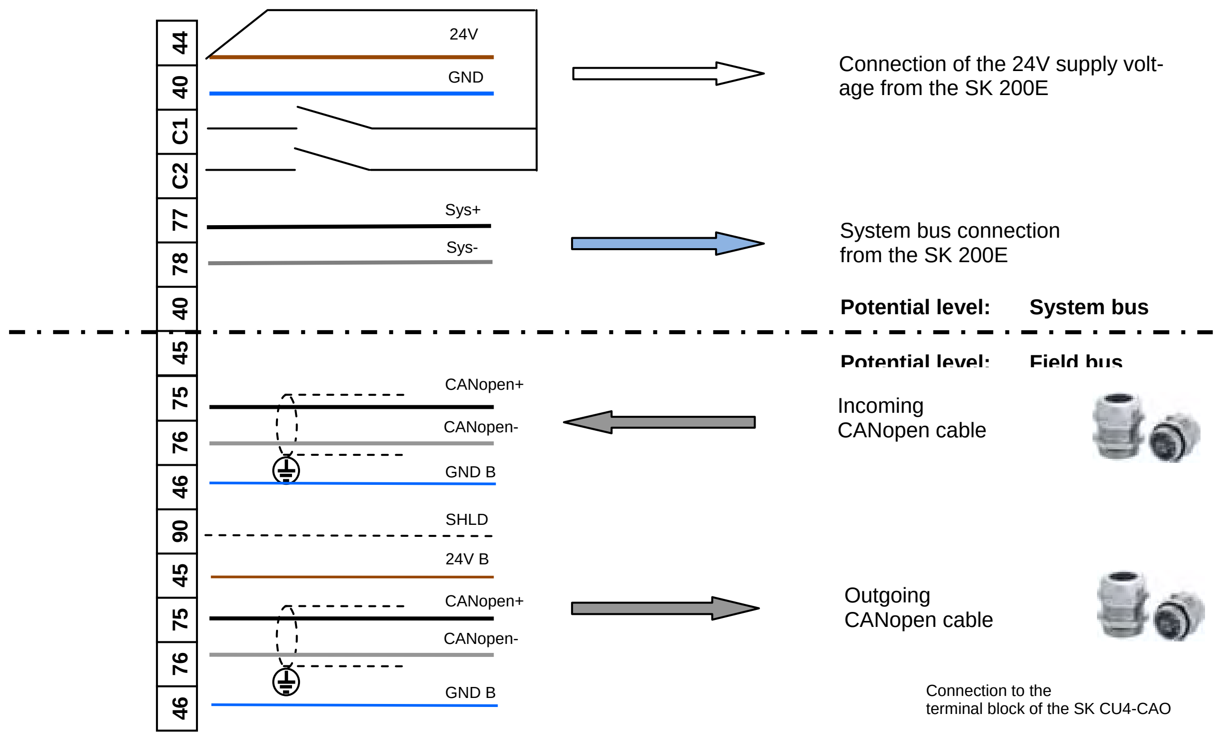
Up to four connected frequency inverters can be managed by the internal CANopen module via CANopen (control, status messages, parameterisation and diagnosis).

- Baud rate: max. 1 MBaud
- Protocol: DS301 and DSP 402 1
- 2x digital inputs
- DIP switches for: addressing, bus termination, baud rate
- Status LEDs: Module status, module error, bus status, bus error, Dig. In 1, Dig. In 2

Similar to illustration

The terminal block of the Customer Unit SK CU4-CAO is divided into two potential levels.

Up to 2 sensors can be connected via the terminal block (terminals C1 and C2).



Connection to the terminal block of the SK CU4-CAO

NOTE

Looping of the 24V supply voltage **(terminals 45/46)** or also **(terminals 44/40)** is in principle possible, however, a maximum current load of **2A** for the **SK CU4-CAO** must not be exceeded!

Detailed information about operation via CANopen can be found in the relevant supplementary manual BU0260.

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Details of the control connections

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
44 24V	external 24V supply (module, system bus level)	24VDC ±20% ≈ 50mA protected against reverse polarity Max. permissible current load: 2A	Connection for module supply voltage and 24V source for the digital inputs (DIN1 and DIN2)	-
40 GND	Reference potential for digital signals			-
C1 DIN1	Digital input 1 (I/O CANopen DIN1)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1 ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2, Type 1	P174
C2 DIN2	Digital input 2 (I/O CANopen DIN2)			P174
77 Sys+	System bus data cable +		System bus interface	-
78 Sys-	System bus data cable -			-
40 GND	Reference potential for digital signals			-
Potential separation				
45 24V Bus	24V bus supply voltage (Field bus)	For CANopen - Bus 24VDC ±20% ≈ 50mA, protected against reverse polarity	Version to terminal 44 is electrically isolated. CANopen bus supply is essential	-
75 CANopen+ (incoming)	Bus + CAN H	RS485 transfer technology	The use of a twisted, shielded two-wire cable is strongly recommended	-
76 CANopen- (incoming)	Bus - CAN L			-
46 GND Bus	Data ground Bus		BUS reference potential Version to terminal 40 is electrically isolated	-
90 SHLD	Bus shield			-
45 24V Bus	24V bus supply voltage	See above (terminal 45).	Version to terminal 44 is electrically isolated. CANopen bus supply is essential	-
75 CANopen+ (outgoing)	Bus + CAN H	RS485 transfer technology	The use of a twisted, shielded two-wire cable is strongly recommended	-
76 CANopen- (outgoing)	Bus - CAN L			-
46 GND Bus	Data ground Bus		BUS reference potential Version to terminal 40 is electrically isolated	-

3.4.6 DeviceNet, SK CU4-DEV

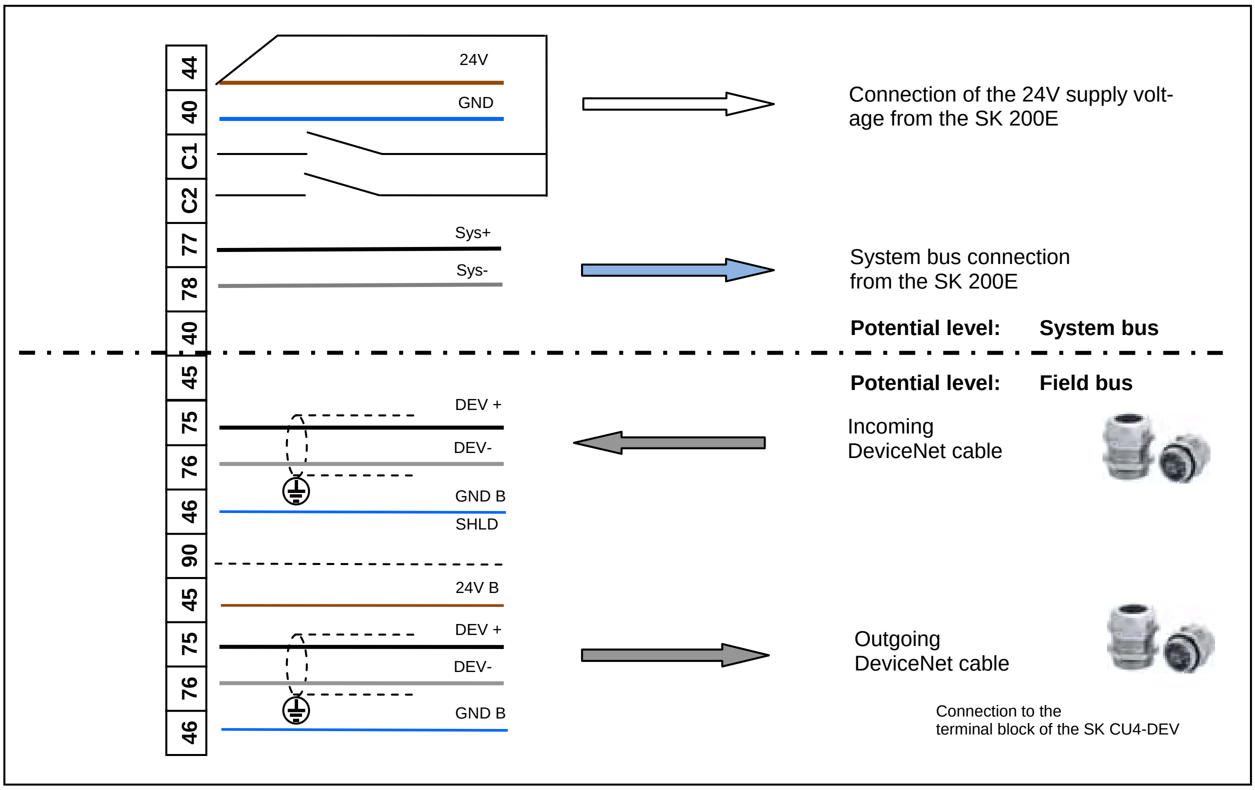
Up to four connected frequency inverters can be managed by the internal DeviceNet module via DeviceNet (control, status messages, parameterisation and diagnosis).

- Baud rate: Max. 500 kBaud
- Protocol: AC-Drive and NORD-AC
- 2x digital inputs
- DIP switches for: addressing, baud rate
- Status LEDs: Module status, module error, bus status, bus error, Dig. In 1, Dig. In 2

Similar to illustration

The terminal block of the Customer Unit SK CU4-DEV is divided into two potential levels.

Up to 2 sensors can be connected via the terminal block (terminals C1 and C2).



NOTE

Looping of the 24V supply voltage **(terminals 45/46)**or also **(terminals 44/40)** is in principle possible, however, a maximum current load of **2A** for the **SK CU4-DEV** must not be exceeded!

Detailed information about operation via DeviceNet can be found in the relevant supplementary manual BU0280.

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Details of the control connections

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
44 24V	external 24V supply (module, system bus level)	24VDC ±20% ≈ 50mA protected against reverse polarity	Connection for module supply voltage and 24V source for the digital inputs (DIN1 and DIN2)	-
40 GND	Reference potential for digital signals			-
C1 DIN1	Digital input 1 (I/O DeviceNet DIN1)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1 ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2, Type 1	P174
C2 DIN2	Digital input 2 (I/O DeviceNet DIN2)			P174
77 Sys+	System bus data cable +		System bus interface	-
78 Sys-	System bus data cable -			-
40 GND	Reference potential for digital signals			-
Potential separation				
45 24V Bus	24V bus supply voltage (Field bus)	For DeviceNet - Bus 24VDC ±20% ≈ 50mA, protected against reverse polarity	Version to terminal 44 is electrically isolated. DeviceNet bus supply is essential	-
75 DVN + (incoming)	Bus + DeviceNet H	RS485 transfer technology	The use of a twisted, shielded two-wire cable is strongly recommended	-
76 DVN - (incoming)	Bus - DeviceNet L			-
46 GND Bus	Data ground		Bus reference potential Version to terminal 40 is electrically isolated	-
90 SHLD	Shield		Data cable shielding	-
45 +24V Bus	24V bus supply voltage (Field bus)	See above (terminal 45).	See above (terminal 45).	-
75 DVN + (outgoing)	Bus + DeviceNet H	RS485 transfer technology	The use of a twisted, shielded two-wire cable is strongly recommended	-
76 DVN - (outgoing)	Bus - DeviceNet L			-
46 GND Bus	Data ground		See above (terminal 46).	-

3.5 Details of external Technology Units SK TU4-…

The Technology Units are divided into two different groups. The BUS group includes all the Bus modules and the I/O extension. These are connected to the SK 200E via the system bus.

The NET group includes the Mains Unit and PotentiometerBox modules. These are each equipped with a 24V mains unit for the supply of the SK 200E and provide the facility processing analog signals.

Because of the very wide variety of functions, these two groups of devices require different adapter units.

3.5.1 Adapter Unit SK TI4-TU-BUS /-NET

Bus modules = SK TI4-TU-BUS
Mains unit modules = SK TI4-TU-NET

SK TI4-TU-BUS

SK TI4-TU-NET

Feature	Bus modules	Mains Unit modules
Designation of Adapter Unit	SK TI4-TU-BUS	SK TI4-TU-NET
Designation of Technology Units	SK-TU4-PBR-… SK-TU4-CAO-… SK-TU4-DEV-… SK-TU4-IOE-…	SK-TU4-POT-… SK-TU4-24V-…
24V supply required	Yes	No
24V supply integrated	No	Yes
System bus connection	Yes	No
Motor mounting possible	Yes	Yes
Mounting near to motor possible	Yes, with wall-mounting kit *SK TIE4-WMK-TU*	Yes, with wall-mounting kit *SK TIE4-WMK-TU*

All connections are made via the Adapter Unit. This also includes the customer's control of the module and the connection of the module to the SK 200E. Parallel to this, the digital inputs and outputs of the SK 200E are also available.

The relevant Technology Unit is attached to the appropriate Adapter Unit with screws.

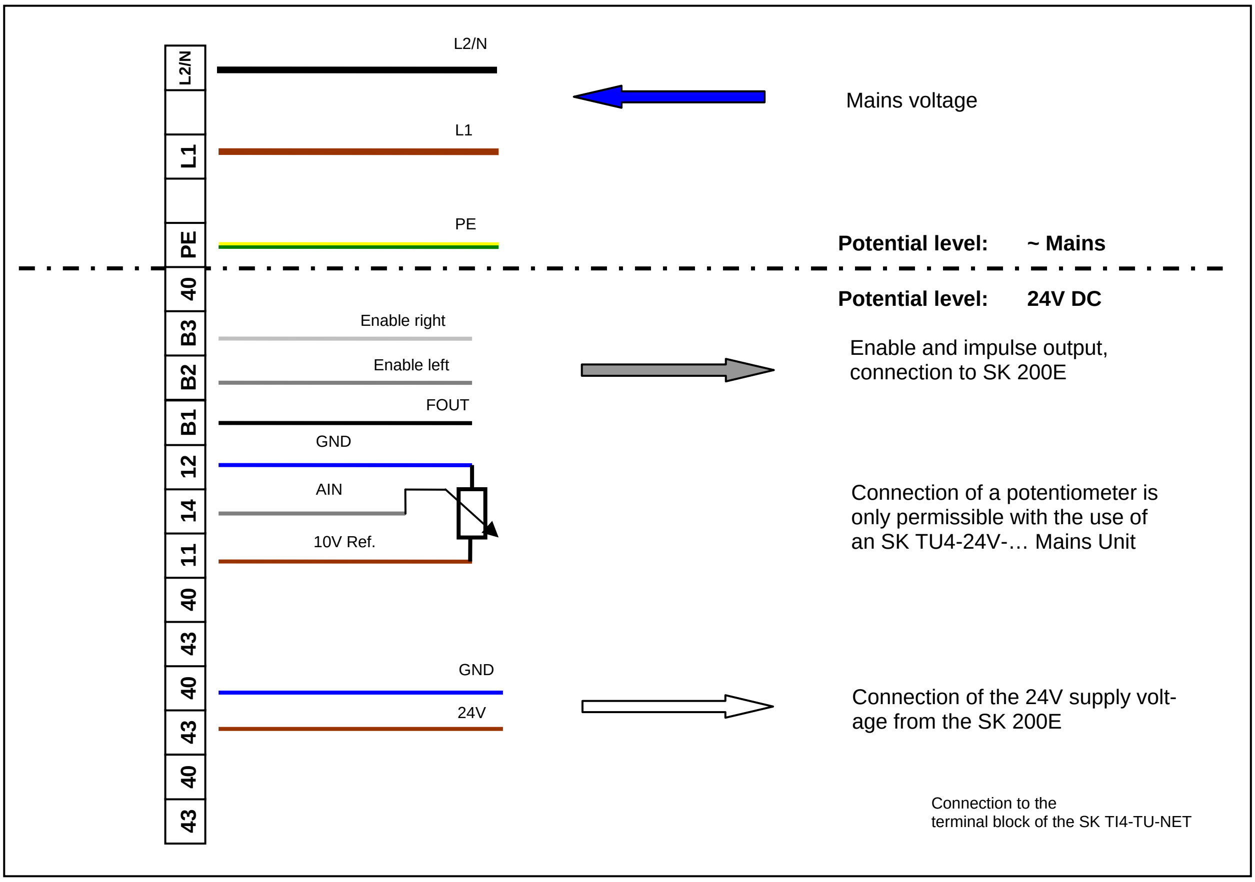
Installation information can be found in Section 3.2.2.

3.5.1.1 SK T14-TU-BUS connections

The precise connections of the 36 spring-loaded terminals depend on the Technology Unit used. Details can be found in the relevant sections for the Technology Units

3.5.1.2 SK TI4-TU-NET Connections

The terminal block of the Adapter Unit SK TI4-TU-NET is divided into two potential levels.



Details of the control connections

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
43 VO/24V	24V supply	24VDC ±10% max. 420mA (total) integrated short-circuit monitoring, limited overtemperature and overload monitoring	Supply voltage (output) for the supply of an SK 200E or other module with 24V.	-
40 GND	Reference potential			-
43 24V	24V supply			-
40 GND	Reference potential			-
43 24V	24V supply			-
40 GND	Reference potential			-
11 +10V	10V reference voltage	10V ± 0.2V Max. load 5mA	**Only in combination with SK TU4-24V-…** For connection of potentiometer 5 - 10kΩ. A 500Ω burden resistor for the evaluation of 0/4 - 20mA signals is contained in the enclosed bag.	-
14 AIN+	Analog input positive	0 … 10V, Resolution: 8Bit Accuracy: 0.2V		-
12 0V GND analog	Analog Ground	Reference potential for analog signals		-
B1 FOUT	Frequency output	SPS compatible in compliance with EN61131-2 Low: 0V, High: 24V Pulse frequency: ~ 1 - 32kHz	Pulses for evaluation via the digital input function P420 [02]/[03] = 26/27 and the analog meaning in P400 [-06]/[-07]. With the use of an SK TU4-24V-... this outputs the setpoint value of the analog input. With the use of an SK TU4-POT-... this outputs the setpoint value of the integrated potentiometer.	P420 P400
B2 ON-L	Digital output, enable left		**Only in combination with SK TU4-POT-…** Control via "Left" key	P420
B3 ON-R	Digital output, enable right		**Only in combination with SK TU4-POT-…** Control via "Right" key	P420
40	Reference potential			-
Potential separation				
PE	PE, Earth		Does not need to be connected. Is already connected to the module housing.	-
			Mains connection, 100 - 240V or 380 - 500V, depending on the module	-
L1	Mains connection 1.Phase			-
				-
L2/N	Mains connection 2. Phase			-

3.5.2 Mains Unit, SK TU4-24V-…

The Mains Unit is used for the production of the 24V control voltage for the FI from the available mains voltage (115V/ 230V/380V/500V). With this, a separate external 24V control voltage is not necessary.

An analog output is also available for the connection of a potentiometer.

- Mains unit for 100-240V, SK TU4-24V-123-B
- Mains unit for 380-500V, SK TU4-24V-140-B
- +24V- output voltage
- 1x analog input (e.g. potentiometer)
- 1x impulse output
- Status LED = 24V
- Max. permissible continuous current: 420mA

The Mains unit SK TU4-24V-…can only be used in combination with an SK TI4-TU-NET adapter unit.

Details of the control connection are described in the Section for the Adapter Unit (Section 3.5.1.2)

A connection and parameterisation example is described in Section 3.4.1.

To process current setpoint values (0(4)-20mA), the enclosed bag contains a 500Ω resistor, for connection between terminals 11 and 14. Matching of the relevant input of the frequency inverter is made via parameter (P420).

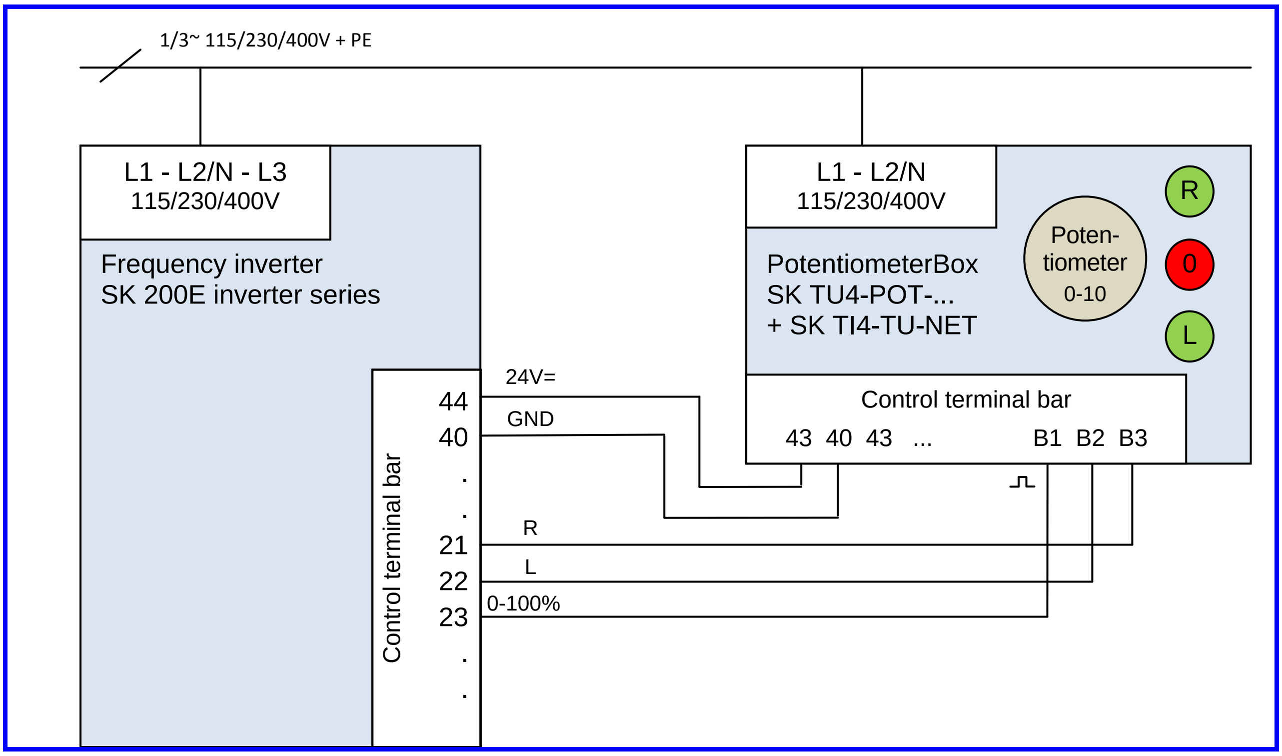
Setpoint	Parameter [Array]	Setting
0 … 20mA	P420 [-02] or [-03]	{26}
4 … 20mA	P420 [-02] or [-03]	{27}

3.5.3 PotentiometerBox SK TU4-POT-…

The PotentiometerBox SK TU4-POT enables simple motor speed and direction control via a series SK 200E frequency inverter. LEDs on the enable keys indicate the selected enable direction. In addition, with the integrated mains unit, the 24V control voltage for the FI is produced from the mains voltage (115V/230V/380V/500V). With this, a separate external 24V control voltage is not necessary.

- Mains unit for 100-240V, SK TU4-POT-123-B
- Mains unit for 380-500V, SK TU4-POT-140-B
- +24V- output voltage
- Button ON R / OFF / ON L
- Setpoint potentiometer 0…100%
- 1 x impulse output (for setpoint)
- Status LED = 24V, enable R, enable L
- Max. permissible continuous current (Mains Unit): 420mA

Connection plan, example:



DIP switch settings:

DIP3 = off, DIP4 = on, DIP5 = off
(With this, no further parameter settings are necessary!
See also Section 5.1.2)

or

recommended
parameter setting, DIP1-8 = off:

P400 [07] = 1 P420 [02] = 2
P420 [01] = 1 P420 [03] = 26

3.5.4 I/O Extension, SK TU4-IOE, ...-M12

The internal I/O units can record sensor and actuator signals. These can be used for a drive function or forwarded to a host bus system (e.g. Profibus or CANopen). Up to two I/O modules (and combinations: 1 x SK CU4-IOE and 1 x SK TU4-IOE) can be connected to an inverter (up to hardware version V1.1 R1 and firmware version V1.0 R1 of the I/O - extension and firmware version V1.1 R2 of the frequency inverter only the evaluation of one I/O - extension is possible for each frequency inverter.).

The I/O extension SK TU4-IOE-… requires an SK TI4-TU-BUS Adapter Unit. Communication with the frequency inverter(s) is via the system bus. All connections (power supply, system bus, sensors,...) are made via the terminal block of the BUS Adapter Unit. The M12-versions of the I/O - extension (SK TU4-IOE-**M12**) also provide M12 connections for each of the digital inputs and outputs on the front side.

- 4x digital inputs
- 2x analog inputs
- 2x digital outputs
- 1x analog output
- Status LEDs: BG status, BG fault
- Additional LEDs, M12 version: Dig. In 1 - 4, Dig. Out 1 - 2
- DIP switches for selection
  0 - 10V, -10 - 10V, 0 - 20mA, 4 - 20mA
- DIP switches for: addressing, bus termination

Control connections SK TU4-IOE(-…)

The double spring terminal block of the BUS -Adapter Unit **is** colour coded to indicate the **three** different **potential levels**.

A separate voltage source should be used to supply the DOs. However, it is also possible to implement the supply of the DOs by bridging the <u>24V o</u> and <u>GND o</u> with one of the terminals of the system bus level (<u>24V</u> and <u>GND</u>). However, in this case it should be noted that this produces an increased risk of errors on the bus cables.

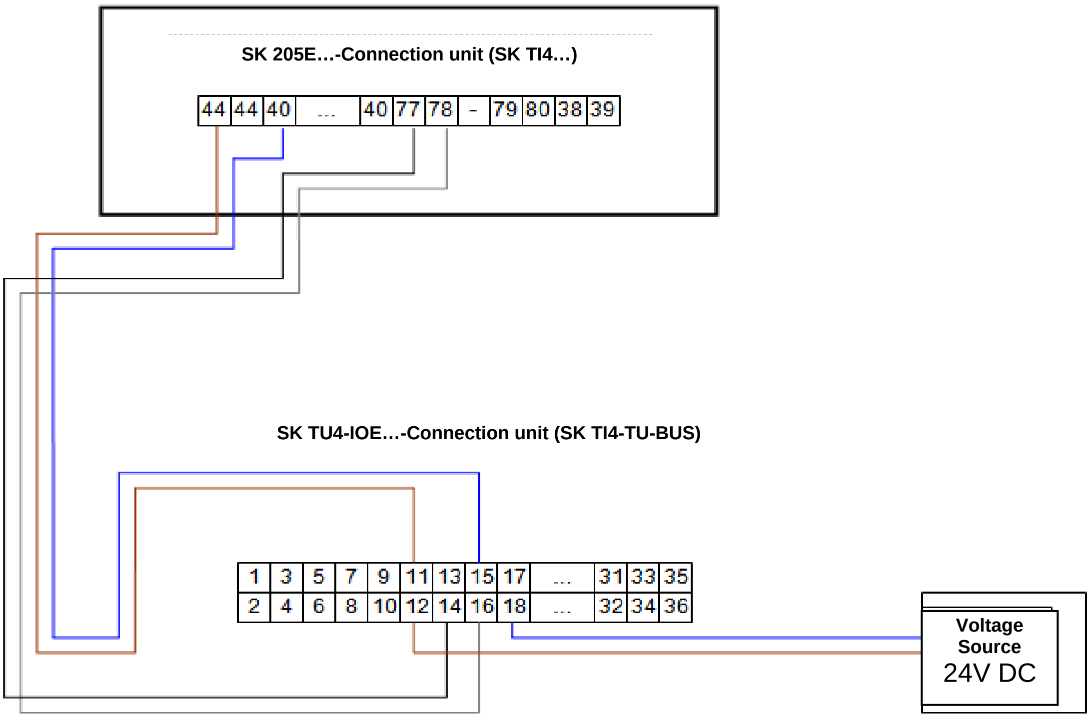
The sensors and actuators are connected to the terminal block. Alternatively, the SK TU4-IOE-**M12** module enables connection of the digital I/Os via the M12 round plug connectors (Socket, 5-pin, A-coded) on the front of the module.

Double *use* of the inputs via the terminal block <u>and</u> the M12 round plug *should be avoided*.

Potential level: Analog I/O					Potential level: System bus										Potential level: DOs		
Analog IOs					**System bus level and digital inputs**										**Digital outputs**		
10VA	AIN1+	AIN1-	GND A	AOUT	24V	24V (as 11)	GND	GND	DIN 1	GND	24V (as 11)	DIN 2	GND	24V (as 11)	24V o DO	DO 1	GND o DO
1	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**	**33**	**35**
2	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**	**32**	**34**	**36**
10VA	AIN2+	AIN2-	GND A	PE	24V (as 11)	Sys+	Sys-	GND	DIN 3	GND	24V (as 11)	DIN 4	GND	24V (as 11)	GND o DO	DO 2	GND o DO

Terminal block of the bus Adapter Unit SK TI4-TU-BUS and assignment of functions

Example for the connection of SK TU4-IOE to SK 200E



NOTE

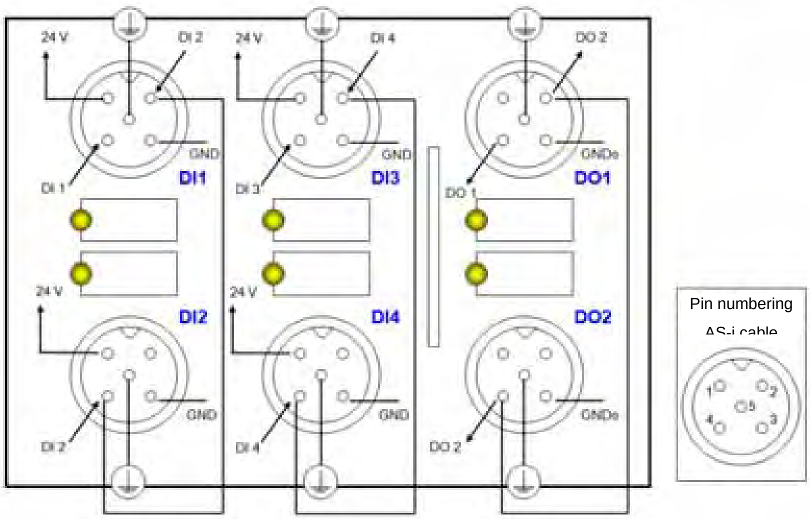
Looping of the 24V supply voltage **(terminals 11/15)** is in principle possible, however, a maximum current load of **3A** for the **SK TU4-IOE(-…)** must not be exceeded!

Detail of the M12 connections of the SK TU4-IOE-M12

The special wiring of the M12 round plug connectors enables the connection of both single and double sensors, which are equipped with normal M12 system plugs with standard sensor/actuator wiring.

If the M12 round plug connectors are used, the terminal block connections for the digital inputs (terminals 19, 20, 25, 26) must not be used.

Wiring of the M12-plug connector to SK TU4-…-M12



3.5.4.1 Details of the control connections

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
1 +10V 2	10V reference voltage	10V ± 0.1V Max. load 20mA	Potentiometer supply voltage	-
3 AIN1+	Analog input 1 positive	Version as differential input Resolution 12Bit Accuracy: 0.1V	Functions: 0V … 10V / -10V … +10V / 0mA … 20mA / 4mA … 20mA (selection via DIP switch)	P400 P176
5 AIN1-	Analog input 1 negative			P400 P176
4 AIN2+	Analog input 2 positive	Version as differential input Resolution: 12Bit Accuracy: 0,1V		-
6 AIN2-	Analog input 2 negative			-
7 0V GND analog 8	Analog Ground		Reference potential for analog signals	-
9 AOUT	Analog Out	Resolution: 10Bit Accuracy 0.25V Max. load 5mA	Functions: 0V … 10V / -10V … +10V / 0mA … 20mA / 4mA … 20mA (selection via DIP switch)	P400 P176
10 PE	PE			-
Potential separation				
11 24V 12 13	external 24V supply (module, system bus level)	24VDC ±20% ≈ 1100mA protected against reverse polarity Max. permissible current load: 3A	Connection for module supply voltage and 24V source for the digital inputs (DIN1 to DIN4)	-
15 GND 17 18	Reference potential for digital signals			-
14 Sys+	System bus data cable +		System bus interface	-
16 Sys-	System bus data cable -			-
19 DIN1	Digital input 1 (I/O IO extension DIN1)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2, Type 1	P480 P174
20 DIN3	Digital input 3 (I/O IO extension DIN3)			P480 P174

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
21 GND 22	Reference potential for digital signals	As for terminal 15		-
23 24V 24	external 24V supply	As for terminal 11		-
25 DIN2	Digital input 2 (I/O IO extension DIN2)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2 Type 1	P480 P174
26 DIN4	Digital input 4 (I/O IO extension DIN4)			P480 P174
27 GND 28	Reference potential for digital signals	As for terminal 15		-
29 24V 30	external 24V supply	As for terminal 11		-
Potential separation				
31 24V o	external 24V supply of the DOs	24VDC ±20% up to 1A, according to load protected against reverse polarity	External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to 24V terminal	-
32 GND o	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-
33 DO1	Digital output 1 (I/O IO extension DO1)	Low = 0V High: 24V Rated current: 500mA each	The digital outputs should be used with a separate 24V supply. Outputs compliant with EN 61131-2	P481 P175
34 DO2	Digital output 2 (I/O IO extension DO2)			P481 P175
35 GND o 36	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-

3.5.4.2 Configuration

Configuration of the external I/O extension (SK TU4-IOE-…) is carried out in the same way as for the internal I/O - extension SK CU4-IOE. The relevant details are described in Section 3.4.3.2.

3.5.4.3 Signal status LEDs

The definition of the LED signals of the external I/O extension (SK TU4-IOE-…) corresponds to that for the internal I/O - extension SK CU4-IOE. The appropriate details are described in Section 3.4.3.3.

Exception: The signal statuses of the digital inputs and outputs (DI … / DO …) are only visualised with the M12 version (SK TU4-IOE-M12) (See also Section 3.5.4 "Details of the M12 connections of the SK TU4-IOE-M12").

I/O displays

I/O channel	Status display	Meaning
	LED (yellow)	
Digital input 1 **DI1**	**ON**	**High** potential on terminal ***19*** or the M12 socket ***DI1***
	OFF	**Low** potential on terminal ***19*** or the M12 socket ***DI1***
Digital input 2 **DI2**	**ON**	**High** potential on terminal ***25*** or the M12 socket ***DI2***
	OFF	**Low** potential on terminal ***25*** or the M12 socket ***DI2***
Digital input 3 **DI3**	**ON**	**High** potential on terminal ***20*** or the M12 socket ***DI3***
	OFF	**Low** potential on terminal ***20*** or the M12 socket ***DI3***
Digital input 4 **DI4**	**ON**	**High** potential on terminal ***26*** or the M12 socket ***DI4***
	OFF	**Low** potential on terminal ***26*** or the M12 socket ***DI4***
Digital output 1 **DO1**	**ON**	**High** potential on terminal ***33*** or the M12 socket ***DO1***
	OFF	**Low** potential output to terminal ***33*** or the M12 socket ***DO1***
Digital output 2 **DO2**	**ON**	**High** potential on terminal ***34*** or the M12 socket ***DO1***
	OFF	**Low** potential output to terminal ***34*** or the M12 socket ***DO1***

3.5.4.4 Termination resistor, addressing, assignment of functions, broadcast mode

The internal and external I/O extensions have identical functions, insofar as the procedure for configuration, addressing etc. of the SK TU4-IOE-… is carried out as for the SK CU4-IOE-…. (For details, see Sections 3.4.3.4 to 3.4.3.7).

3.5.5 PROFIBUS DP, SK TU4-PBR, ...-M12

Up to four connected frequency inverters can be managed by the external PROFIBUS DP module (control, status messages, parameterisation and diagnosis).

- Baud rate: max. 12 MBaud
- Protocol: DPV 0 and DPV 1
- 4x digital inputs
- 2x digital outputs
- Automatic detection: PPO type, baud rate
- DIP switches for: addressing, bus termination
- Status LEDs: Module status, module error, bus status, bus error, Dig.
- Additional LEDs, M12 version: Dig. In 1 - 4, Dig. Out 1 - 2

Control connections SK TU4-PBR(-…)

The double spring terminal block of the BUS -Adapter Unit **is** colour coded to indicate the **three** different **potential levels** .

A separate voltage source should be used to supply the DOs. However, it is also possible to implement the supply of the DOs by bridging the 24V o and GND o with one of the terminals of the system bus level (24V and GND). However, in this case it should be noted that this produces an increased risk of errors on the bus cables.

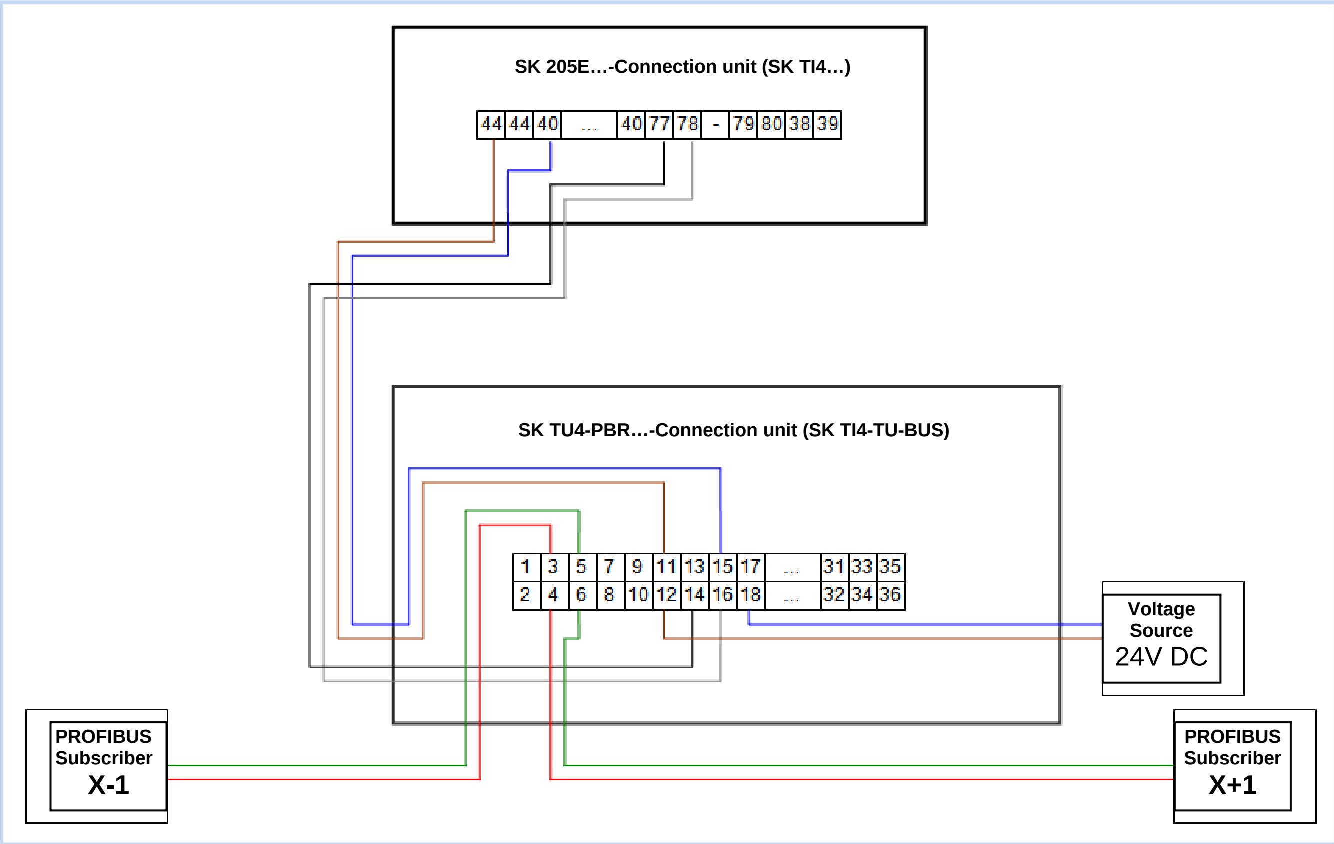
The sensors and actuators are connected to the terminal block. Alternatively, the SK TU4-PBR-**M12** module enables connection of the digital I/Os via the M12 round plug connectors (Socket, 5-pin, A-coded) on the front of the module.

Double *use* of the inputs via the terminal block and the M12 round plug *should be avoided*.

Potential level: Field bus					Potential level: System bus										Potential level: DOs		
Field bus level PROFIBUS DP					**System bus level and digital inputs**										**Digital outputs**		
24V PBR	PBR B IN	PBR A IN	GND B	RTS	24V (as 1)	24V (as 1)	GND	GND	DIN 1	GND	24V (as 1)	DIN 2	GND	24V (as 1)	24V O DO	DO 1	GND O DO
1	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**	**33**	**35**
2	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**	**32**	**34**	**36**
24V PBR	PBR B OUT	PBR A OUT	GND B	+5V PBR	24V (as 1)	Sys+	Sys-	GND	DIN 3	GND	24V (as 1)	DIN 4	GND	24V (as 1)	GND O DO	DO 2	GND O DO

Terminal block of the bus Adapter Unit SK TI4-TU-BUS and assignment of functions

Example for the connection of SK TU4-PBR to SK 200E



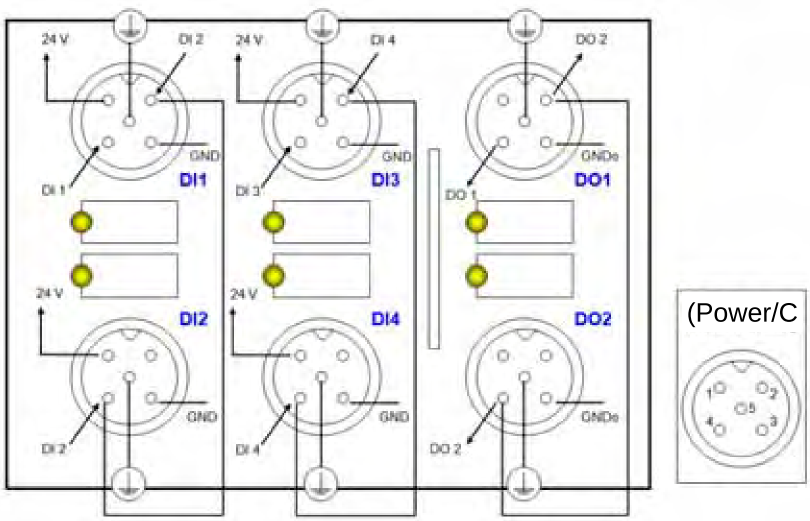
NOTE

Looping of the 24V supply voltage **(terminals 11/15)** is in principle possible, however, a maximum current load of **3A** for the **SK TU4-PBR(-…)** must not be exceeded!

Detail of the M12 connections of the SK TU4-PBR-M12

The special wiring of the M12 round plug connectors enables the connection of both single and double sensors, which are equipped with normal M12 system plugs with standard sensor/actuator wiring.

If the M12 round plug connectors are used, the terminal block connections for the digital inputs (terminals 19, 20, 25, 26) must not be used.



Wiring of the M12-plug connector to SK TU4-…-M12

Details of the control connections

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
1 24V PBR 2	external 24V supply (module, field and system bus level)	24VDC ±20% ≈ 900mA protected against reverse polarity Max. permissible current load: 3A	Connection for module supply voltage and 24V source for the digital inputs (DIN1 to DIN4)	-
3 PBR B (incoming) 4 (outgoing)	Bus + (red wire) RxD/TxD-N	RS485 transfer technology	The use of a twisted, shielded two-wire cable / Profibus cable type A is strongly recommended	-
5 PBR A (incoming) 6 (outgoing)	Bus - (green wire) RxD/TxD-P			-
7 GND PBR 8	Data ground Bus			-
9 RTS	Ready to send			-
10 +5V PBR	5V bus supply voltage	internal Profibus voltage supply	Note: Should not be used externally!	-
Potential separation				
11 24V 12 13	external 24V supply	As for terminal 1	Connection for module supply voltage and 24V source for the digital inputs (DIN1 to DIN4)	-
15 GND 17 18	Reference potential for digital signals			-
14 Sys+	System bus data cable +		System bus interface	-
16 Sys-	System bus data cable -			-
19 DIN1	Digital input 1 (I/O Profibus DIN1)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1ms Inputs compliant with EN 61131-2, Type 1	Each digital input has a reaction time of 1ms	P174
20 DIN3	Digital input 3 (I/O Profibus DIN3)			P174

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
21 GND 22	Reference potential for digital signals	As for terminal 15		-
23 24V 24	external 24V supply	As for terminal 1		-
25 DIN2	Digital input 2 (I/O Profibus DIN2)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1ms Inputs compliant with EN 61131-2, Type 1	Each digital input has a reaction time of 1ms	P174
26 DIN4	Digital input 4 (I/O Profibus DIN4)			P174
27 GND 28	Reference potential for digital signals		External supply voltage for system bus and digital inputs (DIN1 to DIN4)	-
29 24V 30	external 24V supply	As for terminal 1		-
Potential separation				
31 24V o	external 24V supply of the DOs	24VDC -/+20% up to 1A, according to load protected against reverse polarity	External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to 24V terminal	-
32 GND o	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-
33 DO1	Digital output 1 (I/O Profibus DO1)	Low = 0V High: 24V Rated current: 500mA each	The digital outputs should be used with a separate 24V supply.	P175
34 DO2	Digital output 2 (I/O Profibus DO2)			P175
35 GND o 36	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-

Detailed information about operation via PROFIBUS DP can be found in the relevant supplementary manual BU0220.

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3.5.6 CANopen, SK TU4-CAO, ...-M12

Up to four connected frequency inverters can be managed by the internal CANopen module via CANopen (control, status messages, parameterisation and diagnosis).

- Baud rate: max. 1 MBaud
- Protocol: DS301 and DSP 402 1
- 4x digital inputs
- 2x digital outputs
- DIP switches for: addressing, bus termination, baud rate
- Status LEDs: Module status, module error, bus status, bus error, Dig.
- Additional LEDs, M12 version: Dig. In 1 - 4, Dig. Out 1 - 2

Control connections SK TU4-CAO(-…)

The double spring terminal block of the BUS -Adapter Unit **is** colour coded to indicate the **three** different **potential levels** .

A separate voltage source should be used to supply the DOs. However, it is also possible to implement the supply of the DOs by bridging the 24V o and GND o with one of the terminals of the system bus level (24V and GND). However, in this case it should be noted that this produces an increased risk of errors on the bus cables.

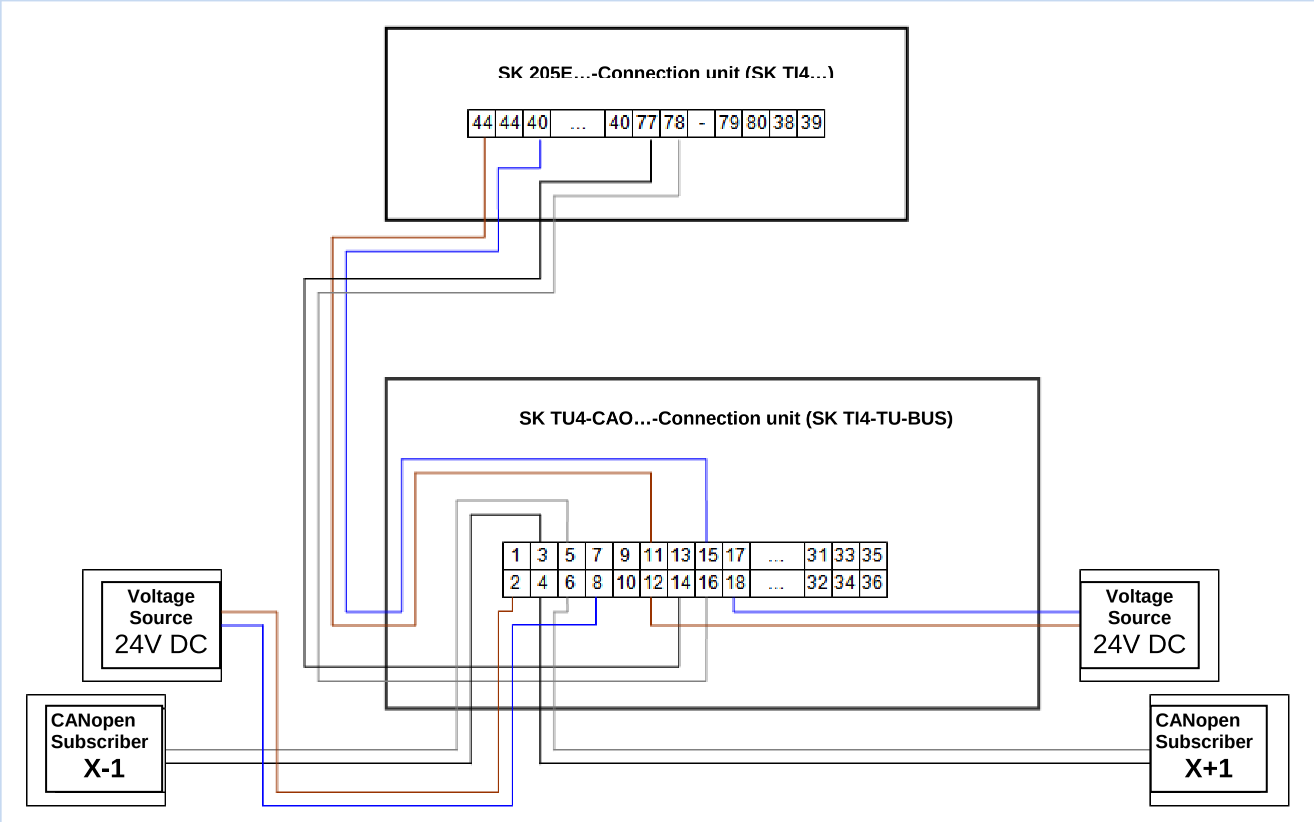
The sensors and actuators are connected to the terminal block. Alternatively, the SK TU4-CAO-**M12** module enables connection of the digital I/Os via the M12 round plug connectors (Socket, 5-pin, A-coded) on the front of the module.

Double *use* of the inputs via the terminal block and the M12 round plug *should be avoided*.

Potential level: Field bus					Potential level: System bus										Potential level: DOs		
Field bus level CANopen					**System bus level and digital inputs**										**Digital outputs**		
24V-B CAO	CAO+ IN	CAO- IN	GND B CAO	SHLD	24V	24V (as 11)	GND	GND	DIN 1	GND	24V (as 11)	DIN 2	GND	24V (as 11)	24V o DO	DO 1	GND o DO
1	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**	**33**	**35**
2	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**	**32**	**34**	**36**
24V-B CAO	CAO+ OUT	CAO- OUT	GND B CAO	PE	24V (as 11)	Sys+	Sys-	GND	DIN 3	GND	24V (as 11)	DIN 4	GND	24V (as 11)	GND o DO	DO 2	GND o DO

Terminal block of the bus Adapter Unit SK TI4-TU-BUS and assignment of functions

Example for the connection of SK TU4-CAO to SK 200E



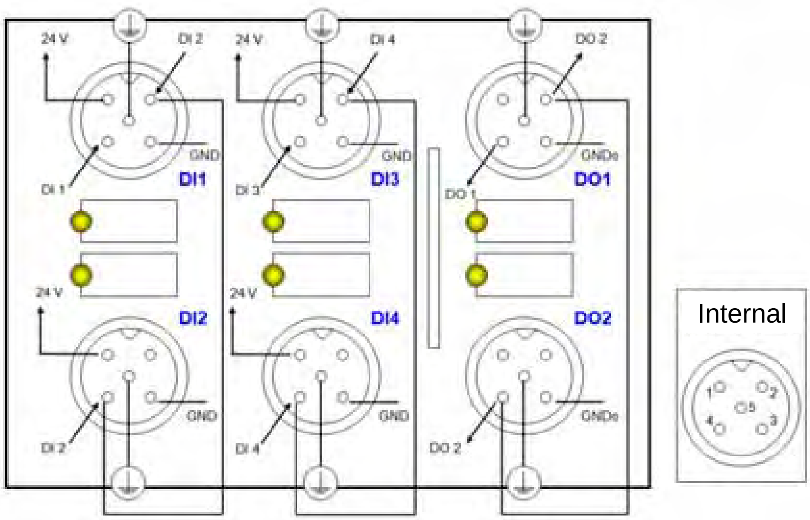
NOTE

Looping of the 24V supply voltage **(terminals 11/15)** is in principle possible, however, a maximum current load of **3A** for the **SK TU4-CAO(-…)** must not be exceeded!

Detail of the M12 connections of the SK TU4-CAO-M12

The special wiring of the M12 round plug connectors enables the connection of both single and double sensors, which are equipped with normal M12 system plugs with standard sensor/actuator wiring.

If the M12 round plug connectors are used, the terminal block connections for the digital inputs (terminals 19, 20, 25, 26) must not be used.



Wiring of the M12-plug connector to SK TU4-...-M12

Details of the control connections

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
1 24V BUS (CAO) 2	External 24V bus supply (Field bus)	24VDC -/+20% ≈ 500mA protected against reverse polarity Max. permissible current load: 3A	Supply voltage for the CANopen controller / field bus Version for the module (terminal 11) is electrically isolated	-
3 CANopen+ (incoming) 4 (outgoing)	Bus + CAN H	RS485 transfer technology	The use of a twisted, shielded two-wire cable is strongly recommended	-
5 CANopen- (incoming) 6 (outgoing)	Bus - CAN L			-
7 GND BUS 8	Data ground Bus		BUS reference potential Version to terminal 15 is electrically isolated	-
9 SHLD	Bus shield			-
10 PE	PE-Bus			-
Potential separation				
11 24V 12 13	external 24V supply (module, system bus level)	24VDC -/+20% ≈ 500mA protected against reverse polarity Max. permissible current load: 3A	Connection for module supply voltage and 24V source for the digital inputs (DIN1 to DIN4) Version to terminal 1 or 7 is electrically isolated	-
15 GND 17 18	Reference potential for digital signals			-
14 Sys+	System bus data cable +		System bus interface	-
16 Sys-	System bus data cable -			-
19 DIN1	Digital input 1 (I/O CANopen DIN1)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2, Type 1	P174
20 DIN3	Digital input 3 (I/O CANopen DIN3)			P174

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
21 GND 22	Reference potential for digital signals	As for terminal 15		-
23 24V 24	external 24V supply	As for terminal 11		-
25 DIN2	Digital input 2 (I/O CANopen DIN2)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2, Type 1	P174
26 DIN4	Digital input 4 (I/O CANopen DIN4)			P174
27 GND 28	Reference potential for digital signals	As for terminal 15		-
29 24V 30	external 24V supply	As for terminal 11		-
Potential separation				
31 24V o	external 24V supply of the DOs	24VDC -/+20% up to 1A, according to load protected against reverse polarity	External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to 24V terminal	-
32 GND o	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-
33 DO1	Digital output 1 (I/O CANopen DO1)	Low = 0V High: 24V Rated current: 500mA each	The digital outputs should be used with a separate 24V supply.	P175
34 DO2	Digital output 2 (I/O CANopen DO2)			P175
35 GND o 36	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-

Detailed information about operation via CANopen can be found in the relevant supplementary manual BU0260.

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3.5.7 DeviceNet, SK TU4-DEV, ...-M12

Up to four connected frequency inverters can be managed by the internal DeviceNet module via DeviceNet (control, status messages, parameterisation and diagnosis).

- Baud rate: Max. 500 kBaud
- Protocol: AC-Drive and NORD-AC
- 4x digital inputs
- 2x digital outputs
- DIP switches for: addressing, baud rate
- Status LEDs: Module status, module error, bus status, bus error, Dig.
- Additional LEDs, M12 version: Dig. In 1 - 4, Dig. Out 1 - 2

Control connections SK TU4-DEV(-…)

The double spring terminal block of the BUS -Adapter Unit **is** colour coded to indicate the **three** different **potential levels** .

A separate voltage source should be used to supply the DOs. However, it is also possible to implement the supply of the DOs by bridging the <u>24V o</u> and <u>GND o</u> with one of the terminals of the system bus level (<u>24V</u> and <u>GND</u>). However, in this case it should be noted that this produces an increased risk of errors on the bus cables.

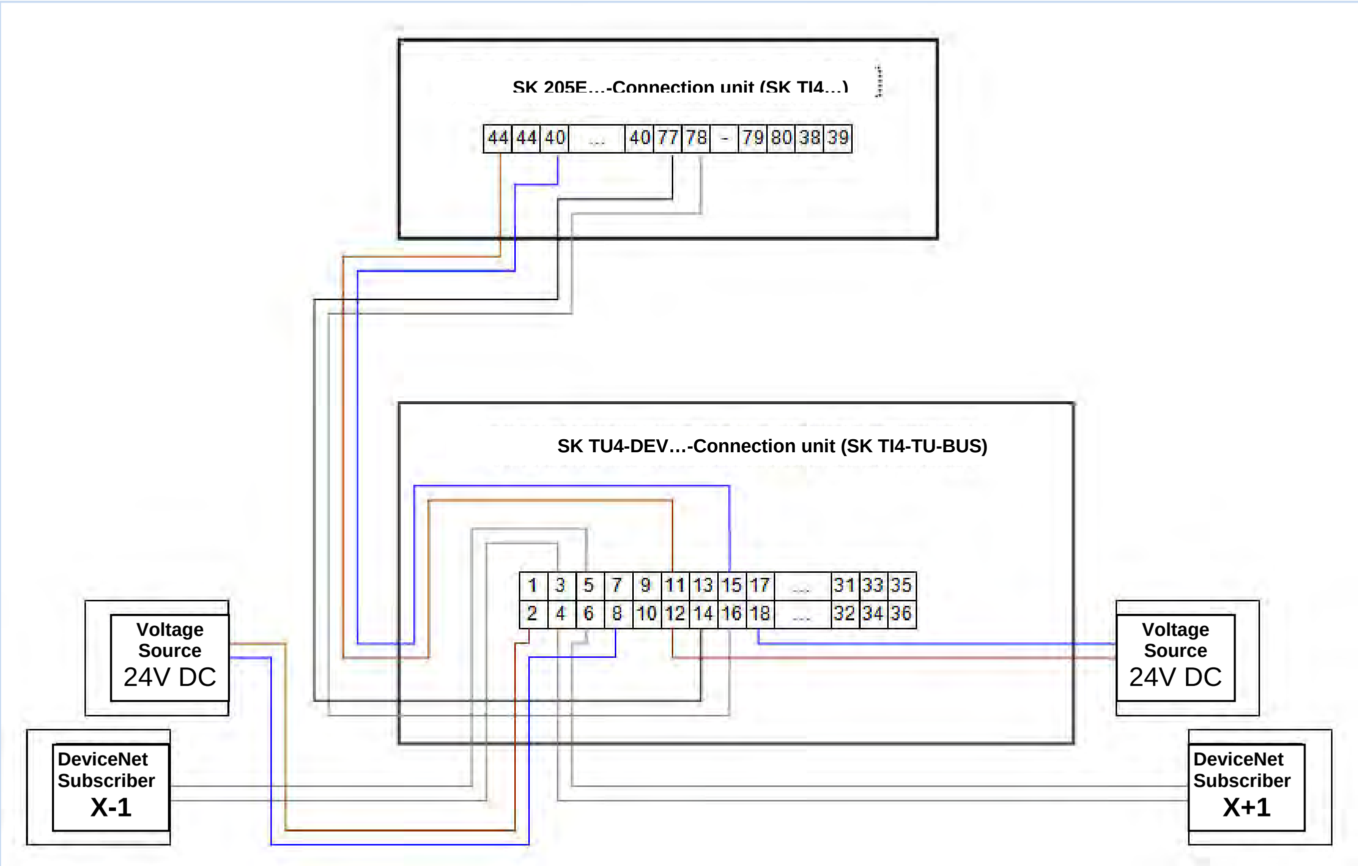
The sensors and actuators are connected to the terminal block. Alternatively, the SK TU4-DEV**-M12** module enables connection of the digital I/Os via the M12 round plug connectors (Socket, 5-pin, A-coded) on the front of the module.

Double *use* of the inputs via the terminal block <u>and</u> the M12 round plug *should be avoided*.

Potential level: Field bus					Potential level: System bus										Potential level: DOs		
Field bus level DeviceNet					System bus level and digital inputs										Digital outputs		
24V-B DEV	DEV+ IN	DEV- IN	GND B DEV	SHLD	24V	24V (as 11)	GND	GND	DIN 1	GND	24V (as 11)	DIN 2	GND	24V (as 11)	24V o DO	DO 1	GND o DO
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36
24V-B DEV	DEV+ OUT	DEV- OUT	GND B DEV	PE	24V (as 11)	Sys+	Sys-	GND	DIN 3	GND	24V (as 11)	DIN 4	GND	24V (as 11)	GND o DO	DO 2	GND o DO

Terminal block of the bus Adapter Unit SK TI4-TU-BUS and assignment of functions

Example for the connection of SK TU4-DEV to SK 200E



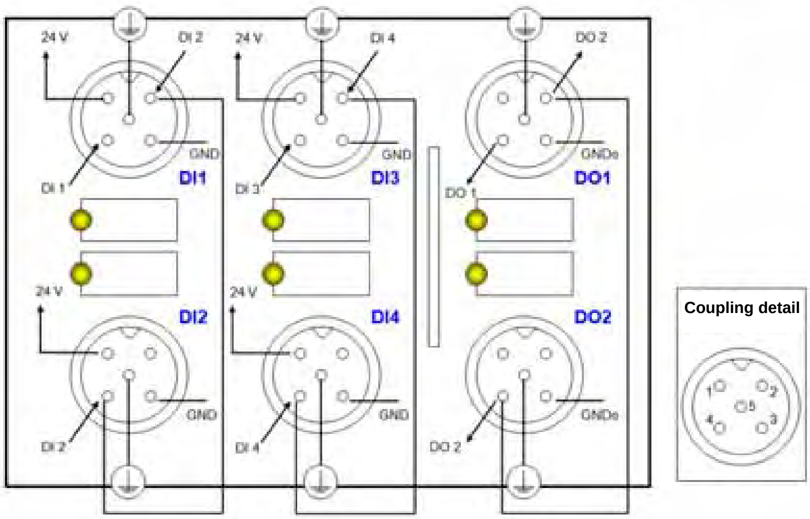
NOTE

Looping of the 24V supply voltage **(terminals 11/15)** is in principle possible, however, a maximum current load of **3A** for the **SK TU4-DEV(-…)** must not be exceeded!

Detail of the M12 connections of the SK TU4-DEV-M12

The special wiring of the M12 round plug connectors enables the connection of both single and double sensors, which are equipped with normal M12 system plugs with standard sensor/actuator wiring.

If the M12 round plug connectors are used, the terminal block connections for the digital inputs (terminals 19, 20, 25, 26) must not be used.



Wiring of the M12-plug connector to SK TU4-…-M12

Details of the control connections

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
1 24V BUS (DEV) 2	External 24V bus supply (Field bus)	24VDC -/+20% ≈ 500mA protected against reverse polarity Max. permissible current load: 3A	Supply voltage for the DeviceNet controller / field bus Version for the module (terminal 11) is electrically isolated	-
3 DVN+ (incoming) 4 (outgoing)	Bus + DeviceNet H	RS485 transfer technology	The use of a twisted, shielded two-wire cable is strongly recommended	-
5 DEV- (incoming) 6 (outgoing)	Bus - DeviceNet L			-
7 GND BUS 8	Data ground Bus		BUS reference potential Version to terminal 15 is electrically isolated	-
9 SHLD	Bus shield			-
10 PE	PE-Bus			-
Potential separation				
11 24V 12 13	external 24V supply (module, system bus level)	24VDC -/+20% ≈ 500mA protected against reverse polarity Max. permissible current load: 3A	Connection for module supply voltage and 24V source for the digital inputs (DIN1 to DIN4) Version to terminal 1 or 7 is electrically isolated	-
15 GND 17 18	Reference potential for digital signals			-
14 Sys+	System bus data cable +		System bus interface	-
16 Sys-	System bus data cable -			-
19 DIN1	Digital input 1 (I/O DeviceNet DIN1)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2, Type 1	P174
20 DIN3	Digital input 3 (I/O DeviceNet DIN3)			P174

Terminal/ Name	Function	Data	Description / wiring suggestion	Parameter
21 GND 22	Reference potential for digital signals	As for terminal 15		-
23 24V 24	external 24V supply	As for terminal 11		-
25 DIN2	Digital input 2 (I/O DeviceNet DIN2)	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1ms	Each digital input has a reaction time of 1ms Inputs compliant with EN 61131-2, Type 1	P174
26 DIN4	Digital input 4 (I/O DeviceNet DIN4)			P174
27 GND 28	Reference potential for digital signals	As for terminal 15		-
29 24V 30	external 24V supply	As for terminal 11		-
Potential separation				
31 24V o	external 24V supply of the DOs	24VDC -/+20% up to 1A, according to load protected against reverse polarity	External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to 24V terminal	-
32 GND o	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-
33 DO1	Digital output 1 (I/O DeviceNet DO1)	Low = 0V High: 24V Rated current: 500mA each	The digital outputs should be used with a separate 24V supply.	P175
34 DO2	Digital output 2 (I/O DeviceNet DO2)			P175
35 GND o 36	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-

Detailed information about operation via DeviceNet can be found in the relevant supplementary manual BU0280.

- www.nord.com -

4 SK 200E displays and control

By the use of various modules for display, control and parameterisation, the NORDAC SK 200E can be easily adapted to a wide range of requirements.

Alphanumeric display and control modules (Section 4.1) can be used for simple commissioning. For more complex tasks, connection to a PC system and the use of Nord Con parameterisation software is available.

As supplied, without additional options, the diagnostic LEDs are externally visible. These signal the actual device status. 2 potentiometers and 8 DIP switches are provided in order to set the most important parameters. In this minimal configuration no other adapted parameters are stored in the plug-in EEPROM. The only exception is the data concerning operating hours, faults and fault circumstances. This data can be stored in the EEPROM.

SK 200E mounted on motor, top view

SK 200E not fitted, view from inside

All parameters can be conveniently accessed for reading or setting with the aid of an optional SimpleBox or ParameterBox (Section 4.1). The changed parameter data is stored in a non-volatile EEPROM memory. This provides the possibility of transferring data from one FI to another by plugging in the EEPROM.

In addition, up to 5 complete frequency inverter data sets can be stored and accessed in the ParameterBox.

Connection between the SimpleBox or ParameterBox is by means of an RJ12-RJ12 cable.

4.1 Overview of external control devices

Module	Description	Data
SimpleBox Hand-held **SK CSX-3H**	Used for commissioning, parameterisation, configuration and control of the FI. Storage of the parameters is <u>not</u> possible. Manual BU 0040 (www.nord.com)	4-digit, 7-segment LED display IP20 RJ12-RJ12 cable (for connection to FI / Option) Part No. 275281013
ParameterBox Hand-held **SK PAR-3H**	Used for commissioning, parameterisation, configuration and control of the FI. Storage of parameters is possible. Manual BU 0040 (www.nord.com)	4 digit back-lit LCD display, keyboard Stores up to 5 complete FI data sets IP20 RJ12-RJ12 cable (for connection to FI / Option) USB-Cable (For connection to PC) Part No. 275281014

Installing the control unit on the SK 200E:

Installation of the control unit is performed as follows:

1. Remove the protective caps from the RJ12 connectors.
2. Connect the RJ12-RJ12 cable between the control unit and the frequency inverter.
3. During normal operation after commissioning, it is essential to replace the protective caps and pay attention to sealing.
4. As long as one of the protective caps is open, take care that no dirt or moisture enters the device.

4.1.1 SimpleBox, SK CSX-3H

This option is used as a simple parameterisation, display and control tool for the SK 200E frequency inverter.

Features

- 4-digit, 7-segment LED display
- Complete parameterisation of the frequency inverter.
- Direct control of a frequency inverter
- Displays the active parameter set during parameterisation and operation and the operating value set in P001.

After the SimpleBox has been connected and the mains switched on, horizontal lines appear in the 4-digit 7-segment display. This display signals the operational readiness of the frequency inverter.

If a creep frequency value is pre-set in parameter P113, or a minimum frequency or setpoint value is pre-set in P104, the display flashes with this initial value.

If the frequency inverter is enabled, the display changes automatically to the operating value selected in parameter >Selection Display value< P001 (factory setting = current frequency).

The actual parameter set in use is shown by the 2 LEDs next to the display on the left in binary code.

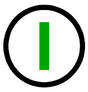
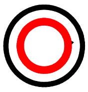
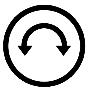
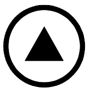
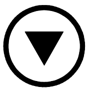
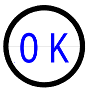
NOTE

The digital frequency setpoint is factory set to 0Hz. To check whether the motor is working, a frequency setpoint must be entered with the ▲ / ▼ key or a jog frequency via the respective parameter >Jog frequency< (P113).

Settings should only be made by qualified personnel, in strict compliance with the warning and safety information.

ATTENTION: The motor may start immediately after pressing the START key I!

Functions of the SimpleBox:

	Starting the frequency inverter. The frequency inverter is now enabled with the set jog frequency (P113). A preset minimum frequency (P104) may at least be provided. Parameter >Interface< P509 and P510 must = 0.
	Stopping the frequency inverter. The output frequency is reduced to the absolute minimum frequency (P505) and the frequency inverter shuts down.
7-segment LED display 4-digit	4 permanently displayed underscores (_ _ _ _) indicate readiness for operation if there is no setpoint. If these underscores are flashing, the frequency inverter is not ready for operation (switch-on lock, e.g. function “safe pulse block”), or there is, or was, an error. This must first be rectified. When the frequency inverter is ready for operation any initial value (P104/P113 for keyboard operation) is indicated by a flashing display. This frequency is immediately displayed on being enabled. During operation, the currently set operating value (selection in P001) or an error code (Section 6) is displayed. During parameterisation, the parameter numbers or the parameter values are shown.
LEDs 1 2	The LEDs indicate the actual operating parameter set in the operating display (P000) and the actual parameter set being parameterised during parameterisation. In this case the display is coded in binary form. 1 2 = P1 1 2 = P2 1 2 = P3 1 2 = P4
	The motor rotation direction changes when this key is pressed. "Rotation to the left" is indicated by a minus sign. **Attention!** Take care when operating pumps. screw conveyors, ventilators, etc. The key may be locked with parameter P540.
	Press key to increase the frequency. During parameterisation, the parameter number or parameter value is increased
	Press the key to reduce the frequency. During parameterisation, the parameter number or parameter value is reduced.
	Press the “OK” key to store an altered parameter value, or to switch between parameter numbers or parameter values. **NOTE**: If a changed value is <u>not</u> to be stored, the key can be used to exit the parameter without storing the change.

Control with the SimpleBox

The frequency inverter can only be controlled via the SimpleBox, if it has not previously been enabled via the control terminals or via a serial interface (P509 = 0 and P510 = 0).

If the START key is pressed, the frequency inverter changes to the operating display (selection P001). The frequency inverter supplies 0Hz or a higher minimum frequency (P104) or jog frequency (P113) which has been set.

Parameter set display:

The LEDs indicate the actual operating parameter set in the operating display (P000) and the current parameter set being parameterised (≠ P000). In this case the display is coded in binary form.

The parameter set can also be changed during operation via the parameter P100, if control is by means of the SimpleBox.

Frequency setpoint:

The current frequency setpoint depends on the setting in the parameters jog frequency (P113) and minimum frequency (P104). This value can be altered during keyboard operation with the value keys and permanently stored in P113 as the jog frequency by pressing the OK key.

Quick stop:

A quick stop can be triggered by simultaneously pressing the STOP key and the "Change direction key".

Parameterisation with the SimpleBox

The **parameterisation** of the FI can be performed in various operating states. All parameters can always be changed online. Switching to the parameter mode occurs in different ways depending upon the operating states and the enabling source.

1. If there is no enable (if necessary, press the STOP key) it is possible to switch from display of the operating values to the parameterisation mode directly from the operating value display with the value keys or . → P 0 _ _ / P 7 _ _
2. If an enable is present via the control terminals or a serial interface and the frequency inverter is producing an output frequency, it is also possible to switch to the parameterisation mode directly from the operating value display using the value keys or . → P 0 _ _ / P 7 _ _
3. If the FI has been enabled via the SimpleBox (START key), the parameterisation mode can be accessed by pressing the START and ENTER keys (+) simultaneously.
4. Switching back to the control mode is achieved by pressing the START key .

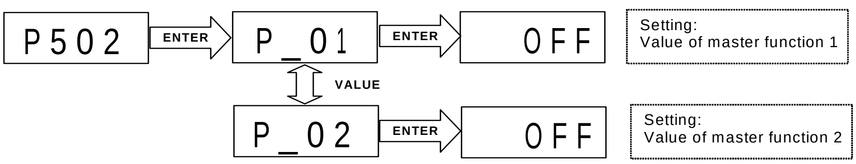
Changing parameter values

To access the parameter section, one of the value keys, or must be pressed. The display changes to the menu group display P 0 _ _ ... P 7 _ _. After pressing the OK key access to the menu group is obtained and the required parameter can be selected with the value keys.

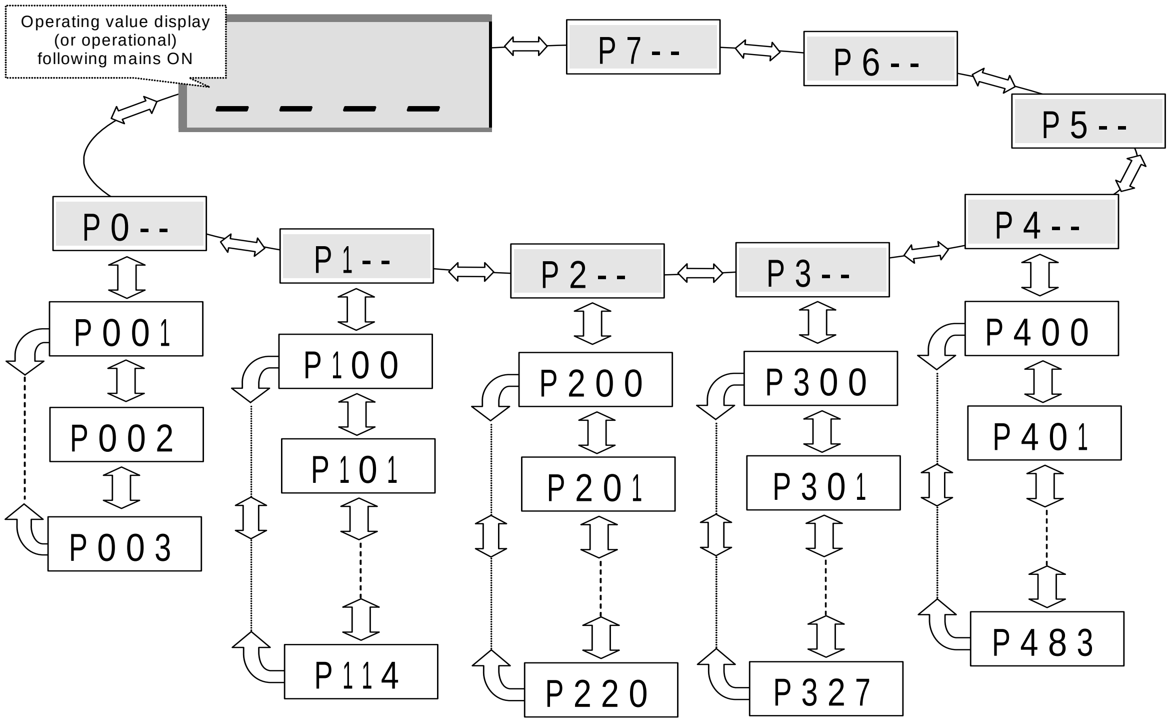
All parameters are arranged in order in the individual menu groups in a continuous scroll pattern. It is therefore possible to scroll forwards and backwards within this section.

Each parameter has a parameter number → P x x x. The significance and description of the parameters starts in Section 6 "Parameterisation".

NOTE: Some parameters (e.g. P502) have additional levels (Arrays), in which further settings can be made, e.g.:



Menu structure with the SimpleBox



To **change** a **parameter value**, the OK key must be pressed when the relevant parameter number is displayed.

Changes can then be made using the VALUE keys or and must be confirmed with to save them in the EEPROM and exit from the parameter.

As long as a changed value has not been confirmed by pressing OK, the value has not yet been stored in the frequency inverter.

During parameter changes, the display does not flash, so that the display is more legible.

If a change is not to be saved, the "DIRECTION" key can be pressed to exit from the parameter.

4.1.2 ParameterBox SK PAR-3H

This option is for simple parameterisation and control of the frequency inverter, as well as the display of current operating settings and states.

Up to 5 FI data sets can be stored and managed, stored and transferred with this device. This enables an efficient commissioning for serial applications.

Features of the ParameterBox

- Illuminated, high resolution LCD graphics screen
- Large-screen display of individual operating parameters
- 6 language display
- Help text for error diagnosis
- 5 complete inverter data sets can be stored in the memory, loaded and processed
- Can be used for the simultaneous display of several operating values
- Standardisation of individual operating parameters to display specific system data
- Direct control of a frequency inverter

Information from the ParameterBox

After plugging the ParameterBox onto the frequency inverter and switching on the mains for the first time, there is initially an enquiry as to the menu language, German or English. The required language is confirmed by pressing OK.

Then the ParameterBox automatically carried out a **“bus scan”**, during which the connected frequency inverters are identified.

In the following display, the type of frequency inverter, its actual operating condition and the current status can be seen.

After the inverter has been enabled, the display mode changes to the 3 current operation values (frequency, voltage, current). The operating values displayed can be selected from a list of possible values (in the >Display< / > Values< menu).

NOTE

The digital frequency setpoint (Jog frequency/minimum frequency) has a default setting of 0Hz. To check whether the motor is working, a frequency setpoint must be entered with the key or a jog frequency entered via the relevant menu level >Parameterise<, >Base parameters< and the relevant parameter >Jog frequency< (P113)..

Settings should only be made by qualified personnel, in strict compliance with the warning and safety information.

ATTENTION: The motor may start immediately after pressing the START key !

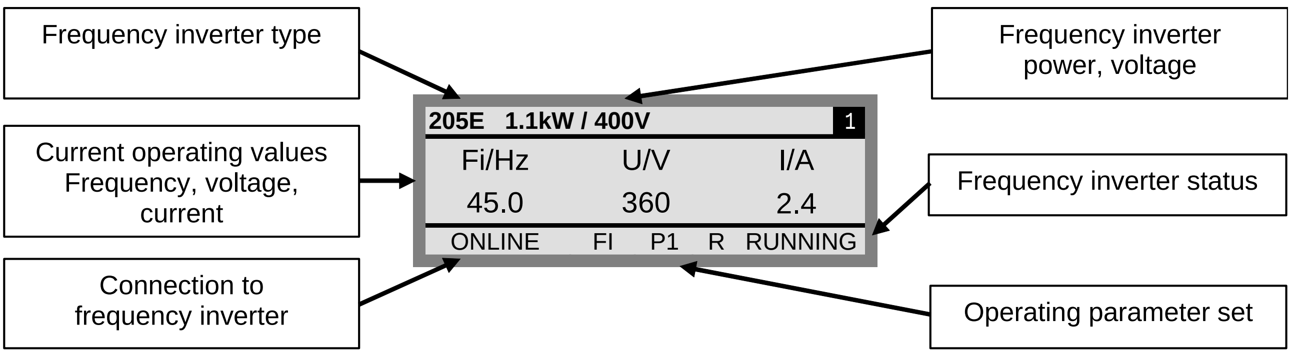
ATTENTION

With the use of a ParameterBox SK PAR-3H this must never be simultaneously connected to the frequency inverter and the PC, as potential shifts may cause damage, especially to the PC. (See also Manual BU0040)

Functions of the ParameterBox

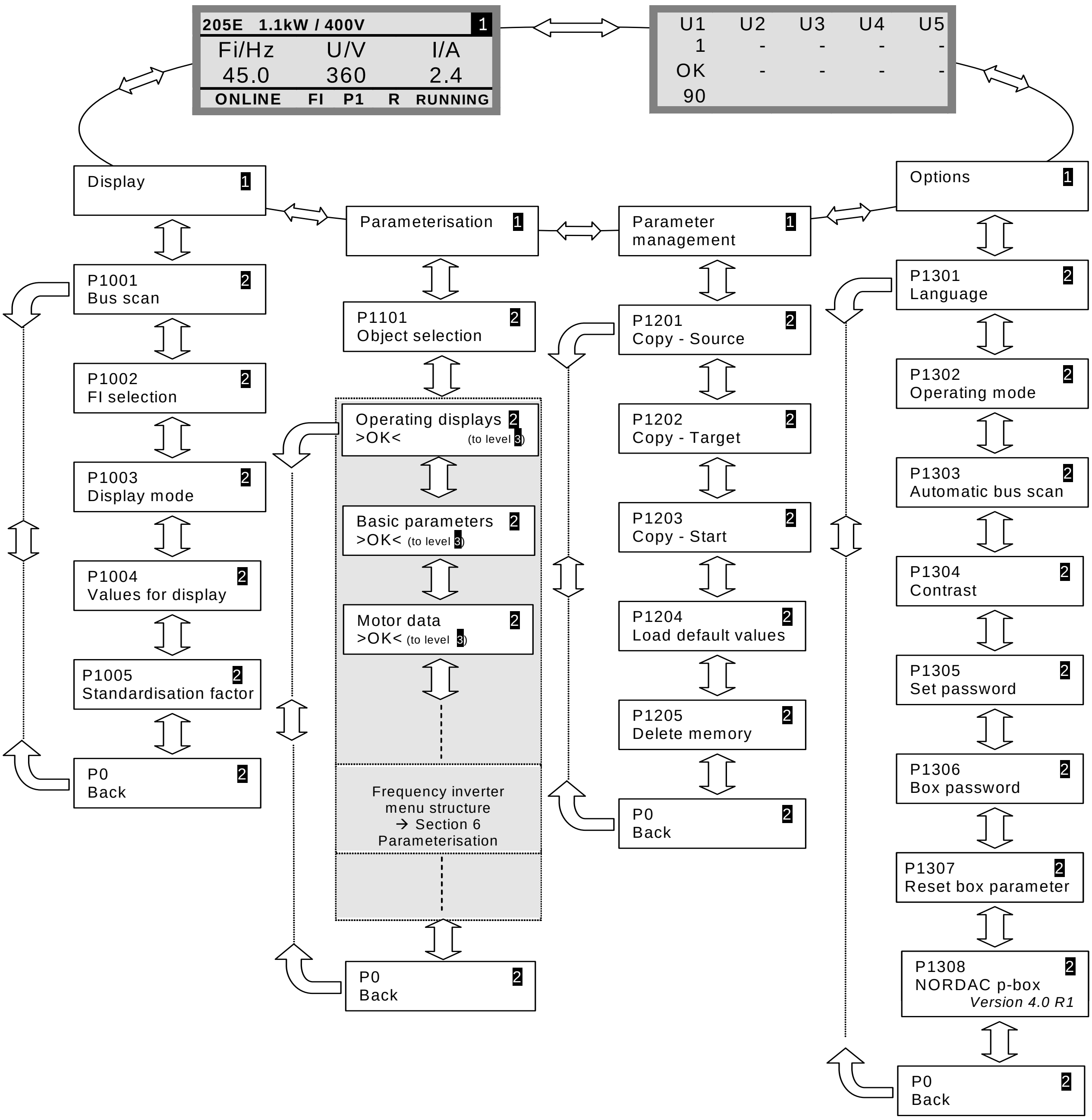
LCD display	Graphic-capable, backlit LCD display for displaying operational values and parameters for the connected frequency inverter and ParameterBox parameters.	
	The menu levels and the individual menu items can be scrolled through with the **SELECTION keys**. The next higher level can be accessed by pressing the keys and at the same time.	
	The contents of individual parameters can be altered with the **VALUES** keys. Press the and keys together to load the default values of the parameter selected. When controlling the inverter using the keyboard, the frequency setpoint is set using the VALUE keys. Here the ramp time is limited to 0.17s/Hz, even if small values are set in P002/P003.	
OK	Press the **OK key** to change to the selected menu group or accept the changed menu items or parameter values. **NOTE:** If a parameter is to be exited, without a new value being stored, then one of the SELECTION keys can be used for this purpose. If the inverter is currently controlled from the keyboard (not control terminals), then the current actual frequency can be stored under the Jog Frequency parameter P113 with the OK key and used as the next initial setpoint frequency.	
	START key for switching on the frequency inverter.	**NOTE:** These functions can only be used of they are enabled in parameter P509 or P540.
	STOP key for switching off the frequency inverter.	
	The direction of rotation of the motor changes when the **DIRECTION key is operated**. Rotation direction left is indicated by a minus sign. Attention! Take care when operating pumps, screw conveyors, fans, etc.	
LEDs DS DE	The LED's indicate the actual status of the ParameterBox. **DS – Device State** The ParameterBox is ready for operation. **DE – Device Error** An error has occurred when processing data, or in the FI.	

LCD display



Menu structure

The menu structure consists of various levels, which are each arranged in a ring structure. The OK key moves the menu on to the next level. Pressing the SELECTION keys simultaneously moves the menu back one level.



>Display< (P11xx), >Administer Parameters< (P12xx) and >Options< (P13xx) are purely ParameterBox-parameters and do not have direct influence on frequency inverter parameters.

Via the menu >Parameterisation< the frequency inverter menu structure can be accessed, if necessary after selection of the object, if frequency inverter data sets are already stored in the ParameterBox.

The description of the frequency inverter parameters is in Section 6 of this manual.

Select language, *brief description*

The following steps must be carried out to change the menu language used in the ParameterBox display. On switching on the ParameterBox for the first time, “German” or “English” will be offered for selection. The selection is made by pressing the selection keys (arrow R/L) and confirming with the OK key.

In the following, “English” was selected on switching on for the first time. After this selection the following displays should appear (varies depending upon output and options).

Initial display

205E 1.1kW / 400V 1
> NORDAC <
Frequenzumrichter
ONLINE FU P1 ESperre

Use the **SELECTION key** ◀ or ▶, to scroll to the **menu** options

1
Optionen
>OK<
ONLINE FU P1 ESperre

Then press **>OK<** OK

P1301 2
Sprache
Deutsch ...
ONLINE FU P1 ESperre

Using the **Value key** ▲, select the required **language**

... English
... Francais
... Espanol
... Sverige
... Nederlands

After selection confirm with **>OK<** OK

P1301 2
Language
English (e.g.)
ONLINE FI P1 Locked

Press both **SELECTION keys** ◀ and ▶, simultaneously

1
Options
>OK<
ONLINE FI P1 Locked

Press both **SELECTION keys** ◀ and ▶, simultaneously

205E 1.1kW / 400V 1
> NORDAC <
Frequency inverter
ONLINE FI P1 Locked

Controlling the frequency inverter with the ParameterBox

The frequency inverter can only be completely controlled via the ParameterBox if the parameter >Interface< (P509) is set to the >Control terminal or Keyboard< function (=0) (factory setting) and the inverter is not enabled via the control terminal.

Note: If the frequency inverter is enabled in this mode, then the parameter set is used, which is selected for this frequency inverter in the Menu >Parameterisation< ... >Basic parameters< ... under Parameters >Parameter set<.

Attention: Following the START command, the frequency inverter may start up immediately with a pre-programmed frequency (minimum frequency P104 or jog frequency P113).

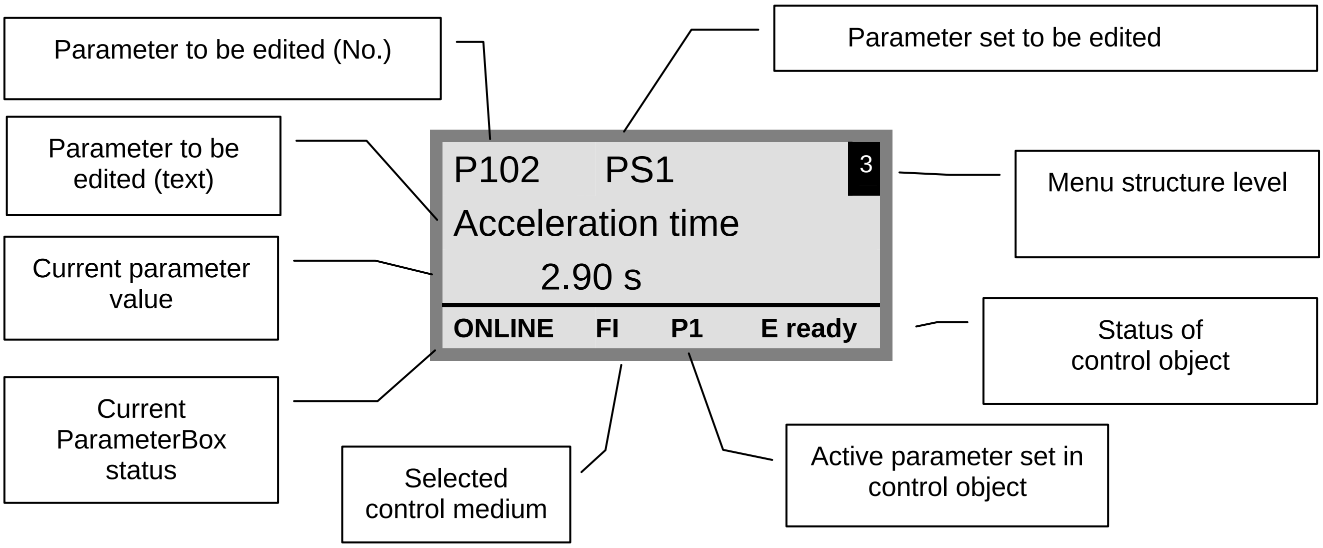
Parameterisation with the ParameterBox

The parameterising mode is entered by selecting the group >Parameterisation< in menu level 1 of the ParameterBox and confirming this with the OK key. The parameter level of the connected frequency inverter is now visible.

Screen layout during parameterisation

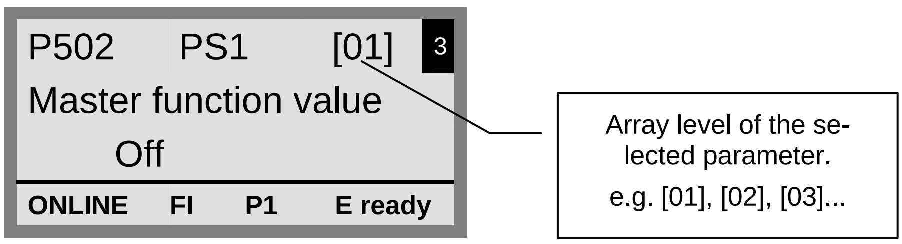
If the setting of a parameter is changed, then the value flashes until it is confirmed with the OK key. In order to retain the default settings for the parameter being edited, both VALUE keys must be pressed simultaneously. Even in this case, the setting must be confirmed with the OK key in order for the change to be saved.

If the change is not to be saved, then pressing one of the SELECTION keys will call up the previously stored value and pressing a SELECTION key again will exit the parameter.



NOTE: The lower line in the display is used to display the current status of the box and the frequency inverter being controlled.

NOTE: Some parameters (e.g. P502) have additional array levels, in which further settings can be made. The required array level must first be selected (see parameterisation, Section 6) and confirmed with OK. The required parameter setting can now be made.



4.1.3 ParameterBox parameters

The following main functions are assigned to the menu groups :

Menu group	No.	Master function
Display	**(P10xx):**	Selection of operating values and display layout
Parameterisation	**(P11xx):**	Programming of the connected inverter and all storage media
Parameter management	**(P12xx):**	Copying and storage of complete parameter sets from storage media and inverters
Options	**(P14xx):**	Setting the ParameterBox functions and all automatic processes

Display

Parameter	Setting value / Description / Note
P1001 Bus scan	A bus scan is initiated with this parameter. During this process a progress indicator is shown in the display. After a bus scan, the parameter is "Off". Depending on the result of this process, the ParameterBox goes into the "ONLINE" or "OFFLINE" operating mode.
P1002 FI selection	Selection of the current item to be parameterised/controlled. The display and further operating actions refer to the item selected. In the inverter selection list, only those devices detected during the bus scan are shown. The current object appears in the status line. Value range: FI, S1 ... S5
P1003 Display mode	Selection of the operating values of the ParameterBox (Selection value(s) in (P1004)) Standard: Any 3 values next to each other List: Any 3 values listed with units Large display: 1 value (any) with unit ControlBox: 1 (any) value without unit (Selection value in (P001) of the FI)
P1004 Values for display	Selection of a display value for the actual value display of the ParameterBox. (See also BU0040) The value selected is placed in the first position of an internal list for the display value and is then also used in the Large Display mode. Possible actual values for the display: Actual frequency, Voltage, Current Speed of rotation, Torque current, Setpoint frequency DC link voltage, Bus actual value1, non-standardised
P1005 Standardisation factor	The first value in the list displayed is scaled using the standardisation factor. If this standardisation factor varies from a value of 1.00, then the units of the scaled value are hidden in the display. Value range: -327.67 to +327.67; resolution 0.01

Parameterisation

Parameter	Setting value / Description / Note
P1101 Object selection	Selection of the object to be parameterised. The ongoing parameterisation process relates to the object selected. Only the devices and storage objects detected during the bus scan are displayed in the selection list. If only one frequency inverter is connected and no storage address occupied, this parameter is not displayed! Value range: FI, S1 ... S5

Parameter management

Parameter	Setting value / Description / Note
P1201 Copy - Source	Selection of the actual source object to be copied. In the selection list, only the frequency inverters and storage media detected during the bus scan are shown. Value range: FI, S1 ... S5
P1202 Copy - Target	Selection of actual target object to copy. In the selection list, only the frequency inverters and storage media detected during the bus scan are shown. Value range: FI, S1 ... S5
P1203 Copy - Start	This parameter triggers a transfer process, whereby all the parameters selected in >Copy – Source< are transferred to the object specified in the >Copy – Target< parameter. While data is being overwritten, an information window with acknowledgement appears . The transfer starts after acknowledgement.
P1204 Load default values	In this parameter, the default settings are written to the parameters of the selected item. This function is particularly important when editing storage objects. It is only via this parameter that a hypothetical frequency inverter can be loaded and edited with the ParameterBox. Value range: FI, S1 ... S5
P1205 Delete memory	In this parameter the data in the selected storage medium is deleted. Value range: S1 ... S5

Options

Parameter	Setting value / Description / Note
P1301 Language	Selection of languages for operation of the ParameterBox Available languages: German, English, Dutch, French, Spanish, Swedish
P1302 Operating mode	Selection of the operating mode for the ParameterBox **Offline**: The ParameterBox is operated autonomously. The inverter data set is not accessed. The storage objects of the ParameterBox can be parameterised and managed. **Online**: A frequency inverter is located at the interface of the ParameterBox. The frequency inverter can be parameterised and controlled. On switchover to the "ONLINE " mode, a bus scan is automatically started. The FI parameters are not yet loaded. PC Slave: For connection to a PC with NORDCON software installed.
P1303 Automatic bus scan	Setting the switch-on characteristics. **Off**: A bus scan is not carried out, the frequency inverters connected before the switch-off are located after switching on. **On**: A bus scan is automatically implemented when the ParameterBox is switched on.
P1304 Contrast	Contrast setting of the ParameterBox display Value range: 0% ... 100%; Resolution 1%
P1305 Set password	The user can set up a password in this parameter. If a value other than 0 has been entered in this parameter (default setting), then the settings of the ParameterBox or the parameters of the connected inverter cannot be altered.

Parameter	Setting value / Description / Note
P1306 Box password	If the >Password< function is to be reset, the password selected in the >Set Password< parameter must be entered here. If the correct password is selected, all of the ParameterBox functions and the parameters of the connected frequency inverter can be used again. **NOTE:** With the master-password '65' the current password is displayed and can be confirmed with the OK key.
P1307 Reset Box parameter	With this parameter the ParameterBox can be reset to the default setting. All ParameterBox settings and the data in the storage media will be deleted.
P1308 Software version	Displays the software version of the ParameterBox. In case of service enquiries by telephone, please have this at hand.

4.1.4 ParameterBox error messages

Display **Error**	**Cause** ➢ **Remedy**
Communication error	
200 INCORRECT PARAMETER NUMBER	These error messages are due to EMC interferences or differing software versions of the participants. ➢ Check the software version of the ParameterBox and that of the connected frequency inverter. ➢ Check the cabling of all components, regarding possible EMC interference
201 PARAMETER VALUE CANNOT BE CHANGED	
202 PARAMETER OUTSIDE VALUE RANGE	
203 FAULTY SUB INDEX	
204 NO ARRAY PARAMETERS	
205 WRONG PARAMETER TYPE	
206 INCORRECT RESPONSE RECOGNITION USS INTERFACE	
207 USS INTERFACE CHECKSUM ERROR (RS485)	Communication between frequency inverter and ParameterBox is faulty (EMC), safe operation cannot be guaranteed. ➢ Check the connection to the frequency inverter. Use a shielded cable between the devices. Route the BUS leads separately from the motor cables.
208 FAULTY STATUS RECOGNITION USS INTERFACE (RS485)	Communication between frequency inverter and ParameterBox is faulty (EMC), safe operation cannot be guaranteed. ➢ Check the connection to the frequency inverter. Use a shielded cable between the devices. Route the BUS leads separately from the motor cables.
209_1 INVERTER DOES NOT RESPOND	The ParameterBox is waiting for a response from the connected frequency inverter. The waiting time has elapsed without a response being received. ➢ Check the connection to the frequency inverter. The settings of the USS parameters for the frequency inverter have been changed during operation.

Display **Error**	**Cause** ➢ **Remedy**
Identification errors	
220 UNKNOWN DEVICE	Device ID not found. The connected inverter is not listed in the database of the ParameterBox; no communication can be established. ➢ ParameterBox is too old for the FI. ➢ Please contact your Getriebebau Nord Representative.
221 SOFTWARE VERSION NOT RECOGNISED	The software version was not found. The software of the connected frequency inverter is not listed in the ParameterBox database, no communication can be established. ➢ Please contact your Getriebebau Nord Representative.
222 CONFIGURATION STAGE NOT RECOGNISED	An unknown component has been detected in the frequency inverter (Customer interface). ➢ Please check the components installed in the frequency inverter ➢ If necessary, check the software version of the ParameterBox and the frequency inverter.
223 BUS CONFIGURATION HAS CHANGED	After restoring the last Bus configuration, a device is reported that is different from the one stored. This error can only occur if the parameter >Auto. Bus Scan< is set to OFF and another device has been connected to the ParameterBox. ➢ Activate the Automatic Bus Scan function.
224 DEVICE NOT SUPPORTED	The inverter type entered in the ParameterBox is not supported! ➢ The ParameterBox cannot be used with this inverter.
225 THE CONNECTION TO THE INVERTER IS BLOCKED	Access to a device that is not online (previously Time Out error). ➢ Carry out a bus scan via the parameter >Bus Scan< (P1001).
ParameterBox operating error	
226 SOURCE AND TARGET ARE DIFFERENT DEVICES	Copying objects of different types (from / to different inverters) is not possible.
227 SOURCE IS EMPTY	Copying of data from a deleted (empty) storage medium
228 THIS COMBINATION IS NOT PERMITTED	Target and source for the copying function are the same. The command cannot be executed.
229 THE SELECTED ITEM IS EMPTY	Parameterisation attempt of a deleted storage medium
230 DIFFERENT SOFTWARE VERSIONS	Warning: Copying objects with different software versions can cause problems when transferring parameters.
231 INVALID PASSWORD	Attempt to alter a parameter without a valid Box password being entered in parameter >Box Password< P 1306.
232 BUS SCAN ONLY WHEN IN MODE: ONLINE	A bus scan (search for a connected frequency inverter) is only possible when in ONLINE mode.

Display **Error**	**Cause** ➢ **Remedy**
Warnings	
240 OVERWRITE DATA? → YES NO	These warnings indicate that there is a possibly significant change which needs additional confirmation. Once the next procedure has been selected, it must be confirmed with the "OK" key.
241 DELETE DATA? → YES NO	
242 MOVE SOFTWARE VERSION? → NEXT CANCEL	
243 MOVE SERIES? → NEXT CANCEL	
244 DELETE ALL DATA? → YES NO	
Inverter control error	
250 THIS FUNCTION IS NOT ENABLED	The required function is not enabled in the parameter >Interface< of the frequency inverter. ➢ Change the value of the parameter >Interface< of the connected inverter to the required function. More detailed information can be obtained from the operating instructions for the frequency inverter.
251 CONTROL COMMAND WAS NOT SUCCESSFUL	The control command cannot be implemented by the frequency inverter, as a higher priority function, e.g. Quick stop or an OFF signal to the control terminals of the frequency inverter is present.
252 CONTROL OFFLINE NOT POSSIBLE	Call up of a control function in Offline mode. ➢ Change the operating mode of the ParameterBox in the parameter >Operating Mode< P1302 to Online and repeat the action.
253 ERROR ACKNOWLEDGEMENT NOT SUCCESSFUL	The acknowledgement of an error at the frequency inverter was not successful, the error message remains.
Error message from inverter	
“ERROR NO. FROM INVERTER” INVERTER FAULT "INVERTER FAULT TEXT"	A fault with the number displayed has occurred in the inverter. The inverter error number and text are displayed.

5 Commissioning, SK 200E

The SK 200E inverter series can be commissioned in various ways:

a) By means of the (internal) DIP switches and the (externally accessible) potentiometer, the SK 200E can be configured for simple conveyor applications. Various LEDs are provided for diagnostic purposes. In this case, no additional options are required; the FI only needs to be supplied with mains voltage and a 24V control voltage. For control (enable regulator, fixed frequencies, setpoint values), up to 4 digital inputs and 2 potentiometers are available.

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

b) A convenient and comprehensive solution is provided by commissioning with software support. Here, a PC with an RS232/458 interface or a SimpleBox/ParameterBox may be used. The connection to the SK 200E is made via the RJ12 socket on the top. A suitable cable for connection to a PC is available.

   Here, the parameterised data is stored in the plug-in EEPROM. This must therefore always remain plugged in during operation.

c) The motor data for the SK 200E is always pre-set to the standard values of a motor with the same power as the frequency inverter.

ATTENTION

DANGER TO LIFE!

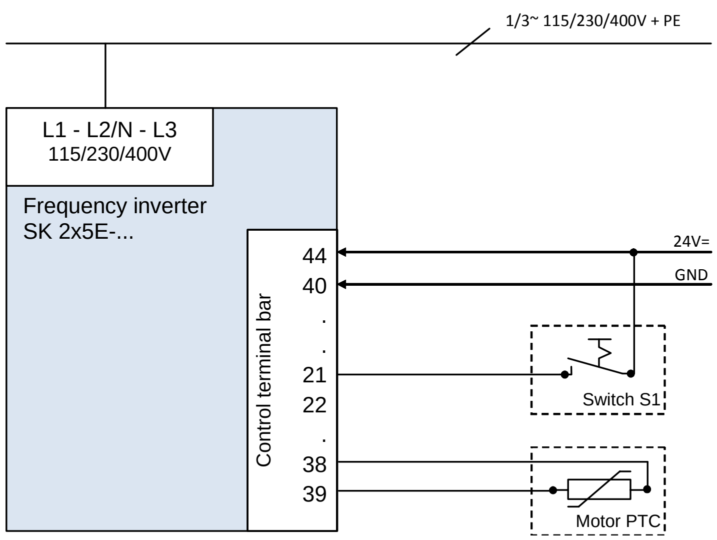
The frequency inverter is not equipped with a line main switch and is therefore always live when connected to the power supply. Live voltages may therefore be connected to a connected motor at standstill.

NOTE

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)).

5.1 Minimal configuration without options

For minimum effort for the commissioning and control, the SK 200E can be operated in its condition as delivered. All that is needed is to provide the FI with mains voltage and a 24V control voltage. This can be provided by the operator of the machine, or an optional module (SK CU4-24V-xxx-B, Section 3.4.1) can be used.



The adjustment of the setpoint values is made via the potentiometer P1, which is integrated in the cover of the SK 200E (Section 5.1.3). In addition, the frequency ramps can be adjusted with P2.

Enabling of the regulator is carried out with the switch S1.

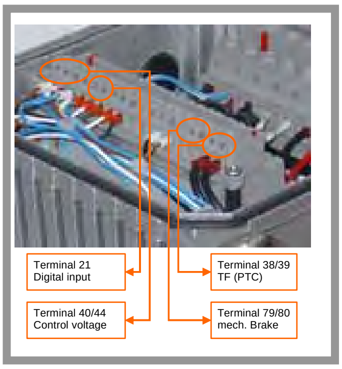
The PTC input must be bypassed, if a motor with PTC is not available.

5.1.1 Quick commissioning

Connection

If a 4-pole standard motor is to be controlled by an SK 200E series frequency inverter of the same power, it is possible to operate the frequency inverter without any aids for test purposes.

The only prerequisite for this is the correct connection of the mains and motor cables to the appropriate terminals (PE, L1, N (/L2, L3) and U, V, W) of the frequency inverter (Section 2.7), and their supply with a 24V DC control voltage (Connection to terminals 44/40 (Section 2.8))



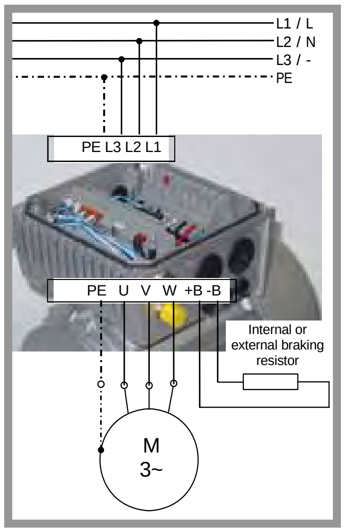


Illustration above: Control cable connections

Illustration right: Mains / motor cable connections

Mains unit

If an SK xU4-…-24V is used to provide the 24V control voltage, this must be connected as described in Section 3.4.1 or 3.5.2 .

DIP switches

For test operation the DIP switches 1 to 5 of the frequency inverter must be set to the "**OFF**" position (Section 5.1.2) and the digital input DIN1 (terminal 21) must be hard-wired to the 24V control voltage (terminal 44).

No. Bit	DIP switch			
8	Int Rbrake – internal brake resistor	off		Behaviour corresponding to P555, P556, P557
		on		Behaviour corresponding to the brake resistor used
7	60Hz* – 50/60Hz-operation	off		Motor data corresponding to the rated power of the FI in kW relative to 50Hz, fmax = 50Hz
		on		Motor data corresponding to the rated power of the FI in hp relative to 60Hz, fmax = 60Hz
6	V/F – Regulating process	off		VFC regulation corresponding to P211/P212
		on		V/f curve (⇒ P211=0 and P212=0)
5/4	I/O – Potentiometer function, digital inputs and AS interface	off	off	Corresponding to P420 [1-4] and P400 [1-2] or P480 [1-4] and P481 [1-4]
		off	on	Further details in the next table. (depends on the DIP3 "BUS")
		on	off	
		on	on	
3	BUS – Source control word and setpoint value	off		Corresponding to P509 and P510 [1] [2]
		on		System bus (⇒ P509=4 and P510=4)
2/1	ADR – System bus address/ baud rate	off	off	Corresponding to P514 and 515 [32, 250kBaud]
		off	on	Address 34, 250kBaud
		on	off	Address 36, 250kBaud
		on	on	Address 38, 250kBaud

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

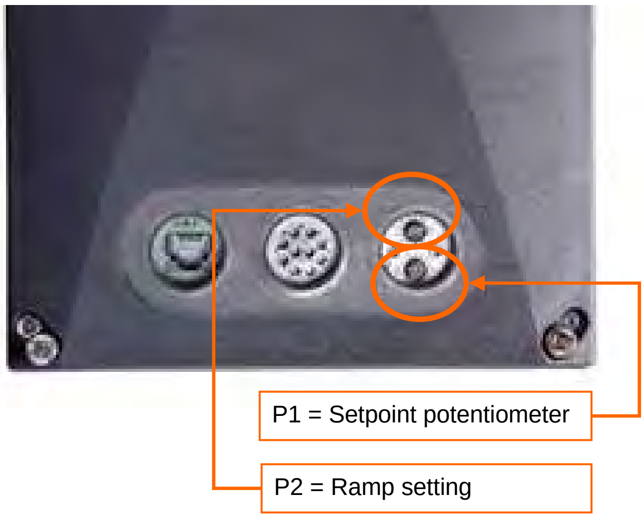
Control

Enabling is carried out as soon as the inverter's own setpoint potentiometer (Potentiometer P1, Section 5.1.3) 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 (Section 5.1.3)



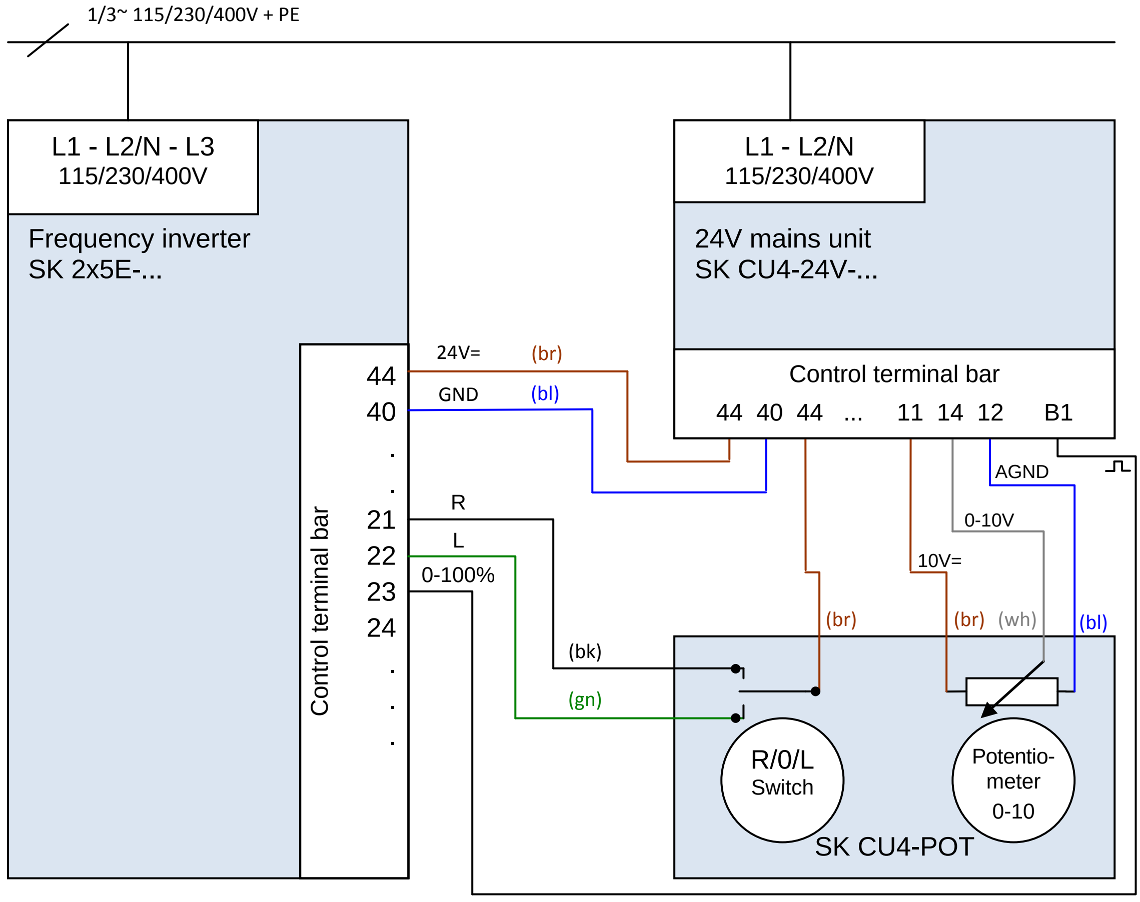
NOTE	This setting method is not suitable for the implementation of a so-called "automatic start with mains". In order to use this function, it is essential that parameter (P428) "Automatic Start" is set to the function "ON" (Section 6) Adjustment of parameters is possible with the aid of a ParameterBox (SK xxx-3H) (Section 4.1) or with the NordCon software (Windows PC and adapter cable required).

Normal operation

In contrast to the configuration method for test operation described above, it is recommended that a Potentiometer Unit (SK CU4-POT) is used for simple standard operation. In combination with an integrated mains unit (SK CU4-…-24V) a completely autonomous solution can be implemented with only one mains cable (1~ / 3~ according to the version), and a suitable speed and direction control can be ensured (See connection example below).

This configuration method also provides the possibility of setting the frequency inverter to start automatically with "Mains On", by parameterising (P428).

Connection plan and parameterisation of SK CU4-POT, example



DIP switch settings:	DIP3 = off, DIP4 = on, DIP5 = off (Section 5.1.2)
or	
recommended parameter setting, DIP1-8 = off:	P400 [07] = 1 P420 [02] = 2 P420 [01] = 1 P420 [03] = 26

5.1.2 DIP switch configuration

The DIP switches provide the possibility of carrying out commissioning without additional control units. Additional settings are made using the potentiometer on the top of the frequency inverter.

As supplied, all DIP switches are at the "Off" position, which corresponds to control via the digital inputs (see Section 5.1). The frequency setpoint value is adjusted via P1 and P2.

SK 200E, internal view

No. Bit	DIP switch			
8 2^7	**Int R_{Brake}** Internal brake resistor	off		Behaviour corresponding to P555, P556, P557
		on		Behaviour corresponding to the brake resistor used
7 2^6	**60Hz*** 50/60Hz-operation	off		Motor data corresponding to the rated power of the FI in kW relative to 50Hz, fmax = 50Hz
		on		Motor data corresponding to the rated power of the FI in hp relative to 60Hz, fmax = 60Hz
6 2^5	**V/F** Regulating process	off		VFC regulation corresponding to P211/P212
		on		V/f curve (⇒ P211=0 and P212=0)
5/4 $2^{4/3}$	**I/O** Potentiometer function, digital inputs and AS interface	off	off	Corresponding to P420 [1-4] and P400 [1-2] or P480 [1-4] and P481 [1-4]
		off	on	Further details in the next table. (depends on the DIP3 "BUS")
		on	off	
		on	on	
3 2^2	**BUS** Source control word and setpoint value	off		Corresponding to P509 and P510 [1] [2]
		on		System bus (⇒ P509=4 and P510=4)
2/1 $2^{1/0}$	**ADR** System bus address/ baud rate	off	off	Corresponding to P514 and 515 [32, 250kBaud]
		off	on	Address 34, 250kBaud
		on	off	Address 36, 250kBaud
		on	on	Address 38, 250kBaud
	*) A changed setting is applied the next time the mains is switched on. Existing settings in parameters P201-P209 and P105 are overwritten!			

NOTE

FACTORY SETTING, AS DELIVERED!

*) As delivered, all DIP switches are in the "off" position. Control is by means of the digital control signals (P420 [01]-[04]) and the potentiometers P1 and P2 integrated in the FI (P400 [01]-[02]).

NOTE

For controlling the frequency inverter via In/Out bits (e.g.: AS-i, DIG In 1 - 4) typical values are preset in the relevant parameters (P480) and (P481). (Details: Section 6)

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

Details of DIP switches 5/4 and 3

Applies to devices SK 205E, SK 215E (without AS interface on board)

DIP			Functions as per the list of digital functions (P420)				Functions as per the list of analog functions (P400)	
5	4	3	Dig 1	Dig 2	Dig 3	Dig 4**	Poti 1	Poti 2
off	off	off	(P420 [01])* {01} "Enable R"	(P420 [02])* {02} "Enable L"	(P420 [03])* {04} "Fixed freq. 1" =5Hz (P465[01])	(P420 [05])* {04} "Fixed freq. 2" =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 parameterised 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 freq. 1" =5Hz (P465[01])	(P420 [04]) {05} Fixed freq. 2" =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"**
(See also Section 6: → Table behind parameter (P420), (P400) or (P434))

* Default setting
** only if available (Devices without function "Safe Stop")

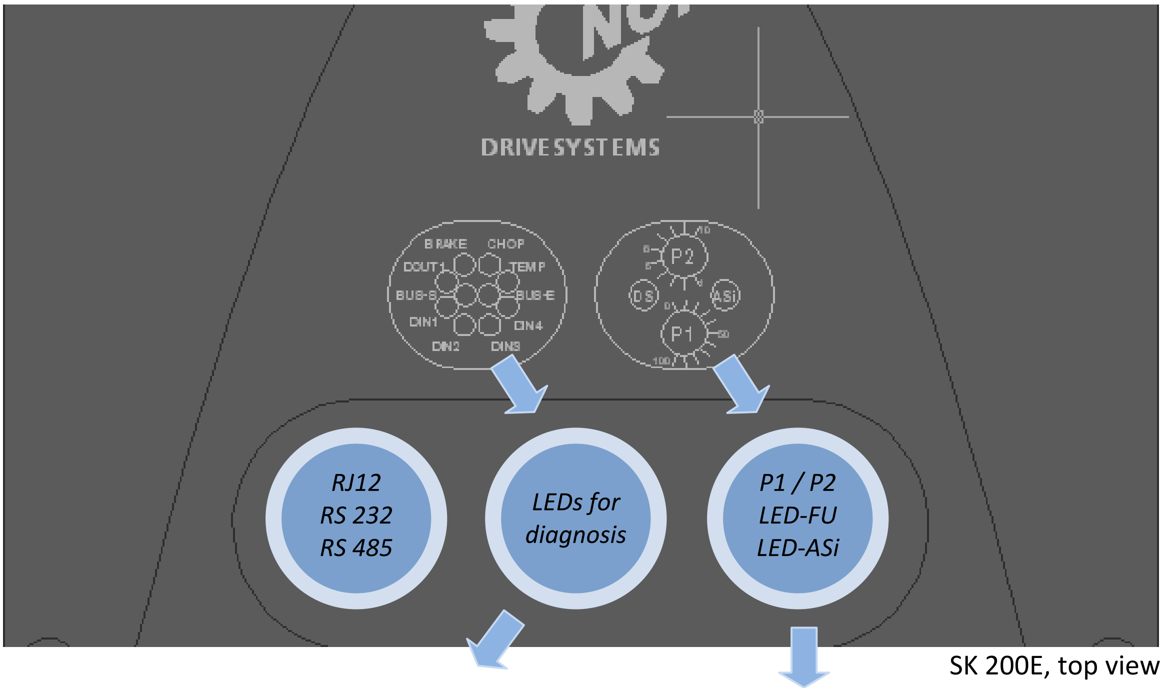
Applies to devices SK 225E, SK 235E (with AS interface on board)

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 parameterised 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.

5.1.3 Potentiometers P1 and P2 and diagnostic LEDs

The enable signal (Start/Stop) is implemented with the external switch. The setpoint value can be fixed with the integrated potentiometer P1. The potentiometer P2 is available for selection of the start-up and braking ramps.



SK 200E, top view

Diagnostic LEDs (5.1.3.1)

1	yellow	Digital output
2	yellow	Digital input 1
3	yellow	Digital input 2
4	yellow	Digital input 3
5	yellow	Digital input 4
6	yellow	Motor PTC
7	yellow	Brake chopper active
8	yellow	Mech. brake status
9	green	Bus Status 1
10	red	Bus Status 2

Potentiometers and LEDs (5.1.3.2)

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

The function of P1 and P2 depends on DIP 4/5 (Section 5.1.1). The meaning changes according to the setting.

As standard, P1 sets the setpoint value of 0-100% and P2 sets the ramp from 0.2-7sec.

LED FI	green red	Ready / Load (flashing) Error / Error number (flashing)
LED AS-I	green red	AS Interface status (dual LED)

5.1.3.1 Diagnostic LEDs

<table>
<tr><th colspan="5">Diagnostic LEDs</th></tr>
<tr><td>1</td><td>yellow</td><td>Digital output</td><td colspan="2">Indicates high signal at digital output</td></tr>
<tr><td>2</td><td>yellow</td><td>Digital input 1</td><td colspan="2" rowspan="4">Indicates high signal at digital input</td></tr>
<tr><td>3</td><td>yellow</td><td>Digital input 2</td></tr>
<tr><td>4</td><td>yellow</td><td>Digital input 3</td></tr>
<tr><td>5</td><td>yellow</td><td>Digital input 4</td></tr>
<tr><td>6</td><td>yellow</td><td>Motor PTC</td><td colspan="2">High signal indicates overheating of motor</td></tr>
<tr><td>7</td><td>yellow</td><td>Brake chopper active</td><td colspan="2">Indicates activity/load of brake chopper</td></tr>
<tr><td>8</td><td>yellow</td><td>Mech. brake status</td><td colspan="2">Indicates control of mechanical brake</td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">green</td><td rowspan="3">BUS Status 1</td><td>off</td><td>No active process data communication</td></tr>
<tr><td>flashing 0.25s</td><td>System bus in state “BUS Warning”</td></tr>
<tr><td>on</td><td>Process data communication on BUS
At least one telegram must be received within one second
SDO transfer is not indicated</td></tr>
<tr><td rowspan="4">10</td><td rowspan="4">red</td><td rowspan="4">BUS Status 2</td><td>off</td><td>No error</td></tr>
<tr><td>flashing 0.25s</td><td>Monitoring error P120 or P513
⇒E10.0 / E10.9</td></tr>
<tr><td>flashing 0.75s</td><td>Error in an external system bus module
⇒ E10.2 / E10.3
Bus module →Timeout on the external BUS (E10.2)
System bus module has a module error (E10.3)</td></tr>
<tr><td>on</td><td>System bus in state “BUS off”</td></tr>
</table>

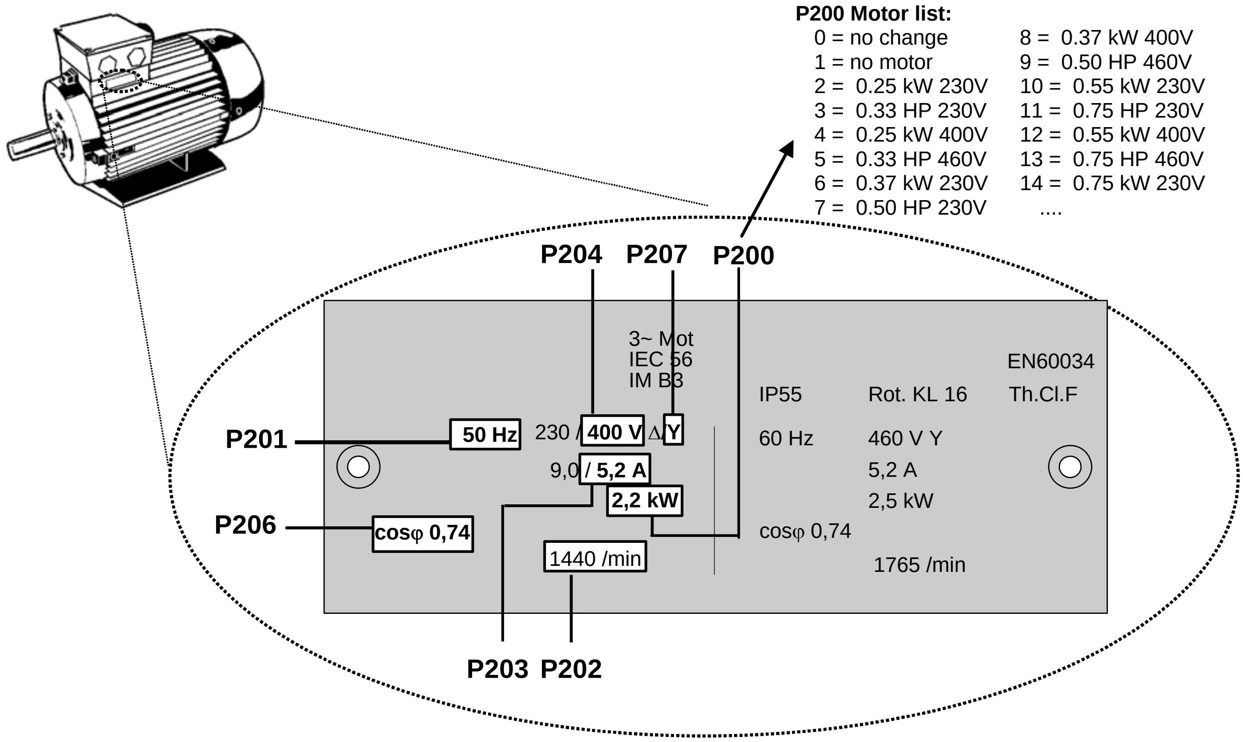
5.1.3.2 Status LEDs

Status LEDs				
LED FI	green red	Ready / Load Error / Error Number	off	FI not ready, no mains/control voltage
			green on	FI ready and not in overload mode
			green flashing	*0.5 Hz flashing frequency:* Standby *2 Hz flashing frequency:* switch-on disabled
			alternating green/red	*0.5 Hz flashing frequency:* Warning *1 Hz - 25 Hz flashing frequency:* FI switched on and in overload mode. Flashing frequency increases with increased overload.
			green on red flashing slowly	24v control voltage available, but no mains voltage. FI not ready for operation.
			red on/ flashing	Error: the flashing frequency indicates the error number.
LED AS-I	green red	AS Interface Status	off	No (PWR) AS interface voltage to the module
			green	Normal operation
			red	No data exchange possible (possible causes: Slave address = 0, master in STOP mode, slave not in LPS, slave with incorrect IO/ID, Reset active)
			alternating green/red	Peripheral error

5.2 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<.

NOTE: All motor data can be pre-set using the parameter P200. After successful 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.



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

In order to automatically determine the stator resistance, P220 = 1 must be set and confirmed by pressing "OK". The value calculated for the line resistance (dependent upon P207) will be saved in P208.

ATTENTION

After a default setting "Enable Left" or "Enable Right", the digital inputs DIN2 and DIN3 are <u>additionally</u> assigned for the evaluation of an HTL incremental encoder. The encoder evaluation function cannot be switched off. This means that with the use of an incremental encoder, it is essential to set parameters (P420[-02]) and (P420[-03]) to "no function". (For using the DIP-switches of the frequency inverter for parametrisation, please lock at section 5.1.2 .)

NOTE

It must be noted that DIP switch settings on the frequency inverter have priority over the parameter settings.

In addition, the settings of the integrated potentiometers P1 and P2 must be taken into account.

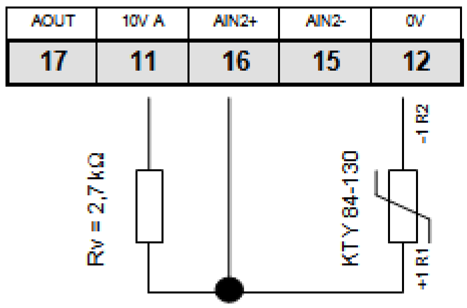
5.3 KTY84-130 connection

The current vector regulation of the SK 200E series can be further optimised by the use of a KTY84-130 temperature sensor ($R_{th(0°C)}$=500Ω, $R_{th(100°C)}$=1000Ω). By continuous measurement of the motor temperature, the highest precision of regulation by the frequency inverter and the associated optimum speed precision of the motor is achieved at all times. As the temperature measurement starts immediately after the (mains) switch-on of the frequency inverter, the frequency inverter provides immediate optimum control, even if the motor has a considerably increased temperature after an intermediate "Mains off / Mains on" of the frequency inverter.

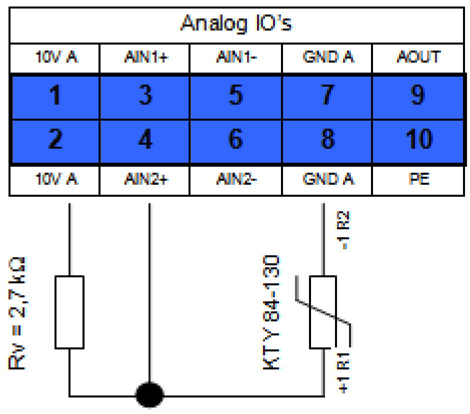
A KTY-84 sensor can only be connected to one of the two analog inputs of the I/O - extension module (SK xU4-IOE).

<u>Connection example</u>
(Assignment of connections, Analog Input 2)

SK CU4-IOE



SK TU4-IOE



(Illustration shows a section of the terminal blocks)

<u>Parameter settings (Analog Input 2)</u>

For the function of the KTY84-130, the following parameters must be set.

1. The motor data **P201-P207** must be set according to the identification plate.
2. The motor stator resistance P208 is determined at 20°C with **P220 = 1**
3. Function of Analog Input 2, **P400 [-04] = 30** (motor temperature)
4. Analog Input 2 mode, **P401 [-02] = 1** (negative temperatures are also measured)
   (from firmware version: V1.2)
5. Matching of Analog Input 2: **P402 [-02] = 1.54V** and **P403 [-03] = 2.64V** (with R_V= 2.7 kOhm)
6. Matching of time constants: **P161 [-02] = 400ms** (Filter time constant is at a maximum)
   Parameter (P161) is a module parameter. This cannot be set on the frequency inverter, but rather directly on the I/O-module. Communication is carried out e.g. via the direct connection of a ParameterBox to the RS232 interface of the module or by the connection of the frequency inverter via the system bus. (Parameter (P1101) object selection → …)
7. Motor temperature control (display): **P739 [-03]**

NOTE

For the determination of the motor stator resistance, the temperature must be within the range 15 … 25°C.

Overtemperature of the motor is monitored simultaneously and at 155°C (switching threshold as for thermistor) the drive is shut down with error message E002.

5.4 AS Interface

5.4.1 The bus system

The **A**ctuator -**S**ensor **Interface** (AS Interface) is a bus system for the lower field bus level. The transfer principle is a single-master system with cyclical polling. Up to 31 standard slaves (or 62 A/B slaves in the extended address range) can be operated on an unshielded two-wire cable up to 100m long and in any network structure (tree / linear / star). For the AS Interface, since the *Complete Specification* V2.1 a differentiation is made between standard and A/B slaves. Version V2.1 includes implements a doubling of the number of slaves to 62. This is implemented by the double assignment of addresses 1-31 and the designation "A slave" and "B slave". A/B slaves are labelled via the ID code and can therefore be uniquely identified by the master. *NORD AS Interface modules are standard slaves.*

The AS Interface cable (yellow) transfers data and energy. Addressing is carried out via the master, which also provides further management functions, or via a separate addressing device. The 4-bit reference data (in each direction) is transferred cyclically with an effective identification of errors and a cycle time of 5 ms. The bus system is defined in the *AS Interface Complete Specification*.

The bus system is standardised as per EN 50295, IEC62026.

5.4.2 Features

The SK 225E and SK 235E frequency inverter versions provide an integrated AS interface as standard. Therefore, these devices can be directly integrated into an AS interface network. Only the adaptation of various frequency inverter functions (Dip switches or parameters), addressing and the correct connection of the power supply, BUS, sensor and actuator cables needs to be carried out.

Features

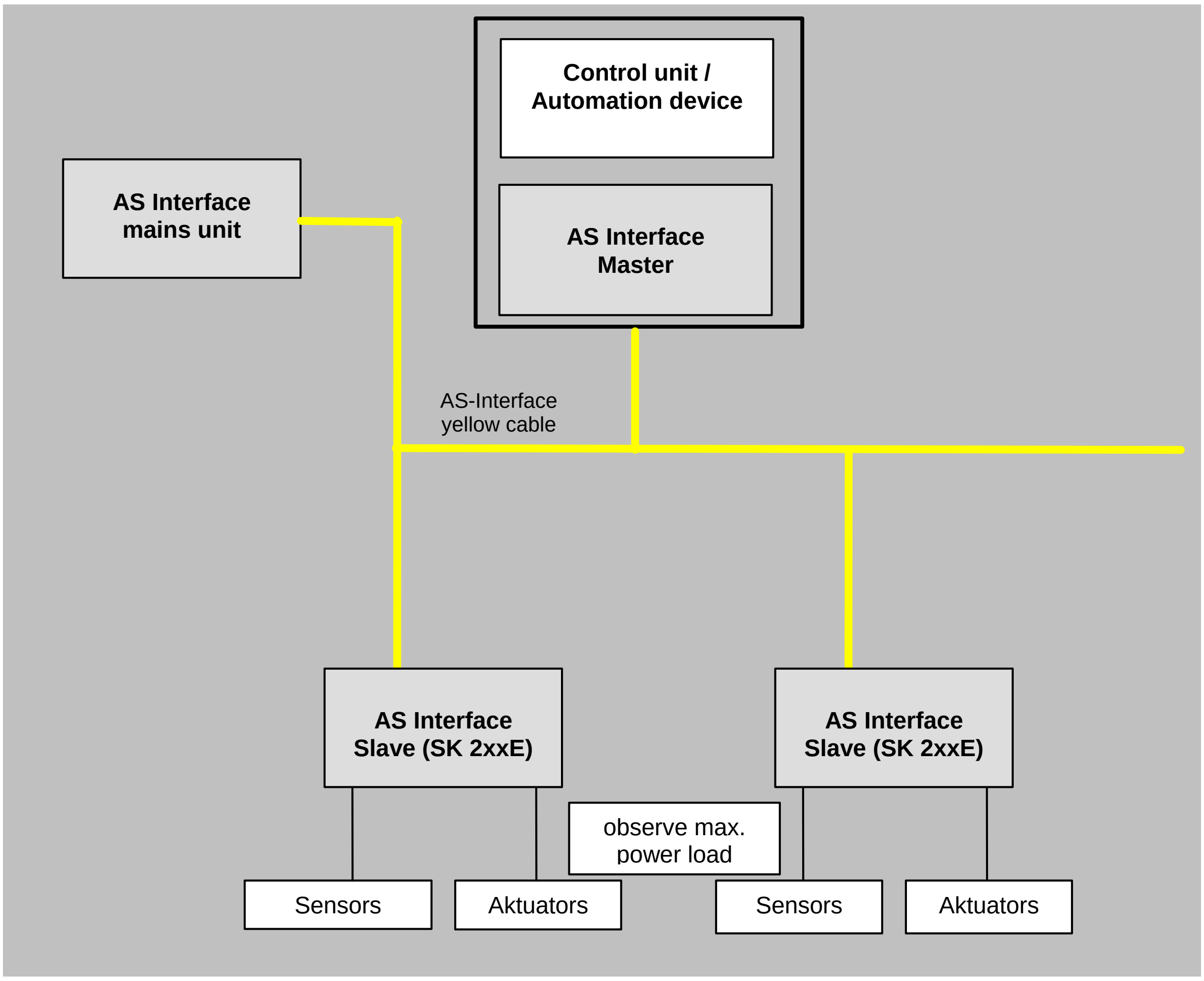
- Electrically isolated bus interface
- Status display (1 LED)
- Configuration optionally via integrated DIP switches and potentiometers or by parameterisation
- Slave profile S-7.0 (4I / 4O)
- 24V supply of the integrated module and the frequency inverter via the yellow AS-i cable.
- Connection to the frequency inverter via the terminal block.
- Optional connection via M12 flange plug connector
- Up to 31 frequency inverters on one bus conductor (standard slave (A-slave) technology)
- Cycle time ≤ 5ms
- Address as delivered = 0
- Max. current consumption 290mA, of which 60mA are available for peripherals (initiators, connected parameterisation tool, actuators).

The factory setting of the frequency inverter enables the immediate availability of common AS-i basic functions. These functions can be adapted by parameterisation. For most common applications, DIP switches are alternatively available of the frequency inverter for the selection of functions.

5.4.3 Bus structure and technology

The AS interface network can be set up in any configuration. Linear, star, ring or tree structures are possible. An existing network can be subsequently extended by the addition of further slaves. Up to 31 standard slaves (i.e. a maximum of 124 binary sensors and 124 binary actuators) can be connected to and AS interface network or an AS interface master. Each AS interface slave has its own address (1 to 31), which is transferred to the slave with the aid of an addressing device or via a command from the AS interface master to the slave. Each slave address may only be assigned once.

Usually the AS interface master is a part or component of the control unit and forms the interface between the control unit and the connected slaves. An AS master communicates independently and exchanges data with the connected AS-i slave options. Normal network components may not be used in an AS interface network. Only a special AS interface mains unit may be used for the power supply of each AS interface strand. This AS interface power supply is connected directly to the yellow standard cable (ASI+ and ASI- cable) and should be located as close as possible to the AS-i master in order to keep the voltage drop as small as possible.



NOTE

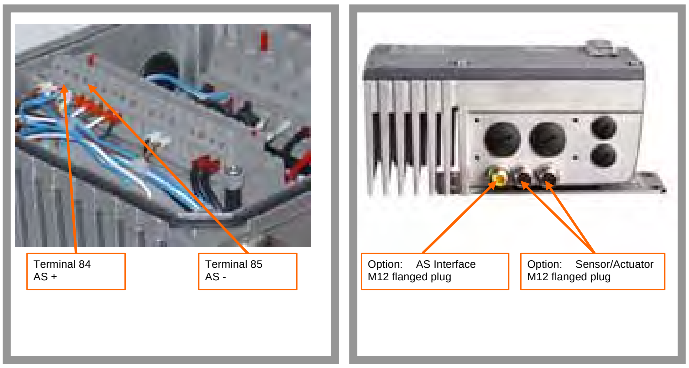
It is essential that the PE connection of the AS interface mains unit (if present) is earthed.

The brown ASi+ and the blue ASi- wire from of the AS interface cable must not be earthed.

5.4.4 Commissioning of the AS Interface

Connection

Connection of the AS interface cable is made via terminals 85/85 of the terminal block and can optionally be made to an appropriately labelled M12 flange plug contact (yellow) Details of the connection terminals are explained in Section 2.8.2.



Illustrations : Connection versions of the AS Interface

Control voltage - frequency inverter supply

With the use of an AS interface, the FI control unit is supplied via the yellow AS-i cable. In this case, a voltage of 24V is provided to terminal 44.

Connection of an additional voltage source to this terminal is not permitted and may cause damage to the device!

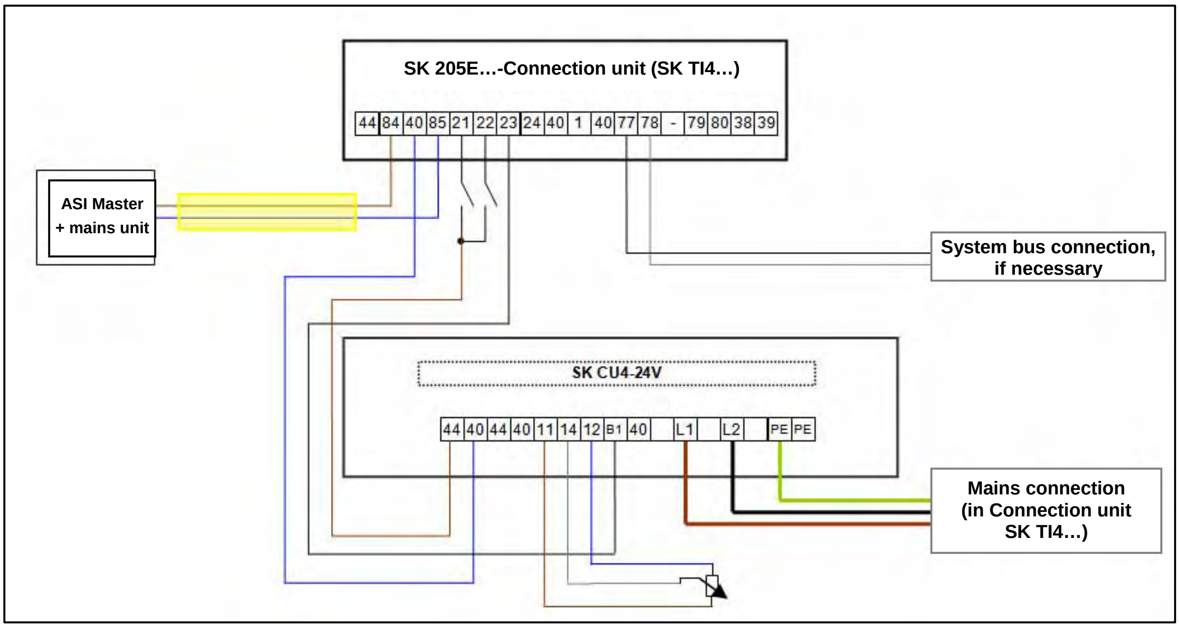
If the AS interface ("yellow cable") is not used, the control voltage is supplied to the frequency inverter in the usual way via terminals 44/40.

NOTE

For use of the yellow AS interface cable:

- no voltage source may be connected to terminals 44/40,
- the frequency inverter supply is via the yellow AS-i cable;
- the supply voltage (24V) for the use of the digital inputs or other external peripherals (e.g. activators) can be obtained from terminals 44/40. The total permissible current is restricted to 60mA!

As the permissible load on terminal 44 is limited to 60mA if the AS interface is used, in case of higher current requirements there is the possibility of including an additional mains unit (e.g. SK CU4-…-24V) to supply the additional peripherals. However, under no circumstances may the 24V from the mains unit be connected to the frequency inverter (See also the following connection example).



If a total current load of 60mA is not exceeded, it is also permissible to supply initiators via terminal 44 of the frequency inverter.

Signal status LED (AS-i - specific display)

The status of the AS interface is indicated by the dual-colour LED **AS-i**. (See also Section 5.1.3)

The displays have the following meaning:

LED (dual-colour) ASi → **AS** Interface	**Meaning**
OFF	No AS interface voltage to the module (PWR) Connections to terminals 84 and 85 exchanged.
green **ON**	Normal operation (AS interface active)
red**ON**	no exchange of data → Slave address = 0 → Slave not in LPS → Slave with incorrect IO/ID → Master in STOP mode → Reset active
alternately flashing red / green	Peripheral error → FI control unit does not start (AS-i voltage too low, control unit faulty)

Configuration

The most important functions (functions of the sensor / actuator signals via the AS-i BUS or the "on board potentiometers" P1 and P2) can be set on the frequency inverter via DIP4 and DIP5 of the DIP switch block (Section 5.1.2 "DIP switch configuration").

Alternatively, the functions can also be assigned via arrays **[-01] … [-04]** of parameters **(P480)** and **(P481)** or [-01] and [-02] of (P400) (Section: 6.1.5). However, settings made in these parameters are only effective if the DIP switches (DIP4 and DIP5) are set to the position "OFF".

NOTE	In the default settings of the DIP switches (DIP 4/5 = off), the digital inputs of the frequency inverter are active. However, as soon as one of the two DIP switches is set to the position "ON", the functions of the digital inputs are switched off. However, the gateway function of digital inputs 1 and 2 to the ASi Out bits 2 and 3 is retained.

NOTE	Due to the low load reserves of the low voltage with the use of the AS interface, it is recommended that parameterisation of the frequency inverter is carried out with the aid of the NordCon software. Especially with longer operation, the use of a ParameterBox (SK PAR-3H / SK CSX-3H) may cause damage to the frequency inverter.

Addressing

In order to use a frequency inverter in an ASi network, this must be assigned with a unique address (1-31). The FI is set to address 1 as the factory setting, and can therefore be identified as a "new device" by the AS-i master (prerequisite for the automatic address assignment by the master).

In many other cases, addressing is carried out by means of a normal addressing device for AS-i slaves. The following should be noted:

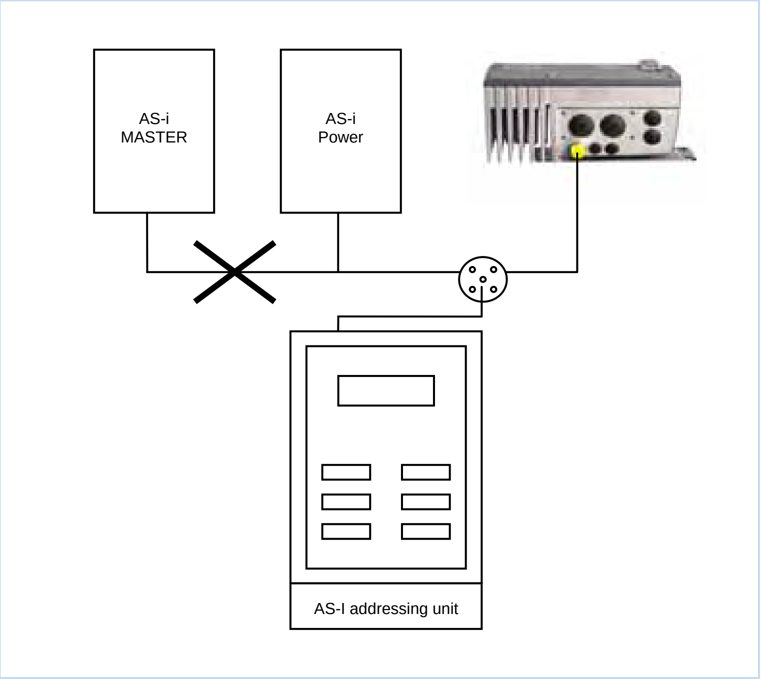
- Do not use the internal voltage source of the addressing device (FI power consumption) →
- Ensure the power supply via the yellow AS-i cable.
- Disconnect the AS-i master during addressing
- Set the address ≠ 0
- Do not doubly assign addresses

Normal hand-held units can be used for the addressing of the frequency inverter. Typical manufacturers are Pepperl+Fuchs (e.g.: VBP-HH1) and IFM. Addressing units without an external power supply cannot provide the required current of 290mA, which is necessary for the supply of the control level of the frequency inverter. Therefore, a version should be selected, which is designed to meet the requirements of the frequency inverter.

The following lists the possibilities for the practical implementation of the addressing of an SK 225E/SK235E using an addressing unit.

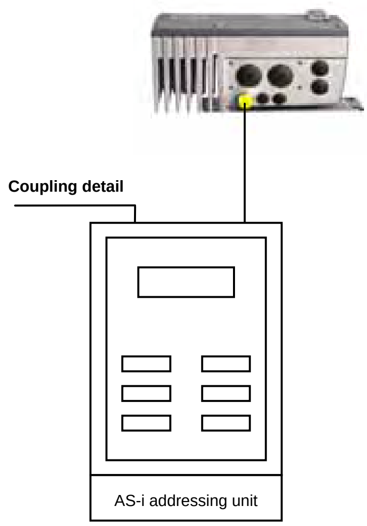
Method 1

With a normal addressing device (equipped with an M12 plug for connection to the AS-i bus) the AS-i can be integrated into the AS-i network via a suitable access point. The prerequisite for this is that the AS-i master can be switched off.



Method 2

With an addressing unit (equipped with an M12 plug for connection to the AS-i bus and an additional M12 plug for an external power supply), the addressing unit can be directly connected into the AS-i cable.



5.4.5 Technical data for AS interface

Name	Value
Supply of AS interface connection, PWR connection (yellow cable)	26.5 – 31.6V, max. 290mA
Slave profile	S-7.0
I/O-Code	7
ID Code	0
Ext. ID-Code 1 / 2	F
Address	01 – 31 (Condition as delivered: 0)

5.4.6 Certificate

Zertifikat
Certificate

Das AS-Interface Produkt
The AS-Interface product

SK 22xE
SK 23xE

der Firma
of the company

Getriebebau NORD GmbH & Co.KG
In/at D-22941 Bargteheide

wurde gemäß der Complete Specification (V 3.0) mit dem Slaveprofil **S-7.0** entwickelt.
has been developed according to the Complete Specification (V 3.0) with the slave profile **S-7.0.**

Das Produkt hat die Bezeichnung
The Product has the designation

SK 22xE
SK 23xE

Dies Produkt darf mit dem Zertifizierungslogo und der Nummer der Zertifizierungs-urkunde (ZU-Nr.) gekennzeichnet werden.
This product may be marked with the certification Logo and the Number of the certification document (ZU-No.).

AS-International Association
Zertifizierungsstelle - certification office
ZU-Nr.: 86501

Gelnhausen, Germany, 14. April 2009

Zertifizierungsstelle – certification office
AS-International Association

Grundlage des Zertifikates ist die Complete Specification (V 3.0), die aktuelle Prüfordnung und die Zertifizierungsrichtlinie der AS-International Association e.V..

Die Baumusterprüfung des Referenzproduktes wurde durchgeführt im **AS-Interface Prüflabor des Steinbeis Transfer-zentrum Leipzig.**

Die Baumusterprüfung und die Herstellererklärung wurden für gut befunden.

Die Verantwortung für das Produkt verbleibt beim Hersteller.

The Certificate is based on the Complete Specification (V 3.0), the actual test requirements and the certification guideline of AS-International Association e.V..

The type test of the reference product was performed by the AS-Interface test laboratory at the Steinbeis Transferzentrum Leipzig.

The type test and the manufacturer declaration have been approved to be good.

The manufacturer is responsible for his product.

6 Parameterisation

The frequency inverter, field bus and I/O -extension modules each have their own logic systems. These can be adapted to customers' requirements by means of changeable parameters. The basic functions of the particular modues are factory-set, so that the units have basic functionalities on delivery. Limited adaptations of individual functions of the relevant devices can be implemented vie DIP switches. For all further adjustments, access to the parameters of the relevant device with the aid of a ParameterBox (SK PAR-3H, SK CSX-3H) or NordCon software is essential. It should be noted that the hardware configuration (DIP switches) has priority over configuration via software (parameterisation).

The following describes the relevant parameters for the frequency inverter (Section 6.1) and the I/O extension modules (Section 6.2). Explanations for the parameters relating to the field bus options or the special functions of the POSICON can be obtained from the relevant supplementary manuals.

ATTENTION

For changes to the frequency inverter software V 1.2 R0, the structure of individual parameters has been changed for technical reasons.

(E.g.: up to version V 1.1 R2, (P417) was a simple parameter. As of version V 1.2. R0 this has been divided into two arrays ((P417) [-01] and [-02]))

When plugging an EEPROM from a frequency inverter with an earlier software version into a frequency inverter with a software version higher than V 1.2, the stored data is automatically adapted to the new format. the new parameters are saved in the default settings. Correct functioning is therefore ensured.

However, it is not permissible to plug an EEPROM with a software version higher than V 1.2 into a frequency inverter with a lower software version, as this may lead to a complete loss of data.

6.1 Parameterisation of frequency inverter SK 200E

Every frequency inverter is factory-set for a motor of the same power. All parameters can be adjusted "online". There are four parameter sets which can be switched over during operation. As delivered, all parameters are visible; however, some can be hidden with parameter P003.

NOTE

As there are dependencies between parameters, it is possible for invalid internal data and operating faults to be generated briefly. Only the inactive or non-critical parameter sets should be adjusted during operation.

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

Menu group	No.	Master function
Operating displays	**(P0--):**	For the selection of the physical units of the display value.
Basic parameters	**(P1--):**	Contain the basic inverter settings, e.g. switch on and switch off procedures and, along with the motor data, are sufficient for standard applications.
Motor data	**(P2--):**	Settings for the motor-specific data, important for ISD current control, and selection of characteristic curve during the setting of dynamic and static boost.
Control Parameters	**(P3--):**	Parameter for the adaptation of any incremental encoder used.
Control terminals	**(P4--):**	Analog input and output scaling, specification of digital input and relay output functions, as well as PI controller parameters.
Additional parameters	**(P5--):**	Functions dealing with e.g. the BUS interface, pulse frequency or error acknowledgement.
Positioning	**(P6--):**	Adjustment of the positioning function in SK 200E. For further details please refer to **Manual BU 0210**.
Information	**(P7--):**	Display of e.g. actual operating values, old error messages, equipment status reports or software version.
Array parameters	**-01 ... -xx**	Some parameters in these groups can be programmed and read in several levels (arrays). After the parameter is selected, the array level must also be selected.

NOTE: Parameter P523 can be used to load the factory settings for all parameters at any time. This can be helpful, e.g. during the commissioning of a frequency inverter whose parameters no longer correspond with the factory settings.

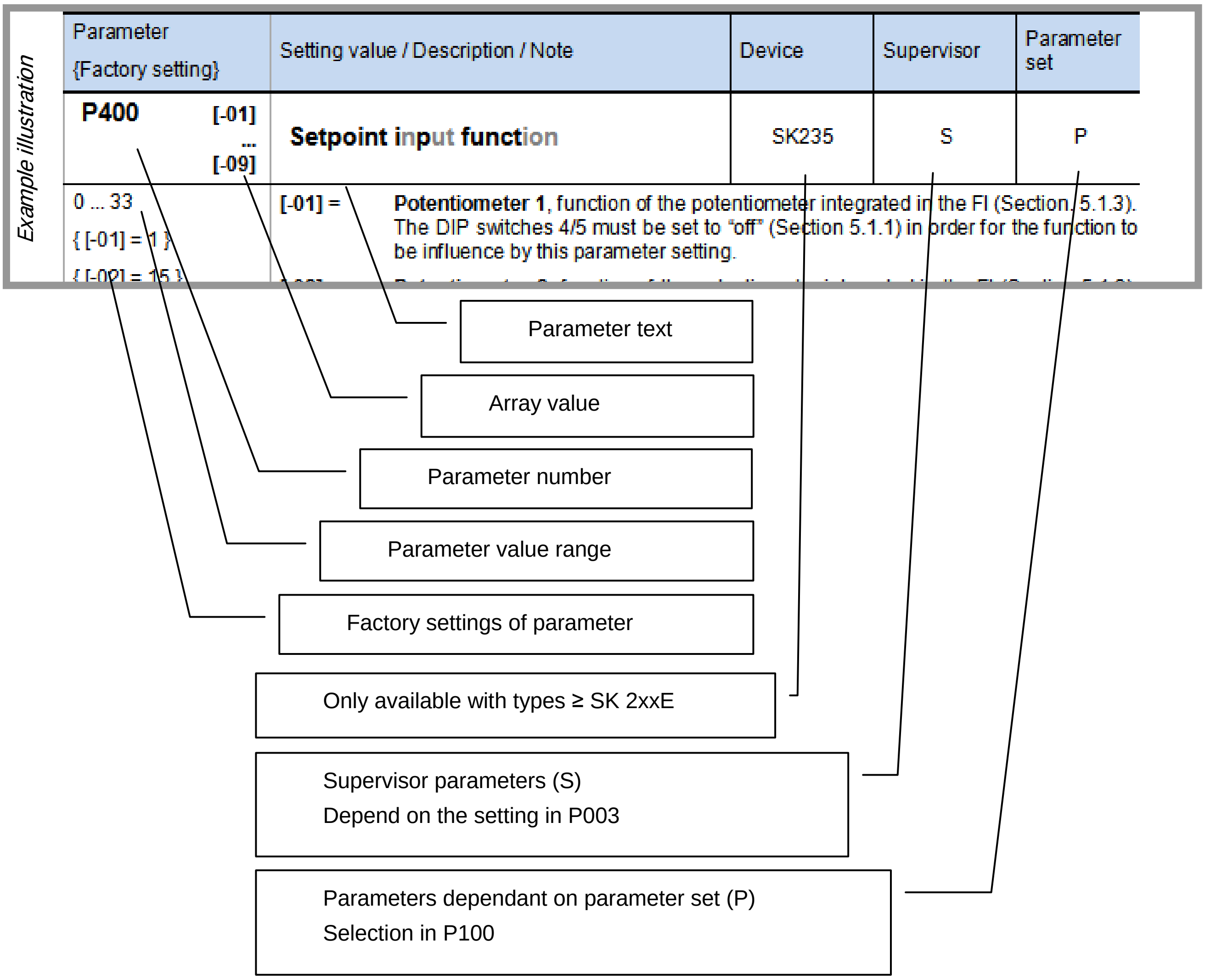
ATTENTION

All current parameter settings will be overwritten, if P523= 1 is set and confirmed with "OK".

To save the actual parameter settings, these can be transferred to the ParameterBox memory.

Availability of the parameters

Due to certain configurations, the parameters are subject to certain conditions. The following tables (from Section 6.1 onwards) list all parameters together with the relevant information.

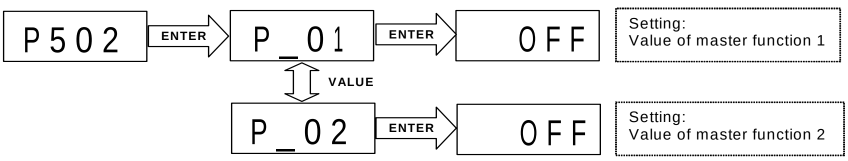


Array parameter display

Some parameters have the option of displaying settings and views in several levels (arrays). After the parameter is selected, the array level is displayed and must then also be selected.

If the SimpleBox SK CSX-3H is used, the array level is shown by _ - 0 1 . With the ParameterBox SK PAR-3H (picture on right) the selection options for the array level appear at the top right of the display.

SimpleBox SK CSX-3H



ParameterBox SK PAR-3H

6.1.1 Operating displays

The abbreviations used are described in Section 9.12 "Abbreviations in this Manual".

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P000	**Operating parameter display**			
0.01 ... 9999	In the SimpleBox (SK CSX-3H) display, the parameter value *online* selected in P100 is displayed.			
P001	**Selection of display value**			
0 ... 63 { 0 }	**0 = Actual frequency *[Hz]***, is the actual output frequency supplied by the FI. **1 = Rotation speed *[1/min]***, is the actual rotation speed as calculated by the FI. **2 = Setpoint frequency *[Hz]***: the output frequency equivalent to the actual setpoint. This need not match the actual output frequency. **3 = Current *[A]***: the actual output current measured by the FI. **4 = Torque current *[A]***: the torque-developing output current of the FI. **5 = Voltage *[V~]***: the actual alternating voltage being output by the FI. **6 = D.c. link circuit voltage *[V =]***: the internal DC voltage of the FI. Amongst other things, this depends on the level of the mains voltage. **7 = cos Phi,** the currently calculated value of the power factor. **8 = Apparent power *[kVA]***: the actual apparent power calculated by the FI. **9 = Real power *[kW]***: the actual effective power calculated by the FI. **10 = Torque *[%]***: the actual torque calculated by the FI. **11 = Field *[%]*:** the actual field in the motor calculated by the FI. **12 = On-time (operating hours) *[h]*:** time that voltage is applied to the FI. **13 = Run-time (enabled operating hours) *[h]*:** time for which the FI has been enabled. **14 = Analog input 1 *[%]*,** actual value AIN1 of the first I/O extension SK xU4-IOE. **15 = Analog input 2 *[%]*,** actual value AIN2 of the second I/O extension SK xU4-IOE. **16 = Position setpoint value** →Posicon, BU 0210 **17 = Position current value** → Posicon, BU 0210 **19 = Temperature of heat sink *[°C]***: current temperature of the FI heat sink. **20 = Usage rate motor *[%]***: average motor load, based on the known motor data (P201...P209). **21 = Usage rate braking resistor - R [%]**: average braking resistor load, based on the known resistance data (P556...P557). **22 = Internal temperature *[°C]***, current temperature in FI housing. **23 = Motor temperature *[°C]***, only in combination with the analog input and appropriate wiring (KTY84). **30 = Current setpoint value of the motor potentiometer-Setpoint value [Hz]**, display of the setpoint which can be set in advance (without the drive unit running) via the motor potentiometer function 71 / 72 (See parameter P420). **50 =** Actual incremental encoder position value → Posicon, BU 0210 **51 =** Actual absolute encoder position value → Posicon, BU 0210 **52 =** Actual position difference → Posicon, BU 0210 **53 =** Actual position difference Absolute/Incremental → Posicon, BU 0210 **54 =** Actual position difference Calculated/Measured → Posicon, BU 0210 **60 = R Stator Ident**: stator resistance, automatic determination of motor data, P220 **61 = R Rotor Ident**: rotor resistance, automatic determination of motor data, P220 **62 = L Scatter Stator Ident**, stator leakage inductance, from automatic determination of motor data, P220 **63 = L Stator Ident**: stator inductance, from automatic determination of motor data, P220			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P002	**Display Factor**		S	
0.01 ... 999.99 { 1.00 }	The selected operating value in parameter P001 >Select of display< is multiplied with the scaling factor in P000 and displayed in >Operating parameter display<. It is therefore possible to display system-specific operating such as e.g. the throughput quantity			
P003	**Supervisor code**			
0 ... 9999 { 1 }	**0 =** All parameters are visible except for the Supervisor parameters and the group P3xx/ P6xx **1 =** All parameters are visible except for the group P3xx and P6xx. **2 =** All parameters are visible except for the group P6xx. **3 =** All parameters are visible. **4 =** ... 9999, (except 65) only parameters P001 and P003 are visible.			

6.1.2 **Basic parameters** (Frequency inverter)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P100	**Parameter set**		S	

0 ... 3

{ 0 }

Selection of the parameters sets to be parameterised. 4 parameter sets are available. All parameter set-dependent parameters are identified by **P**.

The selection of the operating parameter set is performed via a digital input or the Bus control. Switching can take place during operation (online).

Setting	Digital input function [8]	Digital input function [17]	LEDs SimpleBox
0 = Parameter set 1	Low	Low	1 2
1 = Parameter set 2	High	Low	1 2
2 = Parameter set 3	Low	High	1 2
3 = Parameter set 4	High	High	1 2

If enabled via the keyboard (SimpleBox, PotentiometerBox or ParameterBox), the operating parameter set will match the settings in P100.

P101	**Copy parameter set**		S	

0 ... 4

{ 0 }

After confirmation with the OK key, a copy of the parameter set selected in P100 >Parameter set< is written to the parameter set dependent on the value selected here.

0 = Do not copy

1 = Copy actual to P1: copies the active parameter set to parameter set 1

2 = Copy actual to P2: copies the active parameter set to parameter set 2

3 = Copy actual to P3: copies the active parameter set to parameter set 3

4 = Copy actual to P4: copies the active parameter set to parameter set 4

P102	**Acceleration time**			P

0 ... 320.00 s

{ 2.00 }

Acceleration time (acceleration ramp) is the time corresponding to the linear frequency rise from 0Hz to the set maximum frequency (P105). If an actual setpoint of <100% is being used, the acceleration time is reduced linearly according to the setpoint set.

The acceleration time can be extended by certain circumstances, e.g. FI overload, setpoint lag, smoothing, or if the current limit is reached.

Notes on ramp gradient:

Amongst other things, the ramp gradient is governed by the inertia of the rotor.
A ramp with a gradient which is too steep may result in the "inversion" of the motor.
In general, extremely steep ramps (e.g.: 0 - 50Hz in < 0.1 s) should be avoided, as may cause damage to the frequency inverter.

P103	**Deceleration time**			P

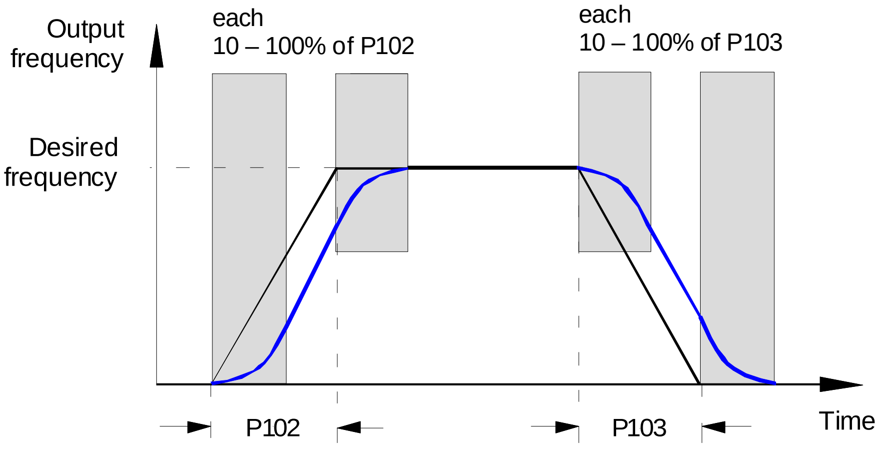
0 ... 320.00 s

{ 2.00 }

Deceleration time (braking ramp) is the time corresponding to the linear frequency reduction from the set maximum frequency (P105) to 0Hz. If an actual setpoint <100% is used, the deceleration time reduces accordingly.

The deceleration time can be extended by certain circumstances, e.g. by the selected >Switch-off mode< (P108) or >Ramp smoothing< (P106).

Notes on ramp gradient: See parameter (P102)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P104	**Minimum frequency**			P
0.0 ... 400.0 Hz { 0.0 }	The minimum frequency is the frequency supplied by the FI as soon as it is enabled and no additional setpoint is set. In combination with other setpoints (e.g. analog setpoint of fixed frequencies) these are added to the set minimum frequency. This frequency is undershot when a) The drive is accelerated from standstill. b) The FI is blocked. The frequency then reduces to the absolute minimum (P505) before it is blocked. c) The FI is reversing. The reverse in the rotation field takes place at the absolute minimum frequency (P505). This frequency can be continuously undershot if, during acceleration or braking, the function "Maintain frequency" (Function Digital input = 9) is executed.			
P105	**Maximum frequency**			P
0.1 ... 400.0 Hz { 50.0 } DIP7 = off { 60.0 } DIP7 = on Section 5.1.1	The frequency supplied by the FI after being enabled and once the maximum setpoint is present, e.g. analog setpoint corresponding to P403, a correspondingly fixed frequency or maximum via the SimpleBox / ParameterBox. This frequency can only be overshot by the slip compensation (P212), the function "Maintain frequency" (function digital input = 9) or a change to another parameter set with lower maximum frequency.			
P106	**Ramp smoothing**		S	P
0 ... 100 % { 0 }	This parameter enables a smoothing of the acceleration and deceleration ramps. This is necessary for applications where gentle, but dynamic speed change is important. Ramp smoothing is carried out for every setpoint change. The value to be set is based on the set acceleration and deceleration time, however values <10% have no effect. The following then applies for the entire acceleration or deceleration time, including rounding: $t_{tot\ \ ACCELERATION\,TIME} = t_{P102} + t_{P102} \cdot \frac{P106\,[\%]}{100\%}$ $t_{tot\ \ DECELERATION\,TIME} = t_{P103} + t_{P103} \cdot \frac{P106\,[\%]}{100\%}$  			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P107	**Brake reaction time**			P
0 ... 2.50 s { 0.00 }	Electromagnetic brakes have a physically-dependent delayed reaction time when actuated. This can cause a dropping of the load for lifting applications, as the brake only takes over the load after a delay. This reaction time can be taken into account under parameter P107 (Braking control). Within the adjustable application time, the FI supplies the set absolute minimum frequency (P505) and so prevents movement against the brake and load drop when stopping. See also the parameter >Release time< (P114) **NOTE:** For the control of electromagnetic braking (especially for lifting operations) an internal relay should be used→, Function 1, external brake (P434). The minimum absolute frequency (P505) should never be less than 2.0Hz. **NOTE:** If a time > 0 is set in (P107) or (P114), at the moment the FI is switched on, the level of the excitation current (field current) is checked. If no magnetising current is present, the FI remains in magnetising mode and the motor brake is not released. In order to achieve a shut-down and an error message (E016) in this case, (P539) must be set to 2 or 3.			

Recommendation for applications:

Lifting equipment with brake, without speed feedback

P114 = 0.2...0.3sec.

P107 = 0.2...0.3sec.

P201…P208 = Motor data

P434 = 1 (ext. brake)

P505 = 2...4Hz

for safe start-up

P112 = 401 (off)

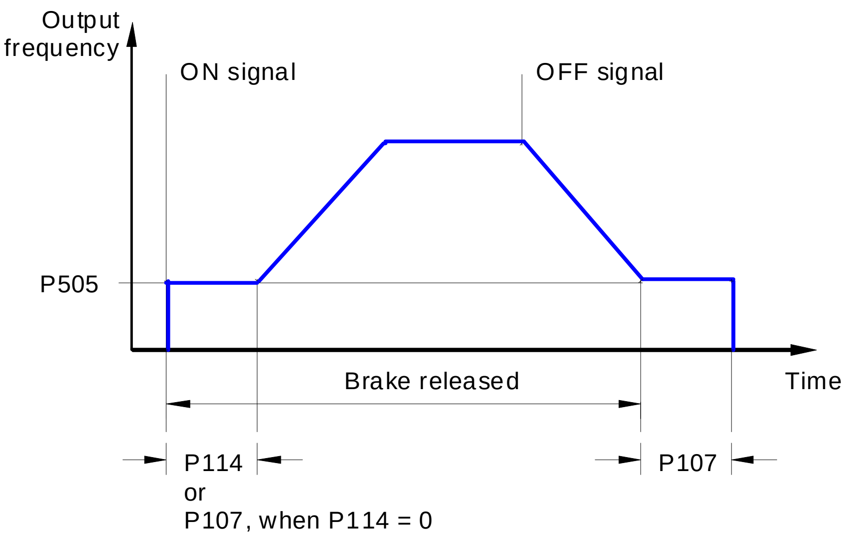
P536 = 2.1 (off)

P537 = 201 (off)

P539 = 2/3 (I_{SD} monitoring)

against load drops

P214 = 50...100% (precontrol)



Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P108	**Disconnection mode**		S	P

0 ... 13

{ 1 }

This parameter determines the manner in which the output frequency is reduced after "Blocking" (controller enable→ Low).

0 = Voltage disable: The output signal is switched off immediately. The FI no longer supplies an output frequency. In this case, the motor is braked only by mechanical friction. Immediately switching the FI on again can lead to an error message.

1 = Ramp down: The current output frequency is reduced in proportion to the remaining deceleration time, from P103/P105.

2 = Delayed ramping: as with ramp, however for generational operation the brake ramp is extended, or for static operation the output frequency is increased. Under certain conditions, this function can prevent overload switch off or reduce brake resistance power dissipation.

NOTE: This function must not be programmed if defined deceleration is required, e.g. with lifting mechanisms.

3 = Instant DC braking: The FI switches to the preselected DC current (P109) immediately. This DC current is supplied for the remaining proportion of the >DC brake time< (P110). Depending on the relationship of the actual output frequency to the max. frequency (P105), the >DC braking time< is shortened. The time taken for the motor to stop depends on the application. This depends on the inertia of the load, the friction and the DC current which is set (P109).
With this type of braking, no energy is fed back to the FI. Heat losses occur primarily in the rotor of the motor.

4 = Constant brake distance: The brake ramp starts after a delay if the equipment is not being driven at the maximum output frequency (P105). This results in an approximately similar stopping distance for different frequencies.

NOTE: This function cannot be used as a positioning function. This function should not be combined with ramp smoothing (P106).

5 = Combined braking: Dependent on the actual link voltage (VDC), a high frequency voltage is switched to the basic frequency (linear characteristic curves only, P211 = 0 and P212 = 0). The deceleration time is retained where possible (P103). →additional motor warming!

6 = Quadratic ramp: The brake ramp does not follow a linear path, but rather a decreasing quadratic one.

7 = Quadratic ramp with delay: Combination of functions 2 and 6

8 = Quadratic ramp with combined braking: Combination of functions 5 and 6

9 = Constant acceleration power: Only applies in field weakening range! The drive is further accelerated or braked with a constant electrical power. The ramp depends on the load.

10 = Distance calculator: Constant distance between actual frequency / speed and the set minimum output frequency (P104).

11 = Constant acceleration power with delay: Combination of functions 2 and 9.

12 = Constant acceleration power Mode3: as 11 with additional brake chopper relief

13 = Switch-off delay

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P109	**DC brake current**		S	P
0 ... 250 % { 100 }	Current setting for the functions of DC current braking (P108 = 3) and combined braking (P108 = 5). The correct setting value depends on the mechanical load and the required deceleration time. A higher setting brings large loads to a standstill more quickly. The 100% setting relates to a current value as stored in the >Nominal current< parameter P203. **NOTE:** The amount of DC current (0Hz) which the FI can supply is limited. For this value, please refer to the table in Section 9.5.3, column: 0Hz. In the basic setting this limiting value is about 110%.			
P110	**Time DC brake on**		S	P
0.00 ... 60.00 s { 2.00 }	The time during which the motor has the current selected in parameter >DC brake current< applied to it during the DC braking functions (P108 = 3). Depending on the relationship, actual output frequency to max. frequency (P105), the >Time DC brake on< is shortened. The time starts running with the removal of the enable and can be interrupted by fresh enabling.			
P111	**P factor torque limit**		S	P
25 ... 400 % { 100 }	Directly affects the behaviour of the drive at torque limit. The basic setting of 100% is sufficient for most drive tasks. If this value is too high, the drive unit will tend to oscillate when the torque limit is reached. If the value is too low, the programmed torque limit may be exceeded.			
P112	**Torque current limit**		S	P
25 ... 400 % / 401 { 401 }	With this parameter, a limit value for the torque-generating current can be set. This can prevent mechanical overloading of the drive. It cannot provide any protection against mechanical blockages (movement to stops). A slipping clutch which acts as a safety device must be provided. The torque current limit can also be set over an infinite range of settings using an analog input. The maximum setpoint (compare adjustment 100%, P403/P408) then corresponds to the value set in P112. The limit value 20% of torque current cannot be undershot by a smaller analog setpoint (P400/405 = 2) (in servo mode with P300 = 1, not below 10%)! **401 = OFF** means that the torque current limit is switched off! This is also the basic setting for the FI.			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P113	**Jog frequency**		S	P

-400.0 ... 400.0 Hz
{ 0.0 }

When using the **SimpleBox or ParameterBox** to control the FI, the jog frequency is the initial value following enabling.

Alternatively, when control is via the control terminals, the jog frequency can be activated via one of the digital inputs.

The setting of the jog frequency can be carried out directly via this parameter or, if the FI is enabled via the keyboard, by pressing the OK key. In this case, the actual output frequency is set in parameter P113 and is then available for the next start.

NOTE: Specified setpoints via the control terminals, e.g. jog frequency, fixed frequencies or analog setpoints, are generally added with the correct sign. The set maximum frequency (P105) cannot be exceeded and the minimum frequency (P104) cannot be undershot.

P114	**Brake delay off (release time)**		S	P

0 ... 2.50 s
{ 0.00 }

Electromagnetic brakes have a delayed reaction time during release, which depends on physical factors. This can lead to the motor starting while the brake is still applied, which will cause the inverter to switch off with an overcurrent report.

This release time can be taken into account in parameter P114 (Braking control).

During the adjustable release time, the FI supplies the set absolute minimum frequency (P505) thus preventing movement against the brake.

See also the parameter >Brake reaction time< P107 (setting example).

NOTE: If the brake release time is set to "0", then P107 is the brake release and reaction time.

P120 [-01] ... [-04]	**External Control Units**		S	

0 ... 2
{ 1 }

Array levels:

[-01] = Bus TB (Extn. 1)

[-02] = Analog TB (Extn.2) *(second I/O-TB)*

[-03] = Analog TB (Extn.3) *(first I/O-TB)*

[-04] = Extension 4 *(reserved)*

Setting values, for each array:

0 = Monitoring off

1 = Auto: communications are only monitored if an existing communication is interrupted. If after switching on the mains a module which was previously present is not detected, this does not result in an error.
The monitoring only becomes active when one of the extensions commences communication with the FI.

2 = Monitoring active immediately: immediately after being connected to the mains, the FI commences monitoring the relevant module. If the module is not detected after the mains have been switched on, the FI remains in the state "Not on standby" for 5 seconds and then triggers an error message.

6.1.3 Motor data / characteristic curve parameters

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P200	**Motor list**			P

0 ... 45

{ 0 }

The factory settings for the motor data can be edited with this parameter. The factory setting in parameters P201...P209 is a 4-pole DS standard motor with the nominal FI power setting.

By selecting one of the possible digits and pressing the OK key, all motor parameters (P201…P209) are adjusted to the selected standard power. The basis for the motor data is a 4-pole DS standard motor

0 = No change of data

1 = No motor: In this setting, the FI operates without current control, slip compensation and pre-magnetising time, and is therefore not recommended for motor applications. Possible applications are induction furnaces or other applications with coils and transformers. The following motor data is set here:
50.0Hz / 1500rpm / 15.0A / 400V / 0.00kW / cos φ=0.90 / star / R_S 0.01Ω / I_{EMPTY} 6.5A

2 = 0.25 kW 230V	**16 =** 0.75 kW 400V	**30 =** 3.0 kW 230V	**44 =** 11.0 kW 400V
3 = 0.33 HP 230V	**17 =** 1.0 HP 460V	**31 =** 3.0 kW 400V	**45 =** 15.0 HP 460V
4 = 0.25 kW 400V	**18 =** 1.1 kW 230V	**32 =** 4.0 kW 230V	**46 =** 15.0 kW 400V
5 = 0.33 HP 460V	**19 =** 1.5 HP 230V	**33 =** 5.0 HP 230V	**47 =** 20.0 HP 460V
6 = 0.37 kW 230V	**20 =** 1.1 kW 400V	**34 =** 4.0 kW 400V	**48 =** 18.5 kW 400V
7 = 0.50 HP 230V	**21 =** 1.5 HP 460V	**35 =** 5.0 HP 460V	**49 =** 25.0 HP 460V
8 = 0.37 kW 400V	**22 =** 1.5 kW 230V	**36 =** 5.5 kW 230V	**50 =** 22.0 kW 400V
9 = 0.50 HP 460V	**23 =** 2.0 HP 230V	**37 =** 7.5 HP 230V	**51 =** 30.0 HP 460V
10 = 0.55 kW 230V	**24 =** 1.5 kW 400V	**38 =** 5.5 kW 400V	**52 =** 30.0 kW 400V
11 = 0.75 HP 230V	**25 =** 2.0 HP 460V	**39 =** 7.5 HP 460V	**53 =** 40.0 HP 460V
12 = 0.55 kW 400V	**26 =** 2.2 kW 230V	**40 =** 7.5 kW 230V	
13 = 0.75 HP 460V	**27 =** 3.0 HP 230V	**41 =** 10 HP 230V	
14 = 0.75 kW 230V	**28 =** 2.2 kW 400V	**42 =** 7.5 kW 400V	
15 = 1.0 HP 230V	**29 =** 3.0 HP 460V	**43 =** 10 HP 460V	

NOTE: As P200 returns to = 0 after the input confirmation, the control of the set motor can be implemented via parameter P205.

If DIP switch 7 (50/60Hz operation, Section 5.1.1) is switched over, the appropriate nominal motor data according to the FI power rating are reloaded from the P200 list.

P201	**Nominal frequency**		S	P
10.0 ... 400.0 Hz {*}	The motor nominal frequency determines the V/f break point at which the FI supplies the nominal voltage (P204) at the output.			
P202	**Nominal speed**		S	P
150 ... 24000 rpm {***}	The nominal motor speed is important for the correct calculation and control of the motor slip and the speed display (P001 = 1).			
P203	**Nominal current**		S	P
0.1 ... 300.0 A {***}	The nominal motor current is a decisive parameter for the current vector control.			

**** These settings are dependent on the nominal power of the FI or the selection in parameter P200.*

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P204	**Nominal voltage**		S	P
100 ... 800 V {*]	The >Nominal voltage< matches the mains voltage to the motor voltage. In combination with the nominal frequency, the voltage/frequency characteristic curve is produced.			
P205	**Nominal power**			P
0.00 ... 150.00 kW {***}	The motor nominal power controls the motor set via P200.			
P206	**Motor cos φ**		S	P
0.50 ... 0.90 {***}	The motor cosφ is a decisive parameter for the current vector control.			
P207	**Star Delta connection**		S	P
0 ... 1 {***}	**0 =** Star **1 =** Delta The motor circuit is decisive for stator resistance measurement (P220) and therefore for current vector control.			
P208	**Stator resistance**		S	P
0.00 ... 300.00 Ω {***}	Motor stator resistance ⇒ : resistance of a phase winding with a DC motor. Has a direct influence on the current control of the FI. Too high a value will lead to a possible overcurrent; too low a value to a motor torque that is too low. The parameter P220 can be used for simple measurement. Parameter P208 can be used for manual setting or as information about the result of an automatic measurement. **NOTE:** For optimum functioning of the current vector control, the stator resistance should be automatically measured by the FI.			
P209	**No load current**		S	P
0.1 ... 300.0 A {***}	This value is always calculated automatically from the motor data if there is a change in the parameter >cos φ< P206 and the parameter >Nominal current< P203. **NOTE:** If the value is to be entered directly, then it must be set as the last motor data. This is the only way to ensure that the value will not be overwritten.			
P210	**Static boost**		S	P
0 ... 400 % { 100 }	The static boost affects the current that generates the magnetic field. This is equivalent to the no load current of the respective motor and is therefore independent of the load. The no load current is calculated using the motor data. The factory setting of 100% is sufficient for normal applications.			
P211 [2]	**Dynamic boost**		S	P
0 ... 150 % { 100 }	The dynamic boost affects the torque generating current and is therefore a load-dependent parameter. The factory 100% setting is also sufficient for typical applications. Too high a value can lead to overcurrent in the FI. Under load therefore, the output voltage will be raised too sharply. Too low a value will lead to insufficient torque.			

[*] *These settings are dependent on the nominal power of the FI or the selection in parameter P200.*

[2]Note: P211 and P212 can be deactivated with the DIP switches, see Section 5.1.1

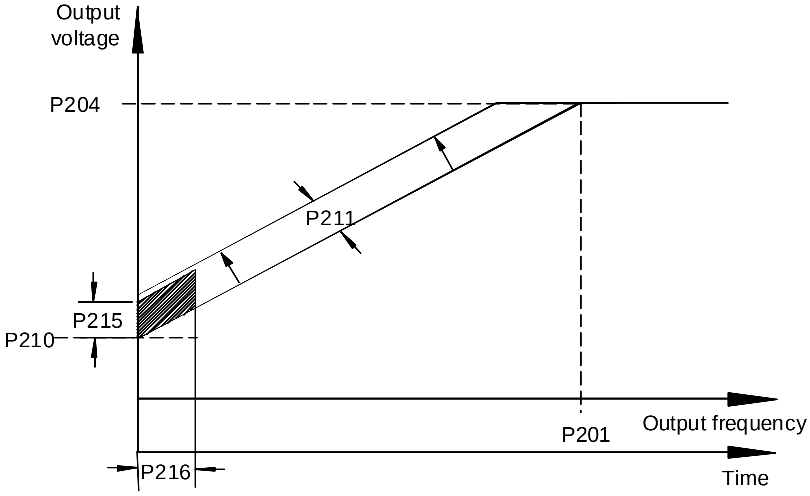
Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P212 [3]	**Slip compensation**		S	P
0 ... 150 % { 100 }	The slip compensation increases the output frequency, dependent on load, to keep the DC asynchronous motor speed approximately constant. The factory setting of 100% is optimal when using DC asynchronous motors and correct motor data has been set. If several motors (different loads or outputs) are operated with one FI, the slip compensation P212 must be set to 0%. This rules out a negative influence. This also applies to synchronous motors that do not have slip due to their design.			
P213	**ISD control loop gain**		S	P
25 ... 400 % { 100 }	This parameter influences the control dynamics of the FI current vector control (ISD control). Higher settings make the controller faster, lower settings slower. Depending on the type of application, this parameter can be altered, e.g. to avoid unstable operation			
P214	**Torque precontrol**		S	P
-200 ... 200 % { 0 }	This function allows a value for the expected torque requirement to be set in the controller. This function can be used in lifting applications for a better load transfer during start-up. **NOTE:** with rotation field to the right, motor torques are entered with a positive sign, generator torques are entered with a negative sign. The reverse applies for the counter clockwise rotation.			
P215	**Boost precontrol**		S	P
0 ... 200 % { 0 }	Only with linear characteristic curve (P211 = 0% and P212 = 0%). For drives that require a high starting torque, this parameter provides an option for switching in an additional current during the start phase. The application time is limited and can be selected at parameter >Time boost precontrol< P216. All current and torque current limits that may have been set (P112 and P536, P537) are deactivated during the boost lead time.			
P216	**Time boost precontrol**		S	P
0.0 ... 10.0 s { 0.0 }	This parameter is used for 3 functionalities **Time limit** for the **boost lead**: Effective time for the increased starting current. Only with linear characteristic curve (P211 = 0% and P212 = 0%). **Time limit** for **suppression of** pulse **switch-off** (P537): enables start-up under heavy load. **Time limit** for **suppression** of **switch-off on error** in parameter (P401), setting { 05 } „0 - 10V with switch-off on error 2“			

[3]Note: P211 and P212 can be deactivated with the DIP switches, see Section 5.1.1

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P217	**Oscillation damping**		S	P
0 ... 400 % { 10 }	With the oscillation damping, idling current harmonics can be damped. Parameter 217 is a measure of the damping power. For oscillation damping, the oscillation component is filtered out of the torque current by means of a high pass filter. This is amplified by P217, inverted and switched to the output frequency. The limit for the switched value is also proportional to P217. The time constant for the high pass filter depends on P213. For higher values of P213 the time constant is lower. With a set value of 10% for P217, a maximum of ± 0.045Hz are switched in. At 400% in P217, this corresponds to ± 1.8Hz The function is not active in “Servo mode, P300”.			
P218	**Modulation depth**		S	
50 ... 110 % { 100 }	This setting influences the maximum possible output voltage of the FI in relation to the mains voltage. Values <100% reduce the voltage to values below that of the mains voltage if this is required for motors. Values >100% increase the output voltage to the motor increased the harmonics in the current, which may cause oscillation in some motors. Normally, 100% should be set.			
P219	**Automatic magnetisation adjustment**		S	
25 ... 100 % / 101 { 100 }	With this parameter, an automatic adjustment of the magnetic flux to the motor load can be made. P219 is a limiting value, to which the field in the motor can be reduced. As standard, the value is set to 100%, and therefore no reduction is possible. As minimum, 25% can be set. The reduction of the field is performed with a time constant of approx. 7.5 sec. On increase of load the field is built up again with a time constant of approx. 300 ms. The reduction of the field is carried out so that the magnetisation current and the torque current are approximately equal, so that the motor is operated with “optimum efficiency”. An increase of the field above the setpoint value is not intended. This function is intended for applications in which the required torque only changes slowly (e.g. pumps and fans). Its effect therefore replaces a quadratic curve, as it adapts the voltage to the load. **NOTE:** This must not be used for lifting or applications where a more rapid build-up of the torque is required, as otherwise there would be overcurrent switch-offs or inversion of the motor on sudden changes of load, because the missing field would need to be compensated by a disproportionate torque current. **101 = automatic**, with the setting P219=101 an automatic magnetisation current controller is activated. The ISD controller then operates with a subordinate magnetizing controller, which improves the slippage calculation, especially at higher loads. The control times are considerably faster compared to the Normal ISD control (P219 = 100)			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set

P2xx Control/characteristic curve parameters



NOTE: "typical" settings for the...

Current vector control (factory setting)	**Linear V/f characteristic curve**
P201 to P209 = Motor data	P201 to P209 = Motor data
P210 = 100%	P210 = 100% (static boost)
P211 = 100%	P211 = 0%
P212 = 100%	P212 = 0%
P213 = 100%	P213 = no significance
P214 = 0%	P214 = no significance
P215 = no significance	P215 = 0% (dynamic boost)
P216 = no significance	P216 = 0s (time dyn. boost)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P220	**Parameter identification**			P

... up to 240s

{ 0 }

The motor data is automatically determined by the FI with this parameter. In most cases this leads to considerably better drive characteristics, as DC asynchronous motors are subject to manufacturing tolerances which are not documented on the rating plate.

The identification of all parameters takes some time. Do not switch off the mains voltage during this time. The identification can only be carried out in an “operative” condition. This must be particularly taken into account in BUS operation.

If unfavourable operating characteristics result, select a suitable motor in P200 or set the parameters P201 … P208 manually.

0 = No identification

1 = Identification RS: only the stator resistance (display in P208) is determined by multiple measurements.

2 = Identification motor: all motor parameters (P202, P203, P206, P208, P209) are determined.

Procedure:

a) The identification should be made with the motor cold. Warming up of the motor during operation is automatically taken into account.

b) The FI must be in an “operative condition” For bus operation, the bus must be operating without error. The FI must not be in a state of switch-on block.

c) The motor power may only be one power level greater or 3 power levels lower than the nominal power of the FI.

d) The motor data should be set according to the rating plate or P200. However, at least the nominal frequency (P201), the nominal speed (P202), the voltage (P204), the power (P205) and the motor circuit (P207) should be known.

e) If the identification cannot be concluded successfully, the error message E019 is generated. See also Section 6, Error messages.

f) Reliable identification can be made with motor cables up 20m in length.

NOTE: After identification of parameters, P220 is again = 0.

Care must be taken that the connection to the motor is not interrupted during the entire measuring process.

6.1.4 Control parameters

In combination with an HTL incremental encoder, a closed speed control loop can be set up via digital inputs 2 and 3 of the FI.

Alternatively, the incremental encoder signal can be used for other purposes. For this, the required function must be selected in parameter 325.

In order for this parameter to be visible, the supervisor parameter P003 = 2/3 must be set.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P300	**Servo mode**		S	P
0 ... 1 { 0 }	This parameter activates speed control with speed measurement via an incremental encoder. This leads to a very stable speed behaviour down to motor standstill. **0 = Off** **1 = On** **NOTE:** for correct function, an HTL incremental encoder must be connected to digital inputs DIN 2 and DIN 3 (See Section 2.8.3 "Colour and contact assignments for incremental encoders (HTL)") and the correct pulse number must be entered in parameter (P301). **ATTENTION:** the functions of digital inputs DIN 2 and DIN 3 must be deactivated ((P420 [-02], [-03]) to "no function").			
P301	**Incremental encoder resolution**		S	
0 ... 17 { 6 }	Input of the pulse-count per rotation of the connected incremental encoder. If the encoder rotation direction is not the same as the motor driven by the FI, (depending on installation and wiring), this can be compensated for by selecting the corresponding negative increment numbers 8...16. **0 =** 500 pulses **1 =** 512 pulses **2 =** 1000 pulses **3 =** 1024 pulses **4 =** 2000 pulses **5 =** 2048 pulses **6 =** 4096 pulses **7 =** 5000 pulses **8 =** -500 pulses **9 =** -512 pulses **10 =** -1000 pulses **11 =** -1024 pulses **12 =** -2000 pulses **13 =** -2048 pulses **14 =** -4096 pulses **15 =** -5000 pulses **16 =** -8192 pulses **17 =** + 8192 pulses **NOTE:** (P301) is important for the positioning control in SK 200E. If an incremental encoder is used for positioning (P604=1), the setting of the pulse number is made here. (see Manual BU 0210)			
P310	**Speed controller P**		S	P
0 ... 3200 % { 100 }	P-component of the encoder (proportional amplification). Amplification factor, with which the speed difference is multiplied from the setpoint and actual frequency. A value of 100% means that a speed difference of 10% produces a setpoint of 10%. Values that are too high can cause the output speed to oscillate.			
P311	**Speed controller I**		S	P
0 ... 800 % / ms { 20 }	I-component of the encoder (Integration component). The integration component of the controller completely eliminates any control deviation. The value indicates how large the setpoint change is per ms. Values that are too small cause the controller to slow down (reset time is too long).			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P312	**Torque current controller P**		S	P
0 ... 800 % { 200 }	Current controller for the torque current. The higher the current controller parameters are set, the more precisely the current setpoint is maintained. Excessively high values in P312 generally lead to high-frequency oscillations at low speeds; on the other hand, excessively high values in P313 generally produce low frequency oscillations across the whole speed range. If the value "Zero" is entered in P312 and P313, then the torque current control is switched off. In this case, only the motor model precontrol is used.			
P313	**Torque current controller I**		S	P
0 ... 800 % / ms { 125 }	I-component of the torque current controller. (See also P312 >Torque current controller P<)			
P314	**Torque current controller limit**		S	P
0 ... 400 V { 400 }	Determines the maximum voltage increase of the torque current controller. The higher the value, the greater the maximum effect that can be exercised by the torque current controller. Excessive values in P314 can specifically lead to instability during transition to the field weakening zone (see P320). The values for P314 and P317 should always be set roughly the same, so that the field and torque current controllers are balanced.			
P315	**Field current controller P**		S	P
0 ... 800 % { 200 }	Current controller for the field current. The higher the current controller parameters are set, the more precisely the current setpoint is maintained. Excessively high values for P315 generally lead to high frequency vibrations at low speeds. On the other hand, excessively high values in P316 generally produce low frequency vibrations across the whole speed range If the value "Zero" is entered in P315 and P316, then the field current controller is switched off. In this case, only the motor model precontrol is used.			
P316	**Field current controller I**		S	P
0 ... 800 % / ms { 125 }	I-component of the field current controller. See also P315 >Field current controller P<			
P317	**Field current controller limit**		S	P
0 ... 400 V { 400 }	Determines the maximum voltage increase of the torque current controller. The higher the value, the greater is the maximum effect that can be exercised by the field current controller. Excessive values in P317 can specifically lead to instability during transition to the field reduction range (see P320). The values for P314 and P317 should always be set roughly the same, so that the field and torque current controllers are balanced.			
P318	**Field weakening controller P**		S	P
0 ... 800 % { 150 }	The field weakening controller reduces the field setpoint when the synchronous speed is exceeded. Generally, the field weakening controller has no function; for this reason, the field weakening controller only needs to be set if speeds are set above the nominal motor speed. Excessive values for P318 / P319 will lead to controller oscillations. The field is not weakened sufficiently if the values are too small or during dynamic acceleration and/or delay times. The downstream current controller can no longer read the current setpoint.			
P319	**Field weakening controller I**		S	P
0 ... 800 % / ms { 20 }	Affects only the field weakening range, see P318 >Field weakening controller P<			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P320	**Field weakening controller border**		S	P
0 ... 110 % { 100 }	The field weakening limit determines at which speed / current the controller will begin to weaken the field. At a set value of 100% the controller will begin to weaken the field at approximately the synchronous speed. If values much larger than the standard values have been set in P314 and/or P317, then the field weakening limit should be correspondingly reduced, so that the control range is actually available to the current controller.			
P321	**Speed control I brake delay off**		S	P
0 ... 4 { 0 }	During the brake release time (P107/P114), the I-component of the rotation speed control is increased. This leads to better load take-up, especially with vertical movements. **0 = P311 speed control I x 1** **1 = P311 speed control I x 2** **2 = P311 speed control I x 4** **3 = P311 speed control I x 8** **4 = P311 speed control I x 16**			
P325	**Function encoder**		S	
0 ... 4 { 0 }	The actual speed list value supplied by an incremental encoder to the FI can be used for various functions in the FI. **0 = Speed measurement, servo mode:** The actual motor speed list value is used for the FI servo mode. The ISD control cannot be switched off in this function. **1 = PID actual frequency value:** The actual speed of a system is used for speed control. This function can also be used for controlling a motor with a linear characteristic curve. It is also possible to use an incremental encoder for speed control that is not mounted directly onto the motor. P413 – P416 determine the control. **2 = Frequency addition:** The speed determined is added to the actual setpoint value. **3 = Frequency subtraction:** The speed determined is subtracted from the actual setpoint. **4 = Maximum frequency:** The maximum possible output frequency / speed is limited by the speed of the encoder.			
P326	**Rotary encoder transformation ratio**		S	
0.01 ... 100.00 { 1.00 }	If the incremental encoder is not mounted directly onto the motor shaft, then the respectively correct transformation ratio of motor speed to encoder speed must be set. $P326 = \frac{\text{Motor speed}}{\text{Encoder speed}}$ Only when P325 = 1, 2, 3 or 4, therefore not in Servo mode (motor speed control)			
P327	**Speed slip error, speed control**		S	P
0 ... 3000 rpm { 0 }	The limit value for a permitted maximum slip error can be set. If this value is reached, the FI switches off and indicates error E013.1. **0 = OFF** Only when P325 = 0, therefore in Servo mode (motor speed control)			
P328	**Speed slip error delay**		S	P
0.0 ... 10.0 s { 0.0 }	In case the permissible slip error defined in (P327) is exceeded, the display of the error message E013.1 is suppressed within the limits which can be set here. **0 = OFF**			

6.1.5 Control terminals

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P400 **[-01] ... [-09]**	**Setpoint input function**			P

0 ... 33

{ [-01] = 1 }
{ [-02] = 15 }
{ [-03] = 0 }
{ [-04] = 0 }
{ [-05] = 1 }
{ [-06] = 0 }
{ [-07] = 1 }
{ [-08] = 0 }
{ [-09] = 0 }

[-01] = **Potentiometer 1**, function of the potentiometer integrated in the FI (Section. 5.1.3). The DIP switches 4/5 must be set to "off" (Section 5.1.1) in order for the function to be influence by this parameter setting.

[-02] = **Potentiometer 2**, function of the potentiometer integrated in the FI (Section 5.1.3). The DIP switches 4/5 must be set to "off" (Section 5.1.1) in order for the function to be influence by this parameter setting.

[-03] = **External analog input 1**, AIN1 of the first I/O extension (SK xU4-IOE).

[-04] = **External analog input 2**, AIN2 of the first I/O extension (SK xU4-IOE).

[-05] = **Setpoint module**, in preparation

[-06] = **Digital input 2**, can be set to impulse signal evaluation via the parameter P420 [-02] =26 or 27. The impulses can then be evaluated as an analog signal in the FI according to the function set here.

[-07] = **Digital input 3**, can be set to impulse signal evaluation via the parameter P420 [-03] =26 or 27. The impulses can then be evaluated as an analog signal in the FI according to the function set here.

[-08] = **External analog input 1 2nd IOE**, AIN1 of the second I/O extension (SK xU4-IOE) (= analog input 3).

[-09] = **External analog input 2 2nd IOE**, AIN2 of the second I/O extension (SK xU4-IOE) (= analog input 4).

...Settings as follows.

The basic equipment of SK 200E devices does not include an analog input. An analog function can only be implemented by the use of options (Array [-01]...[-05] and [-08]…[-09]) or by use of the digital input 2 or 3 (Array [-06]...[-07]). The following settings are then possible:

For standardisation of actual values: See also (Section 0).

0 = Off, the analog input has no function. After the FI has been enabled via the control terminals, it will supply the set minimum frequency (P104).

1 = Set point frequency, the specified analog range (P402/P403) varies the output frequency between the set minimum and maximum frequencies (P104/P105).

2 = Frequency addition **, the supplied frequency value is added to the setpoint.

3 = Frequency subtraction**, the supplied frequency value is subtracted from the setpoint.

4 = Minimum frequency, is a typical setting value for the function of the potentiometers P1 or P2 (P400 [01] or [02]), which are integrated in the cover of the FI (Section 5.1.3).
Standardisation: T_Min.-frequency= 50Hz*U[V]/10V (U=voltage potentiometer (P1 or P2))

5 = Maximum frequency, is a typical setting value for the function of the potentiometers P1 or P2 (P400 [01] or [02]), which are integrated in the cover of the FI (Section 5.1.3).
Standardisation: T_Max.-frequency= 100Hz*U[V]/10V (U=voltage potentiometer (P1 or P2))

6 = Current value process controller*, activates the process controller analog input is connected to the actual value sensor (compensator, air can, flow volume meter, etc.). The mode is set via the DIP switches of the I/O extension or in (P401).

7 = Nominal value process controller*, as function 6, however the setpoint is specified (e.g. by a potentiometer). The actual value must be specified using another input.

8 = Current frequency PI*,

9 = Current frequency, limited by PI *,

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set

10 = Current frequency, supervised by PI *,

11 = Torque current limitation (limiting), depends on parameter (P112), this value corresponds to 100% of the setpoint value. Attainment of the set limiting value causes a reduction of the output frequency at the limit of the torque current.

12 = Torque current limitation (switch-off), depends on parameter (P112), this value corresponds to 100% of the setpoint value. The attainment of this set limiting value causes switch-off with error code E12.3.

13 = Current limit (limiting), depends on parameter (P536). This value corresponds to 100% of the setpoint value. The attainment of the set limiting value causes a reduction of the output voltage in order to limit the output current.

14 = Current limit (switch-off), depends on parameter (P536), this value corresponds to 100% of the setpoint value. The attainment of this set limiting value causes switch-off with error code E12.4.

15 = Ramp time, is a typical setting value for the function of the potentiometers P1 or P2 (P400 [01] or [02]), which are integrated in the cover of the FI (Section 5.1.3).
Standardisation: T_Ramp time= 100Hz*U[V]/10V (U=voltage potentiometer (P1 or P2))

16 = Pre-tension Torque, function which enables a value for the anticipated torque requirement to be entered in the controller (interference factor switching). This function can be used to improve the load take-up of lift equipment with separate load detection.

17 = Multiplication, the setpoint is multiplied with the specified analog value. The analog value adjusted to 100% then corresponds to a multiplication factor of 1.

18 = Curve control (Curve travel calculator), via the external analog input (P400 [-03] or P400 [-04]) or via the BUS (P546 [-01 .. -03]) the master receives the actual speed from the slave. From its own speed, the slave speed and the guide speed, the master calculates the actual setpoint speed, so that neither of the two drives travels faster than the guide speed in the curve.

19 = Servo mode torque, in servo mode, the motor torque can be set or limited using this function.

25 = Ratio gearing (Gearing transformation factor), is a multiplier which takes into account a variable transformation of the setpoint value. E.g.: Setting of the transformation between the master and the slave by means of a potentiometer.

30 = Motor temperature: enables measurement of the motor temperature with a KTY-84 - temperature sensor (Details in Section 5.3)

33 = Setpoint value torque process controller: for the even distribution of torques to the coupled drive units (e.g.: synchronised roller drive). This function is also possible with the use of ISD control.

*) For further details of the PI and process controller, please refer to Section 9.2.

**) The limits of these values are formed by the parameters >minimum frequency auxiliary setpoint values< (P410) and the parameter >maximum frequency auxiliary setpoint values< (P411), whereby the limits defined by (P104) and (P105) cannot be undershot or overshot.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P401 **[-01] ... [-06]**	**Analog input mode** (or Analog ON mode 1)		S	

0 ... 5	**[-01] =**	**External analog input 1**, AIN1 of the first I/O extension (SK xU4-IOE).
{ all 0 }	**[-02] =**	**External analog input 2**, AIN1 of the first I/O extension (SK xU4-IOE).
	[-03] =	**External analog input 1 2nd IOE**, AIN1 of the second I/O extension (SK xU4-IOE) (= analog input 3).
... only with SK CU4-IOE or SK TU4-IOE	**[-04] =**	**External analog input 2 2nd IOE**, AIN1 of the second I/O extension (SK xU4-IOE) (= analog input 4).
	[-05] =	**reserved**
as of SW 1.2	**[-06] =**	**reserved**

0 = **0 – 10V limited:** an analog setpoint value, which is smaller than the programmed adjustment 0% (P402) does not result in the programmed minimum frequency (P104) being undershot. It therefore does not result in a change in the direction of rotation.

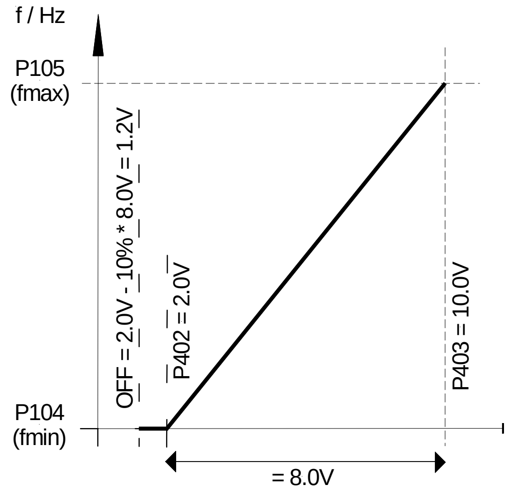
1 = **0 – 10V:** If there is a setpoint value which is smaller than the programmed adjustment 0% (P402), this may result in a change in the direction of rotation. Because of this, a reversal of the direction of rotation may be implemented with a simple voltage source and a potentiometer.

e.g. internal setpoint with change of direction of rotation: P402 = 5V, P104 = 0Hz, potentiometer 0–10V → change of direction of rotation at 5V in the middle setting of the potentiometer.

At the moment of reversal (Hysteresis = ± P505), the drive unit is at a standstill, if the minimum frequency (P104) is less than the absolute minimum frequency (P505). A brake controlled by the FI is applied within the hysteresis range.

If the minimum frequency (P104) is larger than the absolute minimum frequency (P505), the drive reverses when the minimum frequency is reached. Within the hysteresis range ± P104 provides the FI with the minimum frequency (P104), a brake controlled by the FI is not applied.

2 = **0 – 10V controlled:** If the minimum adjusted setpoint value (P402) is undershot by 10% of the difference between (P403) and (P402), the FI output switches off. As soon as the setpoint value is larger than [*P402 - (10% * (P403 - P402))*], it once again provides an output signal.



E.g.: Setpoint value 4-20mA: P402: Adjustment 0% = 1V; P403: Adjustment 100% = 5V; -10% corresponds to -0.4V; i.e. 1...5V (4...20mA) normal operating range, 0.6...1V = minimum frequency setpoint value, below 0.6V (2.4mA) the output is switched off.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set

NOTE:

The SK xU4-IOE provides the frequency inverter with a value standardised to 0…100%. In addition, the frequency inverter also receives a bit, which confirms that the analog input signal is within the defined limits.

Example: Setpoint value: 4 … 20 mA

0…4mA = 0% (0000_{hex})
20mA = 100% (4000_{hex})
≥ 2mA = Bit "Setpoint value valid"

If the "0-10V monitored" mode is selected, the bit "Setpoint value valid" is evaluated and if the setpoint value is undershot by a value of 2mA, the inverter output is switched off.

NOTE:

Settings of parameters (P402) and (P403) are treated in an additive manner, i.e. they can be used for additional adjustment of the limiting values.

3 = **- 10V – 10V:** If there is a setpoint value which is smaller than the programmed adjustment 0% (P402), this may result in a change in the direction of rotation. Because of this, a reversal of the direction of rotation may be implemented with a simple voltage source and a potentiometer.

e.g. internal setpoint with change of direction of rotation: P402 = 5V, P104 = 0Hz, potentiometer 0–10V → change of direction of rotation at 5V in the middle setting of the potentiometer.

At the moment of reversal (Hysteresis = ± P505), the drive unit is at a standstill, if the minimum frequency (P104) is less than the absolute minimum frequency (P505). A brake controlled by the FI is not applied within the hysteresis range.

If the minimum frequency (P104) is larger than the absolute minimum frequency (P505), the drive reverses when the minimum frequency is reached. Within the hysteresis range ± P104 provides the FI with the minimum frequency (P104), a brake controlled by the FI is not applied.

4 = **0 – 10V with switch-off on error 1:** If the 0% adjustment value in (P402) is undershot, the error message 12.8 "Analog In Min. undershot" is activated.
Overshooting of the 100% adjustment value in (P403) activates the error message 12.9 "Analog In Max. overshot".
Even if the analog value is within the limits defined in (P402) and (P403), the setpoint value is limited to 0 - 100%.

The monitoring function only becomes active if there is an enable signal and the analog value has reached the valid range (≥(P402) or ≤(P403)) for the first time (E.g. Build-up of pressure after switching on a pump).

5 = **0 – 10V with switch-off on error 2:**
See Setting 4 ("0 - 10V with switch-off on error 1"), however:

With this setting, the monitoring function is active if there is an enable signal and suppression time for the error monitoring has expired. This suppression time is set in parameter (P216).

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P402 **[-01] ... [-06]**	**Analog input adjustment: 0%**		S	

-50.00 ... 50.00 V

{ all 0.00 }

[-01] = **External analog input 1**, AIN1 of the first I/O extension (SK xU4-IOE).

[-02] = **External analog input 2**, AIN1 of the first I/O extension (SK xU4-IOE).

[-03] = **External analog input 1 2nd IOE**, AIN1 of the second I/O extension (SK xU4-IOE) (= analog input 3).

[-04] = **External analog input 2 2nd IOE**, AIN1 of the second I/O extension (SK xU4-IOE) (= analog input 4).

[-05] = **reserved**

[-06] = **reserved**

... only with SK CU4-IOE or SK TU4-IOE

This parameter sets the voltage which should correspond with the minimum value of the selected function for the analog input 1 or 2. In the factory setting (setpoint) this value is equivalent to the setpoint set via P104 >Minimum frequency<.

Note:
Standardisation of typical signals such as 0(2)-10V or 0(4)-20mA is carried out via the DIP switches on the I/O-extension module. An additional adjustment of parameters (P402) and (P403) is not made in this case.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P403 **[- 01] ... [- 06]**	**Analog input adjustment: 100%**		S	

-50.00 ... 50.00 V

{ all 10.00 }

[-01] = **External analog input 1**, AIN1 of the first I/O extension (SK xU4-IOE).

[-02] = **External analog input 2**, AIN1 of the first I/O extension (SK xU4-IOE).

[-03] = **External analog input 1 2nd IOE**, AIN1 of the second I/O extension (SK xU4-IOE) (= analog input 3).

[-04] = **External analog input 2 2nd IOE**, AIN1 of the second I/O extension (SK xU4-IOE) (= analog input 4).

[-05] = **reserved**

[-06] = **reserved**

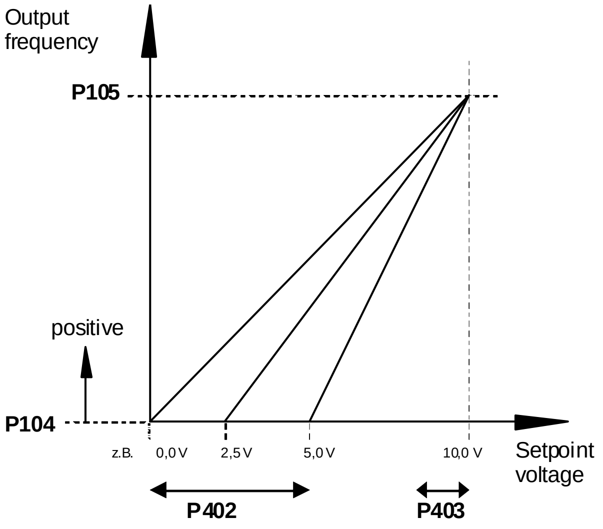
... only with SK CU4-IOE or SK TU4-IOE

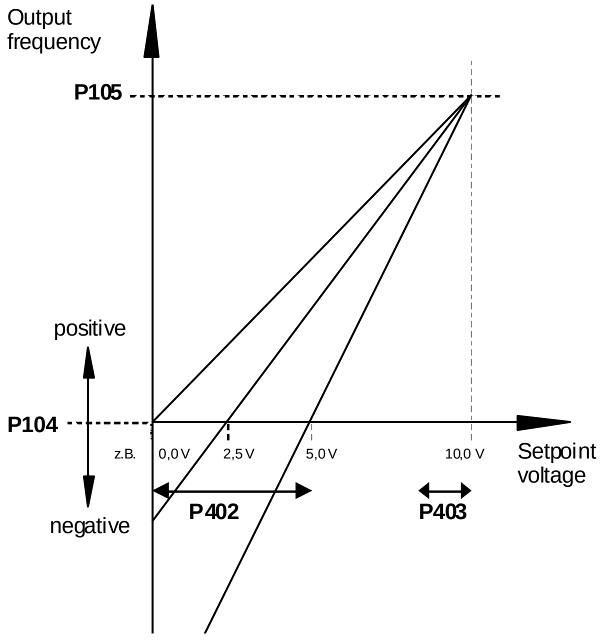
This parameter sets the voltage which should correspond with the maximum value of the selected function for the analog input 1 or 2. In the factory setting (setpoint) this value is corresponds with the setpoint set via P105 >Maximum frequency<.

Note:
Standardisation of typical signals such as 0(2)-10V or 0(4)-20mA is carried out via the DIP switches on the I/O-extension module. An additional adjustment of parameters (P402) and (P403) is not made in this case.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set

P400 ... P403





P404	**[-01]** **[-02]**	reserved			

P410	**Minimum frequency a-in 1/2** **(auxiliary setpoint value)**			P

-400.0 ... 400.0 Hz

{ 0.0 }

The minimum frequency that can act on the setpoint via the auxiliary setpoints.

Auxiliary setpoints are all frequencies which are additionally supplied for further functions in the FI:

Frequency addition	Frequency subtraction
Auxiliary setpoints via BUS	PI process controller
PI controller	Multiplication

P411	**Maximum frequency a-in 1/2** **(auxiliary setpoint value)**			P

-400.0 ... 400.0 Hz

{ 50.0 }

The maximum frequency that can act on the setpoint via the auxiliary setpoints.

Auxiliary setpoints are all frequencies which are additionally delivered for further functions in the FI:

Frequency addition	Frequency subtraction
Auxiliary setpoints via BUS	PI process controller
PI controller	Multiplication

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P412	**Nominal value process controller**		S	P
-10.0 ... 10.0 V { 5.0 }	Fixed specification of a setpoint for the process controller that will only occasionally be altered. Only with P400 = 6 or 7 (PID process controller). Further technical details can be found in Section 9.2.			
P413	**PI control P-component**		S	P
0.0 ... 400.0 % { 10.0 }	This parameter is only effective when the function PI controller actual frequency is selected. The P-component of the PI controller determines the frequency jump if there is a control deviation based on the control difference. For example: At a setting of P413 = 10% and a control difference of 50%, 5% is added to the actual setpoint.			
P414	**PI control I-component**		S	P
0.0 ... 3000.0 %/s { 10.0 }	This parameter is only effective when the function PI controller actual frequency is selected. In case of a control deviation, the I-component of the PI controller determines the frequency change, dependent on time. **Note:** In contrast to other NORD series, parameter P414 is smaller by a factor of 100 (Reason: better setting ability with small I-components).			
P415	**Process controller control limit**		S	P
0 ... 400.0 % { 10.0 }	This parameter is only effective when the function **PI process controller** is selected. This determines the control limit (%) after the PI controller. For further details, see Section 9.2.			
P416	**Ramp time, PI setpoint value**		S	P
0.00 ... 99.99 s { 2.00 }	This parameter is only effective when the function PI process controller is selected. Ramp for PI setpoint			

P417 [-01] [-02]	**Offset, analog output 1**		S	P
-10.0 ... 10.0 V { all 0.0 } ... only with SK CU4-IOE or SK TU4-IOE	**[-01] =** **First IOE,** AOUT of the <u>first</u> I/O extension (SK xU4-IOE) **[-02] =** **Second IOE,** AOUT of the <u>second</u> I/O extension (SK xU4-IOE) In the analog output function an offset can be entered to simplify the processing of the analog signal in other equipment. If the analog output has been programmed with a digital function, then the difference between the switch-on point and the switch-off point can be set in this parameter (hysteresis).			
P418 [-01] [-02]	**Function, analog output 1**		S	P
0 ... 33 { all 0 }	**[-01] =** **First IOE,** AOUT of the <u>first</u> I/O extension (SK xU4-IOE) **[-02] =** **Second IOE,** AOUT of the <u>second</u> I/O extension (SK xU4-IOE)			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set

... only with SK CU4-IOE or SK TU4-IOE

Analog functions (max. load: 5mA analog)**:**

An analog (0 ...+10 Volt) voltage can be obtained from the control terminals (max. 5mA). Various functions are available, whereby:

0 Volt analog voltage always corresponds to 0% of the selected value.

10 V always corresponds to the motor nominal values (unless otherwise stated) multiplied by the P419 standardisation factor, e.g.:

$$\Rightarrow 10\text{Volt} = \frac{\text{Motor nominal value} \cdot \text{P419}}{100\%}$$

For standardisation of actual values: See also (Section 9.10).

0 = No function, no output signal at the terminals.

1 = Actual frequency*, the analog voltage is proportional to the FI output frequency. (100%=(P105))

2 = Actual speed*, this is the synchronous speed calculated by the FI based on the existing setpoint. Load-dependent speed fluctuations are not taken into account.
If Servo mode is being used, the measured speed will be output via this function. (100%=(P202))

3 = Current*, the effective value of the output current supplied by the FI. (100%=(P203))

4 = Torque current*, displays the motor load torque calculated by the FI. (100% = (P112))

5 = Voltage*, the output voltage supplied by the FI. (100%=(P204))

6 = D.c. link circuit voltage, the DC voltage in the FI. This is not based on the nominal motor data. 10V Volt, standardised at 100%, is equivalent to 450V DC (230V mains) or 850 Volt DC (480V mains)!

7 = Value of P542, the analog output can be set using parameter P542 independently of the actual operating status of the FI. For example, with Bus switching (parameter command) this function can supply an analog value from the FI, which is triggered by the control unit.

8 = Apparent power*, the actual apparent power calculated by the FI. (100%=(P203)*(P204) respectively = (P203)*(P204)*√3)

9 = Real power *, the actual effective power calculated by the FI. (100%=(P203)*(P204)*(P206) respectively = (P203)*(P204)*(P206)*√3)

10 = Torque [%]: the actual torque calculated by the FI (100%=Nominal motor torque).

11 = Field [%]*, the actual field in the motor calculated by the FI.

12 = Actual frequency ±*, the analog voltage is proportional to the output frequency of the FI, whereby the zero point is shifted to 5V. For rotation to the right, values between 5V and 10V are output, and for rotation to the left values between 5V and 0V.

13 = Actual motor rotation speed ±*, is the synchronic rotation speed calculated by the FI, based on the current setpoint, where the null point is shifted to 5V. For clockwise directions of rotation, values from 5 - 10V are output. For anticlockwise rotation, values from 5V - 0V.
If servo mode is used, the measured speed is output via this function.

14 = Torque [%] ±*, is the actual torque calculated by the FI, whereby the zero point is shifted to 5V. For drive torques, values between 5V and 10V are output, and for generator torque, values between 5V and 0V.

30 = Setpoint frequency before ramp, displays the frequency produced by any upstream controllers (ISD, PID, etc.). This is then the setpoint frequency for the power stage after it has been adjusted by the acceleration or braking ramp (P102, P103).

31 = Output via BUS PZD, the analog output is controlled via a bus system. The process data is directly transferred (P546, P547, P548).

32 = Setpoint frequency motor potentiometer

*) Values based on the motor data (P201…), or which are calculated from this.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P419 **[-01] [-02]**	**Analog output scal.** **(Standardisation, analog output 1)**		S	P
-500 ... 500 %	**[-01] =** **First IOE,** AOUT of the first I/O extension (SK xU4-IOE)			
{ all 100 }	**[-02] =** **Second IOE,** AOUT of the second I/O extension (SK xU4-IOE)			
... only with SK CU4-IOE or SK TU4-IOE	Using this parameter an adjustment can be made to the analog output for the selected operating zone. The maximum analog output (10V) corresponds to the standardisation value of the appropriate selection. If therefore, at a constant working point, this parameter is raised from 100% to 200%, the analog output voltage is halved. 10 Volt output signal then corresponds to twice the nominal value. For negative values the logic is reversed. A setpoint value of 0% will then produce 10V at the output and -100% will produce 0V.			
P420 **[-01] ... [-04]**	**Digital inputs**			
0 ... 72 { [-01]= 1 } { [-02] = 2 } { [-03] = 4 } { [-04] = 5 }	In the SK 200E, up to 4 freely programmable digital inputs are available. The only restriction is with the versions SK 215E and SK 235E. Here, the fourth digital input is always the input for the function “Safe Stop”. **[-01] = Digital input 1** (DIN1)**, Enable right** as factory setting, control terminal 21 **[-02] = Digital input 2** (DIN2)**, Enable left** as factory setting, control terminal 22 **[-03] = Digital input 3** (DIN3)**, Fixed frequency 1** (P465 [-01]) as factory setting, control terminal 23 **[-04] = Digital input 4** (DIN4)**, Fixed frequency 2** (P465 [-02]) as factory setting, not with SK 215/235E →"Safe Stop", control terminal 24 Various functions can be programmed. These can be seen in the following table. When using DIN2 and DIN3 as rotary encoder evaluation, it is essential to set the functions of the digital inputs DIN2 and DIN3 (Parameter (P420 [-02, -03])) to “No Function”. (For using the DIP-switches of the frequency inverter for parametrisation, please lock at section 5.1.2 .) The additional digital inputs of the I/O- extensions (SK xU4-IOE) are administered via the parameter "Bus I/O In Bit (4…7)“ - (P480 [-05] … [-08]) for the first I/O extension, and via the parameter "Bus I/O In Bit (0…3)" - (P480 [-01] … [-04]) for the second I/O extension.			

List of the possible functions of the digital inputs P420 [01]... [-04]

Value	Function	Description	Signal
00	No function	Input switched off.	---
01	Enabled right	The FI delivers an output signal with the rotation field right if a positive setpoint is present. 0 → 2 Flank (P428 = 0)	High
02	Enable left	The FI delivers an output signal with the rotation field left if a positive setpoint is present. 0 → 2 Flank (P428 = 0)	High
	If the drive is to start up automatically when the mains is switched on (P428 = 1) a permanent High level for enabling must be provided (supply control terminal 21 with 24V). If the functions "Enable right" and "Enable left" are actuated simultaneously, the FI is blocked.		

...continued on the next page

Value	Function	Description	Signal
03	Phase seq. reversal (Change rotation direction)	Causes the rotation field to change direction in combination with Enable right or left.	High
04 [1]	Fixed frequency 1	The frequency from P465 [01] is added to the actual setpoint value.	High
05 [1]	Fixed frequency 2	The frequency from P465 [02] is added to the actual setpoint value.	High
06 [1]	Fixed frequency 3	The frequency from P465 [03] is added to the actual setpoint value.	High
07 [1]	Fixed frequency 4	The frequency from P465 [04] is added to the actual setpoint value.	High
	If several fixed frequencies are actuated simultaneously, then they are added with the correct sign. In addition, the analog setpoint (P400) and if required, the minimum frequency (P104) are added.		
08	Parameter set switching 1	Selection of the active parameter set 1…4 (P100)	High
09	Maintain the frequency	During the acceleration or deceleration phase, a Low level will cause the actual output frequency to be "held". A High level allows the ramp to proceed.	Low
10 [2]	Voltage disable	The FI output voltage is switched off; the motor runs down freely.	Low
11 [2]	Quick stop	The FI reduces the frequency according to the programmed quick stop time (P426).	Low
12 [2]	Fault acknowledgement	Error acknowledgement with an external signal. If this function is not programmed, a fault can also be acknowledged by a low enable setting (P506).	0→1 Flank
13 [2]	PTC resistor input	Only with the use of a temperature monitor (bimetal switching contact). Switch-off delay = 2sec, warning after 1 sec.	High
14 [2]	Remote control	With bus system control, low level switches the control to control via control terminals.	High
15	Jog frequency [1]	The fixed frequency value can be adjusted using the HIGHER/LOWER and OK keys (P113), if control is via the SimpleBox or ParameterBox.	High
16	Motor potentiometer	As in setting **09**, however, the frequency is not maintained below the minimum frequency P104 and above the maximum frequency P105.	Low
17	Parameter set switching 2	Selection of the active parameter set 1…4 (P100)	High
18 [2]	Watchdog	Input must see a high flank cyclically (P460), otherwise error E012 will cause a shutdown. Function starts with the 1st High flank.	0→1 Flank
19	... 20 reserved		
21	...25 reserved for Posicon		
26	Analog function 0-10V Dig2+3	These functions can only be used for the digital inputs 2 (P420 [-02]) and 3 (P420 [-03])! Via **DIN 2** and **DIN 3**impulses which are proportional to an analog signal can be evaluated with this setting. The function of this signal is determined in parameter P400 [-06] or [-07]. The conversion 0-10V to impulses can be carried out via the Customer Unit SK CU/TU4-24V-... This module includes an analog input and an impulse output (ADC). In setting { 28 } a reversal of the direction of rotation takes place with an analog value <5V. An application example is described in Section 3.4.2.	Impulses ≈ 1.6-16kHz
27	Analog function 2-10V Dig2+3		
28	Analog function 5-10V Dig2+3		
30	Inhibit PID	Switching the PID controller / process controller function on and off (High = ON)	High

... continued on the next page

Value	Function	Description	Signal
31 [2]	Inhibit turn right	Blocks the >Enable right/left< via a digital input or Bus control. Does not depend on the actual direction of rotation of the motor (e.g. following negated setpoint).	Low
32 [2]	Inhibit turn left		Low
33	... 44 reserved		
45	3-Wire-Control Start-Right (Closing button)	This control function provides an alternative to enable R/L (01/ 02), in which a permanently applied level is required. Here, only a control impulse is required to trigger the function. The control of the FI can therefore be performed entirely with buttons.	0→1 Flank
46	3-Wire-Control Start-Left (Closing button)		0→1 Flank
49	3-Wire-Control Stop (Opening button)		1→0 Flank
47	Motor potentiometer frequency +	In combination with enable R/L the output frequency can be continuously varied. To save a current value in P113, both inputs must be at a High voltage for 0.5s. This value then applies as the next starting value for the same direction of rotation (Enable R/L) otherwise start at f_{MIN}.	High
48	Motor potentiometer frequency -		High
50	Bit 0 Fixed frequency array	Binary coded digital inputs to generate up to 15 fixed frequencies. (P465: [-01] ... [-15])	High
51	Bit 1 Fixed frequency array		High
52	Bit 2 Fixed frequency array		High
53	Bit 3 Fixed frequency array		High
55	… 64 reserved for Posicon →BU 0210		
65 [2]	Release brake manually / automatically	The brake is automatically released by the frequency inverter (automatic brake control) if this digital input has been set.	High
66 [2]	Release brake manually	The brake is only released of the digital input is set.	High
67	Set digital output manually / automatically	Set digital output manually, or via the function set in (P434)	High
68	Set digital output manually	Set digital output manually	High
69	Speed measurement with initiator	Simple speed measurement (impulse measurement) with initiator	Impulses
70	Evacuation mode (Activate evacuation run)	This also provides the possibility of operation with a very low link circuit voltage (e.g. using batteries). With this function the charging relay is activated and the undervoltage and phase error detection are deactivated.	High
71	Motorpot.F+ and Save Motor potentiometer function Frequency + with automatic saving	With this motor potentiometer function, a setpoint value is set and saved via the digital inputs. With control enabling R/L this is then started up in the correspondingly enabled direction. On change of direction the frequency is retained. Simultaneous activation of the +/- function causes the frequency setpoint value to be set to zero. The frequency setpoint value can also be displayed or set in the operating value display (P001=30, current setpoint MP-S) or in P718. Any minimum frequency set (P104) is still effective. Other setpoint values, e.g. analog or fixed frequencies can be added or subtracted. The adjustment of the frequency setpoint value is performed with the ramps from P102/103.	High
72	Motorpot.F- and Save Motor potentiometer function Frequency - with automatic saving		High
73 [2]	Inhibit turn right+ Quick Stop	As for setting 31, but coupled to the "Quick Stop" function.	Low
74 [2]	Inhibit turn left+ Quick Stop	As for setting 32, but coupled to the "Quick Stop" function.	Low
75	Set digital output 2 manually / automatically	reserved	
76	Set digital output 2 manually	reserved	

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

[2] Also effective for Bus control (RS232, RS485, CANbus, CANopen, DeviceNet, Profibus, InterBus, AS-Interface)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P426	**Quick stop time**		S	P
0 ... 320.00 s { 0.10 }	Setting of the stop time for the quick stop function that can be triggered either via a digital input, the bus control, the keyboard or automatically in case of a fault. Quick stop time is the time for the linear frequency decrease from the set maximum frequency (P105) to 0Hz. If an actual setpoint <100% is being used, the quick stop time is reduced correspondingly.			
P427	**Quick stop on error**		S	
0 ... 2 { 0 }	Activation of automatic emergency stop following error **0 = Disabled:** Automatic quick stop following error is deactivated **1 =** reserved **2 = Enabled:** Automatic quick stop following fault			
P428	**Automatic starting**		S	
0 ... 1 { 0 }	In the standard setting (P428 = **0** → **Off**) the inverter requires a flank for enable (signal change from "Low → High") at the applicable digital input. In the setting **On** → **1** the FI reacts to a High level. This function is only possible if the FI is controlled using the digital inputs. (see P509=0/1) In certain cases, the FI must start up directly when the mains are switched on. This means that P428 = **1** → **On** can be set. If the enable signal is permanently switched on, or equipped with a cable jumper, the FI starts up immediately. **NOTE:** The "Automatic start" function can only be used if a digital input of the frequency inverter (DIN 1 … DIN 4) is parameterised to the function "Enable right" or "Enable left" and this input is permanently set to "High". The digital inputs of the Technology Unit modules (e.g.: SK CU4 - IOE) do not support this "automatic start" function. **NOTE:** The "Automatic start" can only be activated if the frequency inverter has been parameterised to local control ((P509) setting { 0 } or { 1}).			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P434 **[-01] [-02]**	**Digital output function**			

0 ... 39 — **[-01] =** **Digital output 1,** Digital output of the frequency inverter

{ 7 } — **[-02] =** reserved

Control terminals 1/40 (Section 2.8.2): The settings 3 to 5 and 11 work with 10% hysteresis, i.e. the relay contact closes (function 11 does not deliver) on reaching the limiting value 24V and switches this off again if a 10% lower value is undershot (function 11 on again).

This behaviour can be inverted with a negative value in P435.

Setting / Function	Output ... for limiting value or function (see also P435)
0 = No function	Low
1 = External brake, to control an external 24V brake relay (max. 200mA). The relay switches at a programmed absolute minimum frequency (P505). For typical brakes a setpoint delay of 0.2-0.3sec should be programmed (see also P107/P114). A typical motor brake (105-180-205V) can be connected directly via the control terminals 79 MB+/80 MB- (Section 2.8.2).	High
2 = Inverter is working, the output indicates voltage at the FI output (U - V - W).	High
3 = Current limit, based on the setting of the motor rated current in (P203). This value can be adjusted with the standardisation (P435).	High
4 = Torque current limit, based on motor data settings in P203 and P206. Signals a corresponding torque load on the motor. This value can be adjusted with the standardisation (P435).	High
5 = Frequency limit, based on motor nominal frequency setting in P201. This value can be adjusted with the standardisation (P435).	High
6 = Level with setpoint (Setpoint reached), indicates that the FI has completed the frequency increase or decrease. Setpoint frequency = actual frequency! From a difference of 1 Hz → *Setpoint value not achieved – signal Low.*	High
7 = Fault, general error message, error is active or not yet acknowledged. → *Error – Low (Ready – High)*	Low
8 = Warning: general warning, a limit value was reached that could lead to a later shutdown of the FI.	Low
9 = Overcurrent warning: At least 130% of the nominal FI current was supplied for 30 seconds.	Low
10 = Motor overtemperature warning: The motor temperature is evaluated. → Motor is too hot. Warning occurs immediately, overheating switch-off after 2 seconds.	Low
11 = Torque current limit/Current limit active warning: The limiting value in P112 or P536 has been reached. A negative value in P435 inverts the reaction. Hysteresis = 10%.	Low
12 = Value of P541 – external control, the output can be controlled with parameter P541 (Bit 0) independently of the actual operating status of the FI.	High
13 = Torque current limit generator /Generator torque limit active: Limit value in P112 has been reached in the generator range. Hysteresis = 10%.	High
18 = Inverter ready: The FI is in standby state. After being enabled it gives an output signal.	High

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set

Setting value		Note
19 = ... 29 reserved	For Posicon functions see BU 0210	
30 = Status Digital-In 1*	High	Details for the use of the bus systems can be found in the relevant supplementary bus manual.
31 = Status Digital-In 2*	High	
32 = Status Digital-In 3*	High	
33 = Status Digital-In 4*	High	
39 = STO inactive *	High	

*) (P546[-01]…[-03]) = 20

P435 [-01] [-02]	**Dig. out. scaling** **(Standardisation of digital output)**			

-400 ... 400 %

{ 100 }

[-01] = **Digital output 1,** Digital output of the frequency inverter

[-02] = reserved

Adjustment of the limit values of the output function. For a negative value, the output function will be output negative.

Reference to the following values:

Current limit (3) = x [%] · P203 >Rated motor current<

Torque current limit (4) = x [%] · P203 · P206 (calculated rated motor torque)

Frequency limit (5) = x [%] · P201 >Rated motor frequency<

P436 [-01] [-02]	**Digital output hysteresis**		S	

0 ... 100 %

{ 10 }

[-01] = **Digital output 1,** Digital output of the frequency inverter

[-02] = reserved

Difference between switch-on and switch-off point to prevent oscillation of the output signal.

P460	**Time watchdog**		S	

0.0 / 0.1 ... 250.0 s

{ 10.0 }

0.1 ... 250.0 = **The time interval** between the expected watchdog signals (programmable function of digital inputs P420 – P425). If this time interval elapses without an impulse being registered, a switch-off and error message E012 are actuated.

0.0 = **Customer error:** As soon as a high-low flank or a low signal is detected at a digital input (function 18) the FI switches off with error message E012.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P464	**Fixed frequency mode**		S	
0 ... 1 { 0 }	This parameter determines the handling of fixed frequencies. With addition, simultaneously controlled values are added together. Otherwise, each value is output separately, whereby with multiple control the highest frequency value is always output. **0 = Addition to main setpoint value** (Addition of frequency to main setpoint value) **1 = Equal to main setpoint value** (No addition / Fixed frequency is the main setpoint value)			
P465 **[-01] ... [-15]**	**Fixed frequency / Array**			
-400.0 ... 400.0 Hz { [-01] = 5.0 } { [-02] = 10.0 } { [-03] = 20.0 } { [-04] = 35.0 } { [-05] = 50.0 } { [-06] = 70.0 } { [-07] = 100.0 } { [-08] = 0.0 } { [-09] = -5.0 } { [-10] = -10.0 } { [-11] = -20.0 } { [-12] = -35.0 } { [-13] = -50.0 } { [-14] = -70.0 } { [-15] = -100.0 }	In the array levels, up to 31 different fixed frequencies can be set, which in turn can be encoded for the functions 50…54 in binary code for the digital inputs. **[-01] =** Fixed frequency 1 / Array 1 **[-02] =** Fixed frequency 2 / Array 2 **[-03] =** Fixed frequency 3 / Array 3 **[-04] =** Fixed frequency 4 / Array 4 **[-05] =** Fixed frequency / Array 5 **[-06] =** Fixed frequency / Array 6 **[-07] =** Fixed frequency / Array 7 **[-08] =** Fixed frequency / Array 8 **[-09] =** Fixed frequency / Array 9 **[-10] =** Fixed frequency / Array 10 **[-11] =** Fixed frequency / Array 11 **[-12] =** Fixed frequency / Array 12 **[-13] =** Fixed frequency / Array 13 **[-14] =** Fixed frequency / Array 14 **[-15] =** Fixed frequency / Array 15			
P466	**Minimum frequency, process controller**		S	P
-400.0 ... 400.0 Hz { 0.0 }	With the aid of the minimum frequency process controller the control ratio can also be kept to a minimum ratio, even with a master value of “zero”, in order to enable adjustment of the compensator. Further details in P400 and Section 9.2.			
P475 **[-01] ... [-04]**	**Switch-on-/ Switch-off delay**		S	
-30.000 ... 30,000 s { 0.000 }	Adjustable switch-on/switch-off delay for the digital inputs. Use as a switch-on filter or simple process control is possible. **[-01] =** Digital input 1 **[-02] =** Digital input 2 **[-03] =** Digital input 3 **[-04] =** Digital input 4 **Positive values =** switch-on delayed **Negative values =** switch-off delayed			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P480 **[-01] ... [-12]**	**Function of Bus I/O In Bits**			
0 ... 72 { [-01] = 01 } { [-02] = 02 } { [-03] = 05 } { [-04] = 12 } { [-05...-12] = 00 }	The Bus I/O In Bits are perceived as digital inputs. They can be set to the same functions (P420). These I/O bits can also be used in combination with the AS Interface (SK 225E or SK 235E) (Bit 0 … 3) or the I/O extension (SK xU4-IOE) (Bit 4 … 7 and Bit 0 … 3). **[-01] = Bus / AS-i Dig In1** (Bus IO In Bit 0 + AS-i 1 or DI 1 of the **second** SK xU4-IOE (DigIn 09)) **[-02] = Bus / AS-i Dig In2** (Bus IO In Bit 1 + AS-i 2 or DI 2 of the **second** SK xU4-IOE (DigIn 10)) **[-03] = Bus / AS-i Dig In3** (Bus IO In Bit 2 + AS-i 3 or DI 3 of the **second** SK xU4-IOE (DigIn 11)) **[-04] = Bus / AS-i Dig In4** (Bus IO In Bit 3 + AS-i 4 or. DI 4 of the **second** SK xU4-IOE (DigIn 12)) **[-05] = Bus / IOE Dig In1** (Bus IO In Bit 4 + DI 1 of the **first** SK xU4-IOE (DigIn 05)) **[-06] = Bus / IOE Dig In2** (Bus IO In Bit 5 + DI 2 of the **first** SK xU4-IOE (DigIn 06)) **[-07] = Bus / IOE Dig In3** (Bus IO In Bit 6 + DI 3 of the **first** SK xU4-IOE (DigIn 07)) **[-08] = Bus / IOE Dig In4** (Bus IO In Bit 7 + DI 4 of the **first** SK xU4-IOE (DigIN 08)) **[-09] =** Flag 1 **[-10] =** Flag 2 **[-11] =** Bit 8 BUS control word **[-12] =** Bit 9 BUS control word The possible functions for the Bus In Bits can be found in the table of functions for the digital inputs in parameter (P420).			
P481 **[-01] ... [-10]**	**Function of Bus I/O Out Bits**			
0 ... 39 { [-01] = 18 } { [-02] = 08 } { [-03] = 30 } { [-04] = 31 } { [-05...-10] = 00 }	The Bus I/O Out Bits are perceived as multi-function relay outputs. They can be set to the same functions (P434). These I/O bits can also be used in combination with the AS Interface (SK 225E or SK 235E) (Bit 0 … 3) or the I/O extension (SK xU4-IOE) (Bit 4 … 5 and flag 1 … 2). **[-01] = Bus / AS-i Dig Out1** (Bus IO Out Bit 0 + AS-i 1) **[-02] = Bus / AS-i Dig Out2** (Bus IO Out Bit 1 + AS-i 2) **[-03] = Bus / AS-i Dig Out3** (Bus IO Out Bit 2 + AS-i 3) **[-04] = Bus / AS-i Dig Out4** (Bus IO Out Bit 3 + AS-i 4) **[-05] = Bus / IOE Dig Out1** (Bus IO In Bit 4 + DO 1 of the **first** SK xU4-IOE (DigOut 02)) **[-06] = Bus / IOE Dig Out2** (Bus IO In Bit 5 + DO 2 of the **first** SK xU4-IOE (DigOut 03)) **[-07] = Bus / 2nd IOE Dig Out1** (Flag 1 + DO 1 of the **second** SK xU4-IOE (DigOut 04)) **[-08] = Bus / 2nd IOE Dig Out2** (Flag 2 + DO 2 of the **second** SK xU4-IOE (DigOut 05)) **[-09] =** Bit 10 BUS status word **[-10] =** Bit 13 BUS status word The possible functions for the Bus Out Bits can be found in the table of functions for the digital outputs (P434).			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P482 **[-01] ... [-10]**	**Norm. Bus I/O Out Bits** **(Standardisation of Bus I/O Out Bits)**			
-400 … 400 % { all 100 }	Adjustment of the limit values of the limit values of the Bus Out bits. For a negative value, the output function will be output negative. If the limit value is reached and the set values are positive, the output gives a High signal. If the set values are negative, the signal is Low. **[-01] = Bus / AS-i Dig Out1** (Bus IO Out Bit 0 + AS-i 1) **[-02] = Bus / AS-i Dig Out2** (Bus IO Out Bit 1 + AS-i 2) **[-03] = Bus / AS-i Dig Out3** (Bus IO Out Bit 2 + AS-i 3) **[-04] = Bus / AS-i Dig Out4** (Bus IO Out Bit 3 + AS-i 4) **[-05] = Bus / IOE Dig In1** (Bus IO In Bit 4 + DO 1 of the **first** SK xU4-IOE (DigOut 02)) **[-06] = Bus / IOE Dig Out2** (Bus IO In Bit 5 + DO 2 of the **first** SK xU4-IOE (DigOut 03)) **[-07] = Bus / 2nd IOE Dig Out1** (Flag 1 + DO 1 of the **second** SK xU4-IOE (DigOut 04)) **[-08] = Bus / 2nd IOE Dig Out2** (Flag 2 + DO 2 of the **second** SK xU4-IOE (DigOut 05)) **[-09] =** Bit 10 BUS status word **[-10] =** Bit 13 BUS status word			
P483 **[-01] ... [-10]**	**Hysteresis Bus I/O Out Bits**		S	
1 … 100 % { all 10 }	Difference between switch-on and switch-off point to prevent oscillation of the output signal. **[-01] = Bus / AS-i Dig Out1** (Bus IO Out Bit 0 + AS-i 1) **[-02] = Bus / AS-i Dig Out2** (Bus IO Out Bit 1 + AS-i 2) **[-03] = Bus / AS-i Dig Out3** (Bus IO Out Bit 2 + AS-i 3) **[-04] = Bus / AS-i Dig Out4** (Bus IO Out Bit 3 + AS-i 4) **[-05] = Bus / IOE Dig In1** (Bus IO In Bit 4 + DO 1 of the **first** SK xU4-IOE (DigOut 02)) **[-06] = Bus / IOE Dig Out2** (Bus IO In Bit 5 + DO 2 of the **first** SK xU4-IOE (DigOut 03)) **[-07] = Bus / 2nd IOE Dig Out1** (Flag 1 + DO 1 of the **second** SK xU4-IOE (DigOut 04)) **[-08] = Bus / 2nd IOE Dig Out2** (Flag 2 + DO 2 of the **second** SK xU4-IOE (DigOut 05)) **[-09] =** Bit 10 BUS status word **[-10] =** Bit 13 BUS status word			

NOTE: Details for the use of the bus systems can be found in the relevant supplementary bus manual.

6.1.6 Additional parameters

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P501	**Inverter name**			
A…Z (char) { 0 }	Free input of a designation (name) for the device (max. 20 characters). With the the frequency inverter can be uniquely identified for processing with NordCon software or within a network.			
P502 [-01] ... [-03]	**Value master function**		S	P
0 ... 21 { all 0 }	Selection of up to 3 master values: **[-01] = Master value 1** **[-02] = Master value 2** **[-03] = Master value 3** Selection of possible setting values for master values: **0 =** Off **1 =** Actual frequency **2 =** Actual speed **3 =** Current **4 =** Torque current **5 =** Status Digital IO **6 =** ... 7 reserved **8 =** Setpoint frequency **9 =** Error coder **10 =** ... 11 reserved **12 =** Bus IO Out Bits 0-7 **13 =** ... 16 reserved **17 =** Value of analog input 1 (first IOE) **18 =** Value of analog input 2 (first IOE) **19 =** Setpoint frequency master value **20 =** Setpoint frequency after ramp, master value **21 =** Actual frequency without slip, master value **22 =** Speed encoder			
P503	**Leading function output**		S	
0 ... 3 { 0 }	Activation of output of the master value onto the system bus (master functionality). Specification of the communication modes on the system bus for ParameterBox and Nord Con. The definition of the master value or values is carried out in parameter P502. **0 = Off** ***No*** control word and master value output. ***If*** no BUS option (e.g. SK xU4-IOE) is connected to the system bus, only the device directly connected to the ParameterBox or Nord Con is visible. **1 = CANopen (system bus)** ***Control word*** and master values are transferred to the system bus. ***If*** no bus option (e.g. SK xU4-IOE) is connected to the system bus, only the device directly connected to the ParameterBox or Nord Con is visible. **2 = System bus active** ***No*** control word and master value output. ***All*** FIs connected to the system bus are visible in the ParameterBox or Nord Con, even if no bus option is connected. Prerequisite: all FIs must be set to this mode. **3 = CANopen + System bus active** ***Control word*** and master values are transferred to the system bus. ***All*** FIs connected to the system bus are visible in the PameterBox or Nord Con, even if no bus option is connected. Prerequisite: all other FIs must be set to mode { 2 } "System bus active"			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P504	**Pulse frequency**		S	
3.0 ... 16.0 kHz { 6.0 }	The internal pulse frequency for actuating the power component can be changed with this parameter. A higher setting reduces motor noise, but leads to increased EMC emissions and reduction of the possible motor nominal torque. **NOTE:** The radio interference suppression limiting curve A1 according to EN55011 is complied with at a setting of 6.0kHz on condition that the wiring guidelines are complied with. For further details, see Section 9.4 EMC limit value classes. **NOTE:** Raising the pulse frequency leads to a reduction of the possible output current, depending on the time (I^2t curve). For further details, see Section 9.5 Reduced output power.			
P505	**Absolute minimum frequency**		S	P
0.0 ... 10.0 Hz { 2.0 }	Gives the frequency value that cannot be undershot by the FI. If the setpoint is smaller than the absolute minimum frequency, the FI switches off or changes to 0.0Hz. At the absolute minimum frequency, braking control (P434) and the setpoint delay (P107) are actuated. If a setting value of "Zero" is selected, the brake relay does not switch during reversing. When controlling lift equipment, this value should be set at a minimum of 2Hz. From 2Hz, the current control of the FI operates and a connected motor can supply sufficient torque. **NOTE:** Output frequencies < 4.5Hz result in a reduced current overload capacity. For further details, see Section 9.5 power derating.			
P506	**Automatic error acknowledgement**		S	
0 ... 7 { 0 }	In addition to the manual error acknowledgement, an automatic acknowledgement can also be selected. **0 = No automatic** error acknowledgement **1 ... 5 = Number** of permissible automatic error acknowledgments within one mains-on cycle. After mains off and switch on again, the full amount is again available. **6 = always**, an error message will be acknowledged automatically if the cause of the error is no longer present. **7 = quit disable (via enable deactivated)**, acknowlegement is only possible with the OK key or by switching off the mains. Acknowledgement is not implemented by removing the enable!			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P509	**Source control word**		S	

0 ... 4

{ 0 }

Selection of the interface via which the FI is controlled.

0 = Control terminals or keyboard control ** with the SimpleBox (if P510=0), the ParameterBox or via BUS I/O Bits.

1 = Control terminals only *, the FI can only be controlled via the digital and analog input signals or via the Bus I/O Bits.

2 = USS*, the control signals (enable, rotation direction, etc.) are transferred via the RS485 interface, the setpoint via the analog input or the fixed frequencies.

3 = System bus*

4 = System bus broadcast *

*) Keyboard control (SimpleBox, ParameterBox, PotentiometerBox) is blocked, parameterisation is still possible.

**) If the communication during keyboard control is interrupted (time out 0.5 sec), the FI will block without an error message.

NOTE: For details of the optional bus systems, please refer to the relevant supplementary bus manuals (BU02x0).

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As an alternative to parameterisation, switchover to **system bus broadcast** can also be made via DIP switch 3.

P510 **[-01] [-02]**	**Source setpoint**		S	

0 ... 4

{ [-01] = 0 }

{ [-02] = 0 }

Selection of the setpoint source to be parameterised.

[-01] = Source, main setpoint value **[-02] = Source, 2nd (auxiliary) setpoint value**

Selection of the interface via which the FI receives the setpoint.

0 = Auto: The source of the auxiliary setpoint is automatically derived from the setting in the parameter P509 >Interface<

1 = Control terminals only, digital and analog inputs control the frequency, including fixed frequencies

2 = USS

3 = System bus

4 = System bus broadcast

P511	**USS Baud rate**		S	

0 ... 3

{ 3 }

Setting of the transfer rate (transfer speed) via the RS485 interface. All bus participants must have the same baud rate setting.

0 = 4800 baud

1 = 9600 baud

2 = 19200 baud

3 = 38400 baud

P512	**USS address**			

0 ... 30

{ 0 }

Setting the FI Bus address.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P513	**Telegram timeout** (system bus)		S	
-0.1 / 0.0 / 0.1 ... 100.0 s { 0.0 }	Monitoring of the system bus. Following receipt of a valid telegram, the next one must arrive within the set period. Otherwise the FI reports an error and switches off with the error message E010 >Bus Time Out<. **0.0 =** **10.8/10.2 inactive** (Off): Monitoring is switched off. **-0.1 =** **no error**: Even if the communication between the BusBox and the FI is interrupted (e.g. 24V error, Box unplugged, etc.) the FI continues to operate unchanged. 0.1… = **10.8/10.2 active** (On): Monitoring is activated. **Note:** As the transfer rate of the system bus must remain at 250kBaud (Parameter (P514)), a minimum monitoring time of 0.3 s must be set. Otherwise the FI will immediately go into error status.			
P514	**CAN bus baud rate** (system bus)		S	
0 ... 7 { 5 }	Setting of the transfer rate (transfer speed) via the system bus interface. All bus participants must have the same baud rate setting. **Note:** Optional modules (SK xU4-…) only operate with a transfer rate of 250kBaud. Therefore the frequency inverter must remain at the factory setting (250kBaud). **0 =** 10kBaud **3 =** 100kBaud **6 =** 500kBaud **1 =** 20kBaud **4 =** 125kBaud **7 =** 1Mbaud * **2 =** 50kBaud **5 =** **250kBaud** *) Reliable operation cannot be guaranteed			
P515 [-01] ... [-03]	**CAN bus address** (system bus)		S	
0 ... 255$_{dec}$ { all 32$_{dec}$ } or { all 20$_{hex}$ }	Setting of the system bus address. **[-01] = Slave address**,system bus reception address **[-02] = Broadcast slave address**, system bus reception address (slave) **[-03] = Broadcast master address,** transmission address for system bus (master)			
NOTE:	If up to four SK 200E are to be linked via the system bus, the addresses must be set as follows → FI1 = 32, FI2 = 34, FI3 = 36, FI4 = 38. The system bus addresses should be set via the DIP switches 1/2 (Section 5.1.1).			
P516	**Skip frequency 1**		S	P
0.0 ... 400.0 Hz { 0.0 }	The output frequency around the frequency value (P517) set here is masked. This range is transmitted with the set brake and acceleration ramp; it cannot be continuously supplied to the output. Frequencies below the absolute minimum frequency should not be set. **0.0 = Off**: Masking frequency inactive			
P517	**Skip frequency area 1**		S	P
0.0 ... 50.0 Hz { 2.0 }	Masking range for the >Masking frequency 1< P516. This frequency value is added and subtracted from the masking frequency. Masking frequency range 1: P516 - P517 to P516 + P517			
P518	**Skip frequency 2**		S	P
0.0 ... 400.0 Hz { 0.0 }	The output frequency around the frequency value (P519) set here is masked. This range is transmitted with the set brake and acceleration ramp; it cannot be continuously supplied to the output. Frequencies below the absolute minimum frequency should not be set. **0.0 = Off**: Masking frequency inactive			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P519	**Skip frequency area 2**		S	P
0.0 ... 50.0 Hz { 2.0 }	Masking range for the >Masking frequency 2< P518. This frequency value is added and subtracted from the masking frequency. Masking frequency range 2: P518 - P519 to P518 + P519			
P520	**Flying start**		S	P
0 ... 4 { 0 }	This function is required to connect the FI to motors which are already rotating, e.g. in fan drives. Motor frequencies >100Hz are only picked up in speed controlled mode (Servo mode P300 = ON). **0 = Switched off**, no flying start. **1 = Both directions**, the FI looks for a speed in both directions. **2 = Direction of setpoint**, only search in the direction of the existing setpoint. **3 = Both directions after fault**, only after mains failure and faults. **4 = Direction of setpoint after fault**, only after mains failure and faults. **NOTE:** For physical reasons, the flying start only operates above 1/10 of the nominal speed of rotation (P202) or a minimum of 10Hz. For example, this means a minimum speed of rotation of 300 rpm for a 4-pole 50Hz motor.			
P521	**Flying start resolution**		S	P
0.02... 2.50 Hz { 0.05 }	Using this parameter, the flying start search increment size can be adjusted. Values that are too large affect accuracy and causes the FI to cut out with an overcurrent report. If the values are too small, the search time is greatly extended.			
P522	**Flying start offset**		S	P
-10.0 ... 10.0 Hz { 0.0 }	A frequency value which is added to the frequency value found, e.g. to remain in the motor range and so avoid the generator range and therefore the chopper range.			
P523	**Factory setting**			
0 ... 3 { 0 }	By selecting the appropriate value and confirming it with the OK key, the selected parameter range is entered in the factory setting. Once the setting has been made, the value of the parameter automatically returns to 0. **0 = No change:**Does not change the parameterisation. **1 = Load factory settings:** The complete parameterisation of the FI reverts to the factory setting. All originally parameterised data is lost. **2 = Factory setting without bus:** All parameters of the frequency inverter, but <u>not</u> the bus parameters, are reset to the factory setting. **3 = Factory setting without motor data:** All parameters of the frequency inverter, but <u>not</u> the motor data, are reset to the factory setting.			
P533	**Factor I^2t Motor**		S	
50 ... 150 % { 100 }	The motor current for the I^2t motor monitoring P535 can be weighted with the parameter P533. Larger factors permit larger currents.			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P534 **[-01] [-02]**	**Torque disconnection limit**		S	P

25 ... 400 % / 401

{ all 401 }

Via this parameter both the **drive** [-01] and the **generator switch-off value** [-02] can be adjusted.

If 80% of the set value is reached, a warning status is set. At 100% switch-off is performed with an error message.

Error 12.1 is given on exceeding the motor switch-off limit and E12.2 on exceeding the generator switch-off limit.

[-01] = motor switch-off limit

[-02] = generator switch-off limit

401 = OFF, means that this function has been disabled.

P535	**I^2t Motor**			

0 … 24

{ 0 }

The I^2t motor function can now be set in a differentiated manner. Up to four curves with three different triggering times can be set. The trigger times are based on classes 5, 10 and 20 for semiconductor switching devices.

All curves run from 0Hz to half of the nominal motor frequency (P201). The full nominal current is available from half of the nominal frequency upwards.

0 = I^2t Motor Off: Monitoring is inactive

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

NOTE: For switch-off classes 10 and 20, care must be taken that the FI has a sufficiently high overload capacity.

P536	**Current limit**		S	

0.1 ... 2.0 / 2.1 (x FI current rating)

{ 1.5 }

The inverter output current is limited to the set value. If this limit value is reached, the inverter reduces the actual output frequency.

With the analog input function in P400 = 12/13, this limit value can also be varied and cause an error message (E12.4).

0.1 ... 2.0 = Multiplier with the inverter current rating, gives the limit value

2.1 = OFF means that this limit value is disabled. The FI supplies the maximum possible current.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P537	**Pulse disconnection**		S	
10 ... 200 % / 201 { 150 }	This function prevents rapid shutdown of the FI according to the load. With the pulse switch-off enabled, the output current is limited to the set value. This limitation is implemented by brief switching off of individual output stage transistors, the actual output frequency remains unchanged. **10...200% =** Limit value related to the FI current rating **201 =** Function is disabled; the FI supplies the maximum possible current. **NOTE:** The value set here can be undershot with a smaller value in P536. For smaller output frequencies (<4.5Hz) or higher pulse frequencies (>6kHz or 8kHz, P504) the pulse switch-off by the power reduction (see Section 8.3) can be undershot. **NOTE:** If the pulse switch-off is disabled (P537=201) and a high pulse frequency is selected in parameter P504, the FI automatically reduces the pulse frequency when the power limit is reached. If the load on the FI is again reduced, the pulse frequency increases to the original value again.			
P539	**Check output voltage**		S	P
0 ... 3 { 0 }	This protective function monitors the output current at the U-V-W terminals and checks for plausibility. In cases of error, the error message E016 is output. **0 = Disabled:** Monitoring is not active. **1 = Only motor phase errors:** The output current is measured and checked for symmetry. If an imbalance is present, the FI switches off and outputs the error message E016. **2 = Only magnetisation monitoring:** At the moment the FI is switched on, the level of the excitation current (field current) is checked. If insufficient excitation current is present, the FI switches off with the error message E016. A motor brake is not released in this phase. **3 = Motor phase + magnetisation monitoring**: as 1 and 2 combined **NOTE:** This function can also be used as an additional protective function for lifting applications, but is not permissible on its own as protection for persons.			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P540	**Mode phase sequence**		S	P

0 ... 7

{ 0 }

For safety reasons this parameter can be used to prevent a rotation direction reversal and therefore the incorrect rotation direction.

This function does not operate if the position control is active (P600 ≠ 0).

0 = No rotation direction limitation

1 = Disable phase sequence key, rotation direction change key of the SimpleBox is locked

2 = To the right only*, only right-hand field rotation direction is possible. The selection of the "incorrect" rotation direction leads to the output of the minimum frequency P104 with the field of rotation R.

3 = To the left only*, only a left-hand field rotation direction is possible. The selection of the "incorrect" rotation direction leads to the output of the minimum frequency P104 with the field of rotation L.

4 = Enable direction only, rotation direction is only possible according to the enable signal, otherwise 0Hz is output.

5 = Right Orient. Contr. (only right-hand running monitored) *, only a right-hand field rotation is possible. The selection of the "incorrect" rotation direction leads to a switch-off (control lock) of the FI. If necessary, care should be taken that the setpoint (>f_{min}) is sufficiently high.

6 = Right Orient. Contr. (only left-hand running monitored) *, only a left field rotation is possible. The selection of the "incorrect" rotation direction leads to a switch-off (control lock) of the FI. If necessary, care should be taken that the setpoint (>f_{min}) is sufficiently high.

7 = Only enabled direction controlled, rotation is only possible in the direction of the enable signal, otherwise the FI is switched off.

*) Applies for control via keyboard and control terminals.

P541	**Set digital output**		S	

000 ... 1FF(hex)

{ 000 }

This function provides the opportunity to control the relay and the digital outputs independently of the frequency inverter status. To do this, the relevant output must be set to the function "External control".

This function can either be used manually or in combination with a bus control.

Bit 0 = Digital output 1

Bit 1 = Bus/AS-i Out Bit 0

Bit 2 = Bus/AS-i Out Bit 1

Bit 3 = Bus/AS-i Out Bit 2

Bit 4 = Bus/AS-i Out Bit 3

Bit 5 = Bus/Analog /Digital Out Bit 4

Bit 6 = Bus/Analog /Digital Out Bit 5

Bit 7 = Bus digital output 7

Bit 8 = Bus digital output 8

	Bit 8	Bits 7 -4	Bits 3 -0	
Min. value	0	0000	0000	Binary
	0	**0**	**0**	**hex**
Max. value	1	1111	1111	Binary
	1	**F**	**F**	**hex**

Setting of the value via …

BUS: The corresponding hex value is written into the parameter, thereby setting the relay or digital outputs.

SimpleBox: The hexadecimal code is entered directly if the SimpleBox is used.

ParameterBox: Each individual output can be separately called up in plain text and activated.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P542 **[-01] [-02]**	**Set analog output**		S	

0.0 ... 10.0 V	**[-01] =** **First IOE,** AOUT of the first I/O extension (SK xU4-IOE)
{ all 0.0 }	**[-02] =** **Second IOE,** AOUT of the second I/O extension (SK xU4-IOE)
... only with SK CU4-IOE or SK TU4-IOE	The analog output of the FI can be set with this function, independently of the actual operating state. To do this, the relevant analog output must be set to the function "External control" (P418 = 7). This function can either be used manually or in combination with a bus control. The value set here will, once confirmed, be produced at the analog output.

P543 **[-01] ... [-03]**	**Actual bus value 1… 3**		S	P

0 ... 22

{ [-01] = 1 }

{ [-02] = 4 }

{ [-03] = 9 }

In this parameter the returned value on bus actuation can be selected.

NOTE: For further details, please refer to the relevant bus manual or the description for (P418). (Values from 0% … 100% correspond to 0000_{hex} … 4000_{hex}) For standardisation of the actual values: See also (Section 9.10).

[-01] = Actual bus value 1

[-02] = Actual bus value 2 (only for PPO type 2 or 4)

[-03] = Actual bus value 3 (only for PPO type 2 or 4)

Possible setting values:

- **0 =** Off
- **1 =** Actual frequency (x=4000_{hex}*f[Hz]/(P105))
- **2 =** Actual speed (x=4000_{hex}*n(rpm]/(P202))
- **3 =** Current (x=4000_{hex}*I[A]/(P203))
- **4 =** Torque current (100% = P112) (x=4000_{hex}*Iq[A]/(P112)*100/ √((P203)²+(P209)²)
- **5 =** Digital IO status [4]
- **6 =** ... 7 reserved
- **8 =** Setpoint frequency (x=4000_{hex}*fs[Hz]/(P105))
- **9 =** Error code
- **10 =** ... 11 reserved
- **12 =** Bus IO Out Bits 0..-7
- **13 =** ... 16 reserved
- **17 =** Analog input value 1 (AIN1 of the first I/O extension SK xU4-IOE (P400 [-03]))
- **18 =** Analog input value 2 (AIN2 of the first I/O extension SK xU4-IOE (P400 [-04]))
- **19 =** Setpoint frequency master value (P503) (x=4000_{hex}*fs[Hz]/(P105))
- **20 =** Setpoint frequency after ramp, master value (x=4000_{hex}*fsnr[Hz]/(P105))
- **21 =** Actual frequency without slip master value (x=4000_{hex}*f-f2[Hz]/(P105))
- **22 =** Speed from speed encoder (x=4000_{hex}*n[Hz]/(P105)/(60/p)) p=pole-pair number, Determined from (P201) and (202))

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[4] The assignment of the dig. inputs for P543 = 5

Bit 0 = DigIn 1 (FI)	Bit 1 = DigIn 2 (FI)	Bit 2 = DigIn 3 (FI)	Bit 3 = DigIn 4 (FI)
Bit 4 = PTC input (FI)	Bit 5 = DigIn 5 (DI1, 1. SK...IOE)	Bit 6 = DigIn 6 (DI2, 1. SK...IOE)	Bit 7 = DigIn 7 (DI3, 1. SK...IOE)
Bit 8 = DigIn 8 (DI4, 1. SK...IOE)	Bit 9 = reserved	Bit 10 = reserved	Bit 11 = reserved
Bit 12 = DigOut 1 (FI)	Bit 13 = mech. brake (FI)	Bit 14 = DigOut 2(DO1, 1. SK...IOE)	Bit 15 = DigOut 3 (DO2, 1. SK...IOE)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P546	**Function Bus setpoint 1 ... 3**		S	P
0 ... 24 { [-01] = 1 } { [-02] = 0 } { [-03] = 0 }	In this parameter, a function is assigned to the output setpoint during bus actuation. **NOTE:** For further details, please refer to the relevant bus manual or the description for (P400). (Values from 0% … 100% correspond to 0000_{hex} … 4000_{hex},) For standardisation of the setpoint values: See also (Section 9.10). **[-01] = Bus setpoint value 1** **[-02] = Bus setpoint value 2** (only for PPO type 2 or 4) **[-03] = Bus setpoint value 3** (only for PPO type 2 or 4) **Possible setting values:** **0 =** Off **1 =** Setpoint frequency (16 Bit) **2 =** Frequency addition **3 =** Frequency subtraction **4 =** Minimum frequency **5 =** Maximum frequency **6 =** Current value, process controller **7 =** Nominal value, process controller **8 =** PI current frequency **9 =** PI limited current frequency **10 =** PI supervised current frequency **11 =** Torque current limitation (limited) **12 =** Torque current limitation (switch-off) **13 =** Current limit (limited) **14 =** Current limit (switch-off) **15 =** Ramp time **16 =** Pre-tension torque ((P214) multiplication) **17 =** Multiplication **18 =** Curve control (Curve travel calculator) **19 =** Servo mode torque **20 =** BusIO InBits 0-7 **21 =** ..24 reserved for Posicon **31 =** Digital output first IOE (sets status DOUT) **32 =** Analog output first IOE (sets value AOUT)			
P549	**PotentiometerBox function**		S	
0 ... 3 { 1 }	This parameter provides the possibility of adding a correction value (fixed frequency, analog, bus) to the current setpoint value by means of the SimpleBox/ParameterBox keyboard. The adjustment range is determined by the auxiliary setpoint value P410/411. **0 = Off** **1 = Setpoint frequency**, with(P509)≠ 1 control via USS is possible **2 = Frequency addition** **3 = Frequency subtraction**			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P552 **[-01] [-02]**	**CAN Master cycle time (system bus)**		S	

0.0 / 0.1 … 100.0 ms

{ all 0.0 }

In this parameter, the cycle time for the system bus master mode and the CAN open encoder is set (see P503/514/515):

[01] = CAN Master function, cycle time for system bus master functions

[02] = CANopen absolute encoder, cycle time for system bus absolute encoder

With the setting **0 = "Auto"** the default value (see table) is used.

According to the Baud rate set, there are different minimum values for the actual cycle time:

Baud rate	Minimum value tZ	Default System Bus Master	Default System Bus Abs.
10kBaud	10ms	50ms	20ms
20kBaud	10ms	25ms	20ms
50kBaud	5ms	10ms	10ms
100kBaud	2ms	5ms	5ms
125kBaud	2ms	5ms	5ms
250kBaud	1ms	5ms	2ms
500kBaud	1ms	5ms	2ms
1000kBaud:	1ms	5ms	2ms

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P555	**P Chopper Limit**		S	

5 ... 100 %

[100]

A power limit for the brake resistor can be programmed with this parameter. The switch-on time (modulation level) for the brake chopper can only increase to the maximum specified limit.

The result would be an overvoltage switch-off of the FI.

The correct percentage value is calculated as follows: $k[\%] = \frac{R * P_{max\,BR}}{U_{max}^{2}}$

R =Brake resistor resistance
P_{maxBR} = short-term peak power of the brake resistor
U_{max} = chopper switching wave from the FI
1~ 115/230V ⇒ 440V=
3~ 230V~ ⇒ 500V=
3~ 400V~ ⇒ 1000V=

NOTE: With the use of the internal brake resistor SK BRI4-… a suitable limit must be set. However, the activation of the limit via the DIP switch (Section 5.1.1), DIP8 = "On" is recommended.

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P556	**Braking resistor**		S	

20 ... 400 Ω

{ 120 }

Value of the brake resistance for the calculation of the maximum brake power to protect the resistor.

Once the maximum continuous output (P557) including overload (200% for 60s) is reached, an I^2t limit error (E003.1) is triggered. Further details in P737.

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P557	**Brake resistor type**		S	

0.00 ... 20.00 kW

{ 0.00 }

Continuous power (nominal power) of the resistor, to display the actual utilisation in P737. For a correctly calculated value, the correct value must be entered into P556 and P557.

0.00 = Off, monitoring disabled

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P558	**Flux delay (Excitation time)**		S	P
0 / 1 / 2 ... 500 ms { 1 }	The ISD control can only function correctly if there is a magnetic field in the motor. For this reason, a DC current is applied before starting the motor. The duration depends on the size of the motor and is automatically set in the factory setting of the FI. For time critical applications, the excitation time can be set or deactivated. **0 =** switched off **1 =** automatic calculation **2 ... 500 =** according to set time in [ms] **NOTE:** Setting values that are too low can reduce the dynamics and starting torque.			
P559	**DC run-on time**		S	P
0.00 ... 30.00 s { 0.50 }	Following a stop signal and the braking ramp, a direct current is briefly applied to the motor to fully bring the drive to a stop. Depending on the inertia, the time for which the current is applied can be set in this parameter. The current level depends on the previous braking procedure (current vector control) or the static boost (linear characteristic).			
P560	**Mode of parameter save**		S	
0 ... 2 { 1 }	**0 = Only in RAM,** changes to the parameter settings are no longer saved on the EEPROM. All previously saved settings are retained, even if the FI is disconnected from the mains. **1 = RAM and EEPROM,** all parameter changes are automatically written to the EEPROM and remain stored there even if the FI is disconnected from the mains supply. **2 = Off,** no storage in the RAM and EEPROM possible (No parameter changes are accepted) **NOTE:** If BUS communication is used to implement parameter changes, it must be ensured that the maximum number of write cycles (100,000 x) in the EEPROM is not exceeded.			

6.1.7 Positioning

Parameter group P600 is used to adjust the positioning control of the SK 200E. In order to make this parameter visible, the supervisor parameter P003 = 3 must be set.

A detailed description of these parameters can be found in Manual BU 0210.(www.nord.com)

6.1.8 Information (Frequency inverter)

Parameter		Setting value / Description / Note	Device	Supervisor	Parameter set
P700	**[-01] ... [-03]**	**Actual operating status**			
0.0 ... 21.4		Display of current messages for the actual operating status of the frequency inverter such as errors, wanings or the cause of a switch-on block. For details of messages see Section 7 **[-01] = Current fault,** shows the currently active (unacknowledged) error (Section 7.2.1) **[-02] = Actual warning,** shows any current warning message (Section 7.3) **[-03] = Reason FI blocked,** shows the reason for a currently active switch-on block (Section 7.4) **Note** *SimpleBox:Only warning messages and errors* can be displayed with the Simplebox. Display of the messages is encoded. The description of the codes (warning/error numbers) can be found in the relevant table in Section 7.2.1, 7.3. *ParameterBox:* the ParameterBox displays the messages in plain text. The reason for any switch-on block can also be displayed. *Bus:* The display of error messages at bus level is in decimal integer format. If the value is divided by 10, the display corresponds to the description in Section 7.2. Example: Display: 20 → Error number: 2.0			
P701	**[-01] ... [-05]**	**Last fault 1...5**			
0.0 ... 21.4		This parameter stores the last 5 faults. (Details Section 7) With the SimpleBox, the corresponding memory location 1...5- (Array parameter) must be selected and confirmed using the OK key to read the stored error code.			
P702	**[-01] ... [-05]**	**Frequency, last error 1...5**		S	
-400.0 ... 400.0 Hz		This parameter stores the output frequency that was being delivered at the time the fault occurred. The values of the last 5 errors are stored. With the SimpleBox, the corresponding memory location 1...5- (Array parameter) must be selected and confirmed using the OK key to read the stored error code.			
P703	**[-01] ... [-05]**	**Current, last error 1...5**		S	
0.0 ... 999.9 A		This parameter stores the output current that was being delivered at the time the fault occurred. The values of the last 5 errors are stored. With the SimpleBox, the corresponding memory location 1...5- (Array parameter) must be selected and confirmed using the OK key to read the stored error code.			
P704	**[-01] ... [-05]**	**Voltage, last error 1...5**		S	
0 ... 600 V AC		This parameter stores the output voltage that was being delivered at the time the fault occurred. The values of the last 5 errors are stored. With the SimpleBox, the corresponding memory location 1...5- (Array parameter) must be selected and confirmed using the OK key to read the stored error code.			

Parameter		Setting value / Description / Note	Device	Supervisor	Parameter set
P705	**[-01] ... [-05]**	**DC link voltage last error 1...5**		S	
0 ... 1000 V DC		This parameter stores the link voltage that was being delivered at the time the error occurred. The values of the last 5 errors are stored. With the SimpleBox, the corresponding memory location 1...5- (Array parameter) must be selected and confirmed using the OK key to read the stored error code.			
P706	**[-01] ... [-05]**	**Parameter set, last error 1...5**		S	
0 ... 3		This parameter stores the parameter set code that was active when the error occurred. Data for the previous 5 faults are stored. With the SimpleBox, the corresponding memory location 1...5- (Array parameter) must be selected and confirmed using the OK key to read the stored error code.			
P707	**[-01] ... [-03]**	**Software version/ revision**			
0.0 ... 9999.9		This parameter shows the software and revision numbers in the FI. This can be significant when different FIs are assigned the same settings. Array [-03] provides information about any special versions of the hardware or software A zero stands for the standard version. **[-01] = Software version,** version number (V1.0) **[-02] = Software revision,** revision number (R1) **[-03] = Special version**, of the hardware/software (0.0)			
P708		**State of digital inputs**			
00000 ... 11111 (bin) or 00 ... 1F (hex)		Displays the status of the digital inputs in binary/hexadecimal code. This display can be used to check the input signals. **Bit 0 =** Digital input 1 **Bit 1 =** Digital input 2 **Bit 2 =** Digital input 3 **Bit 3 =** Digital input 4 **Bit 4 =** PTC resistor input			

	Bit 4	Bits 3 -0	
Minimum value	0	0000	Binary
	0	0	hex
Maximum value	1	1111	Binary
	1	F	hex

SimpleBox: The binary Bits are converted into a hexadecimal value and displayed.

ParameterBox: The Bits are displayed with increasing values from right to left (binary).

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P709 **[-01] ... [-09]**	**Analog input voltage**			
-100.0 ... 100.0 %	Displays the measured analog input value. **[-01] =** **Potentiometer 1**, internal FI potentiometer P1 (Section 5.1.3), for the adjustment of "maximum frequency", "minimum frequency" and "ramp time" **[-02] =** **Potentiometer 2**, internal FI potentiometer P2 (Section 5.1.3) with fixed steps, the function can also be entered via the DIP switch. **[-03] =** **External analog input 1**, AIN1 of the first I/O extension (SK xU4-IOE). **[-04] =** **External analog input 2**, AIN2 of the first I/O extension (SK xU4-IOE). **[-05] =** **Setpoint module**, in preparation **[-06] =** **Analog function digital input 2**, analog function of the FI digital input 2 **[-07] =** **Analog function digital input 3**, analog function of the FI digital input 3 **[-08] =** **External analog input 1 2nd IOE**, AIN1 of the second I/O extension (SK xU4-IOE) (= analog input 3). **[-09] =** **External analog input 2 2nd IOE**, AIN2 of the second I/O extension (SK xU4-IOE) (= analog input 4).			
P710 **[-01] [-02]**	**Analog output voltage**			
0.0 ... 10.0 V	Displays the delivered value of analog output. **[-01] =** **First IOE,** AOUT of the first I/O extension (SK xU4-IOE) **[-02] =** **Second IOE,** AOUT of the second I/O extension (SK xU4-IOE)			
P711	**Digital output status**			
00 ... 11 (bin) or 0 ... 3 (hex)	Shows the actual status of the digital outputs of the frequency inverter. **Bit 0 =** Digital output 1 **Bit 1 =** Mechanical brake			
P714	**Operating time**			
0.00 ... ___ h	This parameter shows the time for which the FI was connected to the mains and was ready for operation.			
P715	**Running time**			
0.00 ... ___ h	This parameter shows the time for which the FI was enabled and supplied current to the output.			
P716	**Current frequency**			
-400.0 ... 400.0 Hz	Displays the actual output frequency.			
P717	**Current rotation speed**			
-9999 ... 9999 rpm	Displays the actual motor speed calculated by the FI.			
P718 **[-01] ... [-03]**	**Current setpoint frequency**			
-400.0 ... 400.0 Hz	Displays the frequency specified by the setpoint. **[-01] =** Actual setpoint frequency from the setpoint source **[-02] =** Actual setpoint frequency after processing in the FI status machine **[-03] =** Actual setpoint frequency after the frequency ramp			

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P719	**Actual current**			
0.0 ... 999.9 A	Displays the actual output current.			
P720	**Actual torque current**			
-999.9 ... 999.9 A	Displays the actual calculated torque-developing output current (active current). Basis for calculation is the motor data P201...P209 ... . →negative values = generator, →positive values = drive			
P721	**Actual field current**			
-999.9 ... 999.9 A	Displays the actual calculated field current (reactive current). Basis for calculation is the motor data P201...P209			
P722	**Current voltage**			
0 ... 500 V	Displays the actual AC voltage supplied by the FI output.			
P723	**Actual voltage component Ud**			
0 ... 500 V	Displays the actual field voltage component.			
P724	**Actual voltage component Uq**			
0 ... 500 V	Displays the actual torque voltage component.			
P725	**Current cos phi**			
0.00 ... 1.00	Displays the actual calculated cos φ of the drive.			
P726	**Apparent power**			
0.00 ... 99.99 kVA	Displays the actual calculated apparent power. Basis for calculation is the motor data P201...P209			
P727	**Mechanical power**			
-99.99 ... 99.99 kW	Displays the actual calculated effective power of the motor. Basis for calculation is the motor data P201...P209			
P728	**Input voltage**			
0 ... 1000 V	Displays the actual mains voltage at the FI input.			
P729	**Torque**			
-400 ... 400 %	Displays the actual calculated torque. Basis for calculation is the motor data P201...P209			

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P730	**Field**			
0 ... 250 %	Displays the actual field in the motor as calculated by the inverter. Basis for calculation is the motor data P201...P209			
P731	**Parameter set**			
0 ... 3	Shows the actual operating parameter set. **0 =** Parameter set 1 **1 =** Parameter set 2 **2 =** Parameter set 3 **3 =** Parameter set 4			
P732	**Phase U current**		S	
0.0 ... 999.9 A	Displays the actual U phase current. **NOTE:** This value can deviate from the value in P719, due to the measurement procedure used, even with symmetrical output currents.			
P733	**Phase V current**		S	
0.0 ... 999.9 A	Displays the actual V phase current. **NOTE:** This value can deviate from the value in P719, due to the measurement procedure used, even with symmetrical output currents.			
P734	**Phase W current**		S	
0.0 ... 999.9 A	Displays the actual W phase current. **NOTE:** This value can deviate from the value in P719, due to the measurement procedure used, even with symmetrical output currents.			
P735	**Speed encoder**		S	
-9999 ... 9999 rpm	Displays the actual rotation speed supplied by the incremental encoder. For this, P301 must be correctly set.			
P736	**D.c. link voltage**			
0 ... 1000 V DC	Displays the actual link voltage.			
P737	**Usage rate brake resistor**			
0 ... 1000 %	This parameter provides information about the actual degree of modulation of the brake chopper or the current utilisation of the braking resistor in generator mode. If parameters P556 and P557 are correctly set, the utilisation related to P557, the resistor power, is displayed. If only P556 is correctly set (P557=0), the degree of modulation of the brake chopper is displayed. Here, 100 means that the brake resistor is fully switched. On the other hand, 0 means that the brake chopper is not active at present. If P556 = 0 and P557 = 0, this parameter also provides information about the degree of modulation of the brake chopper in the FI.			
P738 **[-01] [-02]**	**Usage rate motor**			
0 ... 1000 %	Shows the actual motor load. Basis for calculation is the motor data P203. The actual recorded current is related to the nominal motor current. **[-01] = related to I_N** (P203) of the motor **[-02] = related to I^2t control** (P535)			

Parameter		Setting value / Description / Note		Device	Supervisor	Parameter set
P739	**[-01] ... [-03]**	**Heat sink temperature**				
-40 ... 150		**[-01] = FI heat sink temperature** **[-02] = Ambient temperature (Internal temperature of the FI)** **[-03] = Temperature Motor KTY**, motor temperature via KTY, recording only via IO extension, setting in parameter (P400) to function {30} "Motor temperature"				
P740	**[-01] ... [-13]**	**Process data Bus In**			S	
0000 ... FFFF (hex)		This parameter provides information about the actual control word (STW) and the setpoints (SW1-3) that are transferred via the bus systems. For values to be displayed, a bus system must be selected in P509. For standardisation of actual values: See also (Section 9.10).				
		[-01] = Control word (P509)	Control word, source from (P509).			
		[-02] = Setpoint 1 (P510-01) / (P546 [-01]) **[-03] = Setpoint 2 (P510-01)** / (P546 [-02]) **[-04] = Setpoint 3 (P510-01)** / (P546 [-03])	Setpoint data from main setpoint (P510 [-01]).			
		[-05] = resulting statusof In Bit P480	The displayed value depicts all Bus In Bit sources linked with *OR*.			
		[-06] = Parameter data In 1 **[-07] = Parameter data In 2** **[-08] = Parameter data In 3** **[-09] = Parameter data In 4** **[-10] = Parameter data In 5**	Data during parameter transfer: Order label (AK), Parameter number (PNU), Index (IND), Parameter value (PWE 1/2)			
		[-11] = Setpoint 1 (P510-02) **[-12] = Setpoint 2 (P510-02)** **[-13] = Setpoint 3 (P510-03)**	Setpoint data from the master function value (broadcast), if P509/510 = 4 (P502/P503)			

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P741 **[-01] ... [-10]**	**Process data Bus Out**		S	

0000 ... FFFF (hex)

This parameter provides information about the actual status word and the actual values that are transferred via the bus systems.

For standardisation of actual values: See also (Section 9.10).

[-01] = Status word	Status word
[-02] = Actual value 1 (P543 [-01])	
[-03] = Actual value 2 (P543 [-02])	
[-04] = Actual value 3 (P543 [-03])	
[-05] = resulting statusof Out Bit P481	The displayed value depicts all Bus Out Bit sources linked with *OR*.
[-06] = Parameter data Out 1	
[-07] = Parameter data Out 2	
[-08] = Parameter data Out 3	Data during parameter transfer.
[-09] = Parameter data Out 4	
[-10] = Parameter data Out 5	

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P742	**Database version**		S	

0 ... 9999 — Displays the internal database version of the FI.

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P743	**Inverter ID**			

0.25 ... 11.00 — Displays the inverter power in kW, e.g. "1.50" ⇒ FI with 1.5 kW nominal power.

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P744	**Configuration**			

0000 ... FFFF (hex)

This parameter displays the special devices integrated in the FI. Display is in hexadecimal code (SimpleBox, Bus system).

The display is in plain text when the ParameterBox is used.

High byte:		Low byte:		
00_{hex}	No extension	00_{hex}	Standard I/O	(SK 205E)
01_{hex}	Encoder	01_{hex}	STO	(SK 215E)
02_{hex}	Posicon	02_{hex}	AS-I	(SK 225E)
03_{hex}	---	03_{hex}	STO and AS-I	(SK 235E)

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P747	**Inverter voltage range**			

0 ... 2 — Indicates the mains voltage range for which this device is specified.

0 = 100..0.120V	**1 =** 200..0.240V	**2 =** 380...480V

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P748	**Status CANopen** **(system bus status)**			

0000 ... FFFF (hex)	Displays the system bus status.	
or	Bit 0:	24V Bus supply voltage
0 ... 65535 (dec)	Bit 1:	CANbus in "Bus Warning" status
	Bit 2:	CANbus in "Bus Off" status
	Bit 3:	System bus → Bus module online (field bus module, e.g.: SK xU4-PBR)
	Bit 4:	System bus → Additional module 1 online (I/O - module, e.g.: SK xU4-IOE)
	Bit 5:	System bus → Additional module 2 online (I/O - module, e.g.: SK xU4-IOE)
	Bit 6:	The protocol of the CAN module is 0 = CAN / 1 = CANopen
	Bit 7:	vacant
	Bit 8:	"Bootsup Message" sent
	Bit 9:	CANopen NMT State
	Bit 10:	CANopen NMT State

CANopen NMT State	Bit 10	Bit 9
Stopped	0	0
Pre-Operational	0	1
Operational	1	0

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P749	**Status DIP switches**			

0000 ... 00FF (hex)	This setting displays the actual setting of the FI DIP switches (Section 5.1.1).	
or	Bit 0:	DIP switch 1
0 ... 255 (dec)	Bit 1:	DIP switch 2
	Bit 2:	DIP switch 3
	Bit 3:	DIP switch 4
	Bit 4:	DIP switch 5
	Bit 5:	DIP switch 6
	Bit 6:	DIP switch 7
	Bit 7:	DIP switch 8

Parameter		Setting value / Description / Note	Device	Supervisor	Parameter set
P750		**Overcurrent statistic**		S	
0 ... 9999		Number of overcurrent messages during the operating period P714.			
P751		**Overvoltage statistic**		S	
0 ... 9999		Number of overvoltage messages during the operating period P714.			
P752		**Mains fault statistic**		S	
0 ... 9999		Number of mains faults during the operating period P714.			
P753		**Overtemperature statistic**		S	
0 ... 9999		Number of overtemperature faults during the operating period P714.			
P754		**Parameter loss statistic**		S	
0 ... 9999		Number of parameters lost during the operating period P714.			
P755		**System error statistic**		S	
0 ... 9999		Number of system faults during the operating period P714.			
P756		**Timeout statistic**		S	
0 ... 9999		Number of Time out errors during the operating period P714.			
P757		**Customer error statistic**		S	
0 ... 9999		Number of Customer Watchdog faults during the operating period P714.			
P760		**Actual mains current**		S	
0.0 ... 50		Displays the actual input current.			
P799	**[-01] ... [-05]**	**Operating hours last error** (or duration of error)			
0.00 ... ___ h		This parameter shows the operating hours counter status (P714) at the moment of the previous fault. Array [-01] ... [-05] corresponds to the last fault 1 ... 5.			

6.2 Parameterisation of I/O - extension SK xU4-IOE-…

In order to access the parameters of the I/O extension, the parameterisation tool (ParameterBox, SimpleBox, NordCon) must be connected directly to the device.

If the I/O extension is on an active system bus, access can be obtained by using ParameterBox SK PAR-3H or the NordCon software as well as via a different device (e.g. frequency inverter SK 200E). After the bus scan, it is only necessary to select the I/O extension (menu item SK PAR-3H: "Object selection").

6.2.1 Basic parameters (I/O - extension)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P150	**Set relays**	SK TU4-IOE		
0 ... 4 { 0 }	The switching statuses of the digital outputs (only SK TU4 IOE) can be changed. **0 = Via bus:** all digital outputs are controlled via the system bus, the functions are defined in the frequency inverter (P480) **1 = Outputs Off:** all digital outputs are off (Low = 0V) **2 = Output 1 on (DO1):** digital output DO1 is set to "High" (active), digital output DO2 remains switched off **3 = Output 2 on (DO1):** digital output DO2 is set to "High" (active), digital output DO1 remains switched off **4 = Outputs 1 and 2 on:** all digital outputs are set to "High" (active)			

P152	**Factory setting**			
0 ... 2 { 0 }	By selecting the appropriate value and confirming it with the OK key, the selected parameter range is entered in the factory setting. Once the setting has been made, the value of the parameter automatically returns to 0. **0 = No change:**Does not change the parameterisation. **1 = Load factory setting:** The complete parameterisation of the FI reverts to the factory setting. All originally parameterised data is lost. **2 = Calibration AOUT:** The accuracy of the analog output can be improved with a correction line, however, this is not activated as standard. If factory settings (P152={ 1 }) are loaded, the correction values are retained. A calibration is carried out if (P152) is set to { 2 }, i.e. the line is re-recorded and stored in the EEPROM.			

P153 **[-01] [-02]**	**Min. system bus cycle time**			
0 ... 250.00 ms { [-01] = 10 } { [-02] = 5 }	To reduce the load on the system bus, the transmission cycle time of the **s**ervice **d**ata **o**bjects and **p**rocess **d**ata **o**bjects may be increased. **[-01] = SDO Inhibit Time** **[-02] = PDO Inhibit Time**			

P160	**Set analog output**			
-0.1 ... 10.0 V { -0.1 }	The analog output can output a defined value, which is independent of the system bus. **-0.1** = Control voltage via system bus **0.0 …. 10.0** = Voltage value in V			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P161 **[-01] ... [-09]**	**Filter time**			

0 ... 400.00 ms
{ [-01] = 100 }
{ [-02] = 100 }
{ [-03] = 0 }
{ [-04] = 2 }
{ [-05] = 2 }
{ [-06] = 2 }
{ [-07] = 2 }
{ [-08] = 0 }
{ [-09] = 0 }

The analog and digital inputs are read cyclically every 250µs, this results in an input uncertainty of 0.25ms. In order to eliminate bounce and smooth the input signals, the information which is read in is passed through a filter routine. The filter time can be parameterised

If, for example, a filter time of 1 ms is parameterised for a digital input, the input signal is delayed by approx. 1...1.25ms.

The parameterisation of the filter time for the analog outputs is used to round off signal jumps.

[-01] = AIN1
[-02] = AIN2
[-03] = AOUT
[-04] = DIN1
[-05] = DIN2
[-06] = DIN3 (only SK TU4-IOE)
[-07] = DIN4 (only SK TU4-IOE)
[-08] = DOUT1 (only SK TU4-IOE)
[-09] = DOUT2 (only SK TU4-IOE)

P162	**Send broadcast**			

0 ... 1
{ 0 }

Activation of this parameter (setting **On** → **1**) switches the I/O extension module into broadcast mode and thus enables simultaneous access by up to four frequency inverters. Each frequency inverter evaluates the information from the I/O extension individually.

The addressing of the module (DIP switches) is no longer taken into account.

0 = Off
1 = On

NOTE: The data received by the I/O module is subject to an OR logic. If several frequency inverters are linked to the digital outputs of the module, the relevant output is set to "High" as soon as an inverter accesses it. The analog outputs behave in a similar manner. Here, the highest value has priority.

P163	**AOut Inverse** (Inversion of Analog OUT)			

0 ... 1
{ 0 }

The function of the analog output can be inverted

0 = No inversion
1 = Analog output signal is inverted

6.2.2 Information (I/O - extension)

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P170 ... [-01] ... [-02]	**Actual error**			
0 ... 9999	Actual fault present. Further details in Section 7 "Operating status messages". **… [-01]** = Actual module fault **… [-02]** = Last module fault **Possible displayed values:** **1000 =** EEPROM error **1030 =** Systembus Bus Off **2000 =** DIP changed **2001 =** DIP configuration error / not permissible **2010 =** Analog output error			
P171 ... [-01] ... ... [-03]	**Software version/ revision**			
0.0 ... 9999.9	This parameter shows the software and revision numbers in the module. Array [-03] provides information about any special versions of the hardware or software A zero stands for the standard version. **… [-01] = Software version 1** Version number**:** (e.g.: V**1.0**) **… [-02] = Software version 2** Version number**:** (e.g.: R**1**) **… [-03] = Software version 3** Version number**:** (e.g.: **0**)			
P172	**Configuration**			
0 ... 2	This parameter displays the functions or variants integrated into the module. **1 = Internal bus module** (SK CU4-…) **2 = External bus module** (SK CU4-…) **3 = BUS Technology Unit via SPI**			

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P173	**Option status (Module status)**			
0 ... FFFF (hex)	**Possible displayed values:** Bit 0 = not used Bit 1 = not used Bit 2 = not used Bit 3 = not used Bit 4 = not used Bit 5 = not used Bit 6 = System bus “BUS WARNING” Bit 7 = System bus “BUS OFF” Bit 8 = Status FI1 (Low - Bit) Bit 9 = Status FI1 (High - Bit) Bit 10= Status FI2 (Low - Bit) Bit 11= Status FI2 (High - Bit) Bit 12= Status FI3 (Low - Bit) Bit 13= Status FI3 (High - Bit) Bit 14= Status FI4 (Low - Bit) Bit 15= Status FI4 (High - Bit) **Status for FIx:** **BIT High** / **BIT Low** / **Meaning** 0 / 0 / FI is offline 0 / 1 / unknown FI 1 / 0 / FI is online 1 / 1 / FI lost (switched off)			

Parameter	Setting value / Description / Note	Device	Supervisor	Parameter set
P174	**State of digital inputs**			
0 ... 15	Instantaneous image of input level logic of the digital inputs. **Possible displayed values:** Bit 0= Input 1 ((DIN1) (of the BUS module)) Bit 1= Input 2 ((DIN2) (of the BUS module)) Bit 2= Input 3 ((DIN3) (of the BUS module)) Bit 3= Input 4 ((DIN4) (of the BUS module))			
P175	**State of relays**	SK TU4-IOE		
0 ... 3	Instantaneous image of output level logic of the digital output. **Possible displayed values:** Bit 1= Output 1 ((DO1) (of the BUS module)) Bit 2= Output 2 ((DO2) (of the BUS module))			
P176 **... [-01]** **...** **... [-03]**	**Current voltage**			
0.0 ... 10.0 V	Displays the voltage level of the signals at the analog inputs/outputs of the I/O extension module. **... [-01]** = Actual voltage (AIN1) **... [-02]** = Actual voltage (AIN2) **... [-03]** = Actual voltage (AOUT)			

6.3 Parameter overview, User settings

(P) ⇒ Depends on parameter set. These parameters can be set in various ways in the four parameter sets.

[- xx] ⇒ Array parameter. A parameter can be set in various sub-groups.

S ⇒ Supervisor parameter, visibility depends on P003.

6.3.1 Overview of frequency inverter parameters

Parameter No. [Array]		Name	Factory setting	Super visor	Setting after commissioning			
					P 1	P 2	P 3	P 4
OPERATING DISPLAYS (Section 6.1.1)								
P000		Operating para. display						
P001		Selection of display value	0					
P002		Display factor	1.00	S				
P003		Supervisor code	1		1 = All parameters visible except P3xx/P6xx 3 = all parameters visible			
BASIC PARAMETERS (Section 6.1.2)								
P100		Parameter set	0	S				
P101		Copy parameter set	0	S				
P102	(P)	Acceleration time [s]	2.0					
P103	(P)	Deceleration time [s]	2.0					
P104	(P)	Minimum frequency [Hz]	0.0					
P105	(P)	Maximum frequency [Hz]	50.0 (60.0)					
P106	(P)	Ramp smoothing [%]	0	S				
P107	(P)	Brake reaction time [s]	0.00					
P108	(P)	Disconnection mode	1	S				
P109	(P)	DC brake current [%]	100	S				
P110	(P)	Time DC brake on [s]	2.0	S				
P111	(P)	P factor torque limit [%]	100	S				
P112	(P)	Torque current limit [%]	401 (off)	S				
P113	(P)	Jog frequency [Hz]	0.0	S				
P114	(P)	Brake delay off [s]	0.00	S				
P120	[-01]	External Control Units *BUS TB (Extension1)*	1 (auto)	S				
P120	[-02]	External Control Units *BUS TB (Extension 2)*	1 (auto)	S				
P120	[-03]	External Control Units *Setpoint TB (Extension 3)*	1 (auto)	S				
P120	[-04]	External Control Units *Extension 4*	1 (auto)	S				

Parameter No. [Array]		Name	Factory setting	Super visor	Setting after commissioning			
					P 1	P 2	P 3	P 4
MOTOR DATA / CHARACTERISTIC CURVE PARAMETERS (Section 6.1.3)								
P200	(P)	Motor list	0					
P201	(P)	Nominal frequency [Hz]	50.0 *	S				
P202	(P)	Nominal speed [rpm]	1385 *	S				
P203	(P)	Nominal current [A]	4.8 *	S				
P204	(P)	Nominal voltage [V]	230 *	S				
P205	(P)	Nominal power [kW]	1.10 *					
P206	(P)	cos phi	0.78 *	S				
P207	(P)	Star Delta con. [star=0/delta=1]	1 *	S				
P208	(P)	Stator resistance [Ω]	6.28*	S				
P209	(P)	No-load current [A]	3.0 *	S				
P210	(P)	Static boost [%]	100	S				
P211	(P)	Dynamic boost [%]	100	S				
P212	(P)	Slip compensation [%]	100	S				
P213	(P)	ISD control loop gain [%]	100	S				
P214	(P)	Torque precontrol [%]	0	S				
P215	(P)	Boost precontrol [%]	0	S				
P216	(P)	Time boost precontrol [s]	0.0	S				
P217	(P)	Oscillation damping [%]	10	S				
P218		Modulation depth [%]	100	S				
P219		Auto. magn. adjustment [%]	100	S				
P220	(P)	Parameter identification	0					

*) dependent on FI power or P200/P220

CONTROL PARAMETERS (Section 6.1.4)								
P300	(P)	Servo Mode [On / Off]	0 (Off)	S				
P301		Incremental encoder	6	S				
P310	(P)	Speed controller P [%]	100	S				
P311	(P)	Speed controller I [%/ms]	20	S				
P312	(P)	Torque current controller P [%]	200	S				
P313	(P)	Torque current controller I [%/ms]	125	S				
P314	(P)	Torque current controller limit [V]	400	S				
P315	(P)	Field current controller P [%]	200	S				
P316	(P)	Field current controller I [%/ms]	125	S				
P317	(P)	Field current controller limit [V]	400	S				
P318	(P)	Field weakening controller P [%]	150	S				

Parameter No. [Array]	Name	Factory setting	Super visor	Setting after commissioning			
				P 1	P 2	P 3	P 4
P319 (P)	Field weakening controller I [%/ms]	20	S				
P320 (P)	Field weakening border [%]	100	S				
P321 (P)	Speed control I brake off	0	S				
P325	Function encoder	0	S				
P326	Encoder ratio	1.00	S				
P327 (P)	Speed slip error [rpm]	0 (Off)	S				
P328 (P)	Speed slip delay [s]	0.0	S				
CONTROL TERMINALS (Section 6.1.5)							
P400 [-01] (P)	Function, setpoint inputs *Potentiometer 1*	1					
P400 [-02] (P)	Function, setpoint inputs *Potentiometer 2*	15					
P400 [-03] (P)	Function, setpoint inputs *Ext. analog input 1*	0					
P400 [-04] (P)	Function, setpoint inputs *Ext. analog input 2*	0					
P400 [-05] (P)	Setpoint input function *Setpoint module*	1					
P400 [-06] (P)	Function, setpoint inputs *Digital inpput 2*	0					
P400 [-07] (P)	Function, setpoint inputs *Digital inpput 3*	1					
P400 [-08] (P)	Function, setpoint inputs *Ext. analog input1 2nd IOE*	0					
P400 [-09] (P)	Function, setpoint inputs *Ext. analog input 2 2nd IOE*	0					
P401 [-01]	Analog input mode *Ext. analog input 1*	0					
P401 [-02]	Analog input mode *Ext. analog input 2*	0					
P401 [-03]	Function, analog input *Ext. analog input1 2nd IOE*	0					
P401 [-04]	Function, analog input *Ext. analog input 2 2nd IOE*	0					
P401 [-05]	Analog input mode reserved	0					
P401 [-05]	Analog input mode reserved	0					
P402 [-01]	Adjustment: 0% [V] *Ext. analog input 1*	0.0	S				
P402 [-02]	Adjustment: 0% [V] *Ext. analog input 2*	0.0	S				
P402 [-03]	Adjustment: 0% [V] *Ext. analog input 1 2nd IOE*	0.0	S				

Parameter No. [Array]	Name	Factory setting	Super visor	Setting after commissioning			
				P 1	P 2	P 3	P 4
P402 [-04]	Adjustment: 0% [V] *Ext. analog input 2 2nd IOE*	0.0	S				
P402 [-05]	Adjustment: 0% [V] reserved	0.0	S				
P402 [-06]	Adjustment: 0% [V] reserved	0.0	S				
P403 [-01]	Adjustment: 100% [V] *Ext. analog input 1*	10.0	S				
P403 [-02]	Adjustment: 100% [V] *Ext. analog input 2*	10.0	S				
P403 [-03]	Adjustment: 100% [V] *Ext. analog input 1 2nd IOE*	10.0	S				
P403 [-04]	Adjustment: 100% [V] *Ext. analog input 2 2nd IOE*	10.0	S				
P403 [-05]	Adjustment: 100% [V] reserved	0.0	S				
P403 [-06]	Adjustment: 100% [V] reserved	0.0	S				
P404 [-01]	reserved						
P404 [-02]	reserved						
P410 (P)	Min. freq. a-in 1/2 [Hz]	0.0					
P411 (P)	Max. freq. a-in 1/2 [Hz]	50.0					
P412 (P)	Setpoint, process ctrl. [V]	5.0	S				
P413 (P)	P-component PI control [%]	10.0	S				
P414 (P)	I-component PI control [%/s]	10.0	S				
P415 (P)	Process controller limit [%]	10.0	S				
P416 (P)	Ramp time PI setpoint. [s]	2.00	S				
P417 [-01] (P)	Analog output offset [V] *first IOE*	0.0	S				
P417 [-02] (P)	Analog output offset [V] *second IOE*	0.0	S				
P418 [-01] (P)	Analog output function *first IOE*	0	S				
P418 [-02] (P)	Analog output function *second IOE*	0	S				
P419 [-01] (P)	Analog output scaling [%] *first IOE*	100	S				
P419 [-02] (P)	Analog output scaling [%] *second IOE*	100	S				
P420 [-01]	Digital inputs (DIN 1)	1					
P420 [-02]	Digital inputs (DIN2)	2					
P420 [-03]	Digital inputs (DIN3)	4					
P420 [-04]	Digital inputs (DIN4)	5					
P426 (P)	Quick stop time [s]	0.10	S				
P427	Quick stop on Error	0	S				

Parameter No. [Array]		Name	Factory setting	Super visor	Setting after commissioning			
					P 1	P 2	P 3	P 4
P428		Automatic starting	0 (Off)	S				
P434		Digital output function	1					
P435		Digital output scaling [%]	100					
P436		Digital output hysteresis [%]	10	S				
P460		Watchdog time [s]	10.0	S				
P464		Fixed frequency mode	0	S				
P465	[-01]	Fixed frequency field [Hz]	5					
P465	[-02]	Fixed frequency field [Hz]	10					
P465	[-03]	Fixed frequency field [Hz]	20					
P465	[-04]	Fixed frequency field [Hz]	35					
P465	[-05]	Fixed frequency field [Hz]	50					
P465	[-06]	Fixed frequency field [Hz]	70					
P465	[-07]	Fixed frequency field [Hz]	100					
P465	[-08]	Fixed frequency field [Hz]	0					
P465	[-09]	Fixed frequency field [Hz]	-5					
P465	[-10]	Fixed frequency field [Hz]	-10					
P465	[-11]	Fixed frequency field [Hz]	-20					
P465	[-12]	Fixed frequency field [Hz]	-35					
P465	[-13]	Fixed frequency field [Hz]	-50					
P465	[-14]	Fixed frequency field [Hz]	-70					
P465	[-15]	Fixed frequency field [Hz]	-100					
P466	(P)	Min. freq .process controller	0.0	S				
P475	[-01]	On/Off switching delay [s] *Digital input 1*	0.000	S				
P475	[-02]	On/Off switching delay [s] *Digital input 2*	0.000	S				
P475	[-03]	On/Off switching delay [s] *Digital input 3*	0.000	S				
P475	[-04]	On/Off switching delay [s] *Digital input 4*	0.000	S				
P480	[-01]	Function, Bus I/O In Bits *Bus / AS-i Dig In1*	1					
P480	[-02]	Function, Bus I/O In Bits *Bus / AS-i Dig In2*	2					
P480	[-03]	Function, Bus I/O In Bits *Bus / AS-i Dig In3*	5					
P480	[-04]	Function, Bus I/O In Bits *Bus / AS-i Dig In4*	12					
P480	[-05]	Function, Bus I/O In Bits *Bus / IOE Dig In1*	0					
P480	[-06]	Function, Bus I/O In Bits *Bus / IOE Dig In2*	0					
P480	[-07]	Function, Bus I/O In Bits *Bus / IOE Dig In3*	0					

Parameter No. [Array]		Name	Factory setting	Supervisor	Setting after commissioning			
					P 1	P 2	P 3	P 4
P480	[-08]	Function, Bus I/O In Bits *Bus / IOE Dig In4*	0					
P480	[-09]	Function, Bus I/O In Bits *Flag 1*	0					
P480	[-10]	Function, Bus I/O In Bits *Flag 2*	0					
P480	[-11]	Function, Bus I/O In Bits *Bit 8 Bus control word*	0					
P480	[-12]	Function, Bus I/O In Bits *Bit 9 Bus control word*	0					
P481	[-01]	Function, Bus I/O Out Bits *Bus / AS-i Dig Out1*	18					
P481	[-02]	Function, Bus I/O Out Bits *Bus / AS-i Dig Out2*	8					
P481	[-03]	Function, Bus I/O Out Bits *Bus / AS-i Dig Out3*	30					
P481	[-04]	Function, Bus I/O Out Bits *Bus / AS-i Dig Out4*	31					
P481	[-05]	Function, Bus I/O In Bits *Bus / IOE Dig Out1*	0					
P481	[-06]	Function, Bus I/O In Bits *Bus / IOE Dig Out2*	0					
P481	[-07]	Function, Bus I/O In Bits *Bus / 2nd IOE Dig Out1*	0					
P481	[-08]	Function, Bus I/O In Bits *Bus / 2nd IOE Dig Out2*	0					
P481	[-09]	Function, Bus I/O In Bits *Bit10 Bus status word*	0					
P481	[-10]	Function, Bus I/O In Bits *Bit13 Bus status word*	0					
P482	[-01]	Norm. Bus IO Out Bits [%] *Bus / AS-i Dig Out1*	100					
P482	[-02]	Norm. Bus IO Out Bits [%] *Bus / AS-i Dig Out2*	100					
P482	[-03]	Norm. Bus IO Out Bits [%] *Bus / AS-i Dig Out3*	100					
P482	[-04]	Norm. Bus IO Out Bits [%] *Bus / AS-i Dig Out4*	100					
P482	[-05]	Norm. Bus IO Out Bits [%] *Bus / IOE Dig Out1*	100					
P482	[-06]	Norm. Bus IO Out Bits [%] *Bus / IOE Dig Out2*	100					
P482	[-07]	Norm. Bus IO Out Bits [%] *Bus / 2nd IOE Dig Out1*	100					
P482	[-08]	Norm. Bus IO Out Bits [%] *Bus / 2nd IOE Dig Out2*	100					
P482	[-09]	Norm. Bus IO Out Bits [%] *Bit10 Bus status word*	100					
P482	[-10]	Norm. Bus IO Out Bits [%] *Bit13 Bus status word*	100					

Parameter No. [Array]	Name	Factory setting	Supervisor	Setting after commissioning P 1	P 2	P 3	P 4
P483 [-01]	Hysteresis, Bus IO Out Bits [%] *Bus / AS-i Dig Out1*	10	S				
P483 [-02]	Hysteresis, Bus IO Out Bits [%] *Bus / AS-i Dig Out2*	10	S				
P483 [-03]	Hysteresis, Bus IO Out Bits [%] *Bus / AS-i Dig Out3*	10	S				
P483 [-04]	Hysteresis, Bus IO Out Bits [%] *Bus / AS-i Dig Out4*	10	S				
P483 [-05]	Hysteresis Bus IO Out Bits [%] *Bus / IOE Dig Out1*	10	S				
P483 [-06]	Hysteresis Bus IO Out Bits [%] *Bus / IOE Dig Out2*	10	S				
P483 [-07]	Hysteresis, Bus IO Out Bits [%] *Bus / 2nd IOE Dig Out1*	10	S				
P483 [-08]	Hysteresis, Bus IO Out Bits [%] *Bus / 2nd IOE Dig Out2*	10	S				
P483 [-09]	Hysteresis, Bus IO Out Bits [%] *Bit10 Bus status word*	10	S				
P483 [-10]	Hysteresis, Bus IO Out Bits [%] *Bit13 Bus status word*	10	S				
ADDITIONAL PARAMETERS (Section 6.1.6)							
P501	Inverter name	0					
P502 [-01] (P)	Value of master function 1	0	S				
P502 [-02] (P)	Value of master function 2	0	S				
P502 [-03] (P)	Value of master function 3	0	S				
P503	Leading function output	0	S				
P504	Pulse frequency [kHz]	6.0	S				
P505 (P)	Abs. minimum frequency [Hz]	2.0	S				
P506	Auto. Error acknowledgement	0	S				
P509	Source control word	0	S				
P510 [-01]	Source setpoints *Main setpoint source*	0 (auto)	S				
P510 [-02]	Source setpoints *Auxiliary setpoint source*	0 (auto)	S				
P511	USS baud rate	3	S				
P512	USS address	0					
P513	Telegram time-out [s]	0.0	S				
P514	CAN baud rate * [kBaud]	5	S				
P515 [-01]	CAN address *slave address*	32(dec)	S				
P515 [-02]	CAN address *broadcast slave address*	32(dec)	S				
P515 [-03]	CAN address * *Master address*	32(dec)	S				
	*) System bus						

Parameter No. [Array]	Name	Factory setting	Super visor	Setting after commissioning			
				P 1	P 2	P 3	P 4
P516 (P)	Skip frequency 1 [Hz]	0.0	S				
P517 (P)	Skip frequency area 1 [Hz]	2.0	S				
P518 (P)	Skip frequency 2 [Hz]	0.0	S				
P519 (P)	Skip frequency area 2 [Hz]	2.0	S				
P520 (P)	Flying start	0	S				
P521 (P)	Flying st. resolution [Hz]	0.05	S				
P522 (P)	Flying st. offset [Hz]	0.0	S				
P523	Factory setting	0					
P533	Factor I^2t motor [%]	100	S				
P534 [-01] (P)	Torque disconnection limit [%] *Motor limit*	401 (off)	S				
P534 [-02] (P)	Torque disconnection limit [%] *Generator limit*	401 (off)	S				
P535	I^2t motor	0					
P536	Current limit	1.5	S				
P537	Pulse disconnection [%]	150	S				
P539 (P)	Check output voltage	0	S				
P540 (P)	Mode phase sequence	0	S				
P541	Set relay [hex]	0000	S				
P542 [-01]	Set analog output [V] *first IOE*	0.0	S				
P542 [-02]	Set analog output [V] *second IOE*	0.0	S				
P543 [-01] (P)	Actual bus value 1	1	S				
P543 [-02] (P)	Actual bus value 2	4	S				
P543 [-03] (P)	Actual bus value 3	9	S				
P546 [-01] (P)	Function Bus setpoint 1	1	S				
P546 [-02] (P)	Function Bus setpoint 2	0	S				
P546 [-03] (P)	Function Bus setpoint 3	0	S				
P549	PotentiometerBox function	1	S				
P552 [-01]	CAN master cycle [ms] *CAN Master function*	0	S				
P552 [-02]	CAN master cycle [ms] *CANopen abs. encoder*	0	S				
P555	P chopper limit [%]	100	S				
P556	Braking resistor [Ω]	120	S				
P557	Brake resistor type [kW]	0	S				
P558 (P)	Flux delay [ms]	1	S				
P559 (P)	DC run-on time [s]	0.50	S				
P560	Mode of parameter save	1	S				

Parameter No. [Array]		Name	Factory setting	Super visor	Setting after commissioning			
					P 1	P 2	P 3	P 4
POSITIONING (Section 6.1.7) NOTE: Further details are listed and described in Manual BU 0210. (www.nord.com)								
P600	(P)	Position control	0 (off)	S				
P601		Actual position [rev]	---	S				
P602		Actual setpoint pos. [rev]	---	S				
P603		Current position diff. [rev]	---	S				
P604		Encoder type	0	S				
P605	[-01]	Absolute value encoder (multi)	10	S				
P605	[-02]	Absolute value encoder (single)	10	S				
P607	[-01]	Ratio (increment)	1	S				
P607	[-02]	Ratio (absolute)	1	S				
P607	[-03]	Ratio (setpoint/actual)	1	S				
P608	[-01]	Reduction ratio (increment)	1	S				
P608	[-02]	Reduction ratio (absolute)	1	S				
P608	[-03]	Reduction ratio (setpoint/actual)	1	S				
P609	[-01]	Offset position (incr.) [rev]	0	S				
P609	[-02]	Offset position (abs.) [rev]	0	S				
P610		Setpoint mode	0	S				
P611		Position controller P [%]	5	S				
P612		Pos. Window [rev]	0	S				
P613	[-01]	Position 1 [rev]	0	S				
P613	[-02]	Position 2 [rev]	0	S				
P613	[-03]	Position 3 [rev]	0	S				
P613	[-04]	Position 4 [rev]	0	S				
P613	[-05]	Position 5 [rev]	0	S				
P613	[-06]	Position 6 [rev]	0	S				
P613	[-07]	Position 7 [rev]	0	S				
P613	[-08]	Position 8 [rev]	0	S				
P613	[-09]	Position 9 [rev]	0	S				
P613	[-10]	Position 10 [rev]	0	S				
P613	[-11]	Position 11 [rev]	0	S				
P613	[-12]	Position 12 [rev]	0	S				
P613	[-13]	Position 13 [rev]	0	S				
P613	[-14]	Position 14 [rev]	0	S				
P613	[-15]	Position 15 [rev]	0	S				
P613	[-16]	Position 16 [rev]	0	S				
P613	[-17]	Position 17 [rev]	0	S				
P613	[-18]	Position 18 [rev]	0	S				
P613	[-19]	Position 19 [rev]	0	S				
P613	[-20]	Position 20 [rev]	0	S				

Parameter No. [Array]		Name	Factory setting	Supervisor	Setting after commissioning			
					P 1	P 2	P 3	P 4
P613	[-21]	Position 21 [rev]	0	S				
P613	[-22]	Position 22 [rev]	0	S				
P613	[-23]	Position 23 [rev]	0	S				
P613	[-24]	Position 24 [rev]	0	S				
P613	[-25]	Position 25 [rev]	0	S				
P613	[-26]	Position 26 [rev]	0	S				
P613	[-27]	Position 27 [rev]	0	S				
P613	[-28]	Position 28 [rev]	0	S				
P613	[-29]	Position 29 [rev]	0	S				
P613	[-30]	Position 30 [rev]	0	S				
P613	[-31]	Position 31 [rev]	0	S				
P613	[-32]	Position 32 [rev]	0	S				
P613	[-33]	Position 33 [rev]	0	S				
P613	[-34]	Position 34 [rev]	0	S				
P613	[-35]	Position 35 [rev]	0	S				
P613	[-36]	Position 36 [rev]	0	S				
P613	[-37]	Position 37 [rev]	0	S				
P613	[-38]	Position 38 [rev]	0	S				
P613	[-39]	Position 39 [rev]	0	S				
P613	[-40]	Position 40 [rev]	0	S				
P613	[-41]	Position 41 [rev]	0	S				
P613	[-42]	Position 42 [rev]	0	S				
P613	[-43]	Position 43 [rev]	0	S				
P613	[-44]	Position 44 [rev]	0	S				
P613	[-45]	Position 45 [rev]	0	S				
P613	[-46]	Position 46 [rev]	0	S				
P613	[-47]	Position 47 [rev]	0	S				
P613	[-48]	Position 48 [rev]	0	S				
P613	[-49]	Position 49 [rev]	0	S				
P613	[-50]	Position 50 [rev]	0	S				
P613	[-51]	Position 51 [rev]	0	S				
P613	[-52]	Position 52 [rev]	0	S				
P613	[-53]	Position 53 [rev]	0	S				
P613	[-54]	Position 54 [rev]	0	S				
P613	[-55]	Position 55 [rev]	0	S				
P613	[-56]	Position 56 [rev]	0	S				
P613	[-57]	Position 57 [rev]	0	S				
P613	[-58]	Position 58 [rev]	0	S				
P613	[-59]	Position 59 [rev]	0	S				
P613	[-60]	Position 60 [rev]	0	S				

Parameter No. [Array]	Name	Factory setting	Super visor	Setting after commissioning			
				P 1	P 2	P 3	P 4
P613 [-61]	Position 61 [rev]	0	S				
P613 [-62]	Position 62 [rev]	0	S				
P613 [-63]	Position 63 [rev]	0	S				
P615	Maximum position [rev]	0	S				
P616	Minimum position [rev]	0	S				
P625	Hysteresis output [rev]	1	S				
P626	Relay position [rev]	0	S				
P630	Position slip error [rev]	0	S				
P631	Abs/Inc slip error [rev]	0	S				
P640	Unit of pos. value	0	S				

Parameter No. [Array]	Name	Supervisor	Actual status and displayed values
INFORMATION (6.1.8), read only			
P700 [-01]	Current fault *Current fault*		
P700 [-02]	Current fault *Current warning*		
P700 [-03]	Current fault *Reason FI blocked*		
P701 [-01…-05]	Last fault 1...5		
P702 [-01…-05]	Freq. Last error 1...5	S	
P703 [-01…-05]	Current, last error 1...5	S	
P704 [-01…-05]	Voltage, last error 1...5	S	
P705 [-01…-05]	VDC last error 1...5	S	
P706 [-01…-05]	P-set, last error 1...5	S	
P707 [-01…-03]	Software version *Version / Revision / Special*		
P708	State of digital inputs (bin/hex)		
P709 [-01…-09]	Analog input voltage [V] ***P1/P2/AI1/AI2/SW/DI2/DI3/AI1 2nd/AI2 2nd***		
P710 [-01…-02]	Analog output voltage [V] *first IOE / second IOE*		
P711	State of relays [hex]		
P714	Operating time [h]		
P715	Running time [h]		
P716	Current frequency [Hz]		
P717	Current speed [rpm]		
P718 [-01…-03]	Current setpoint frequency 1..3 [Hz]		
P719	Actual current [A]		
P720	Actual torque current [A]		
P721	Actual field current [A]		
P722	Current voltage [V]		
P723	Voltage-d [V]	S	
P724	Voltage-q [V]	S	
P725	Current cos phi		
P726	Apparent power [kVA]		
P727	Mechanical power [kW]		
P728	Input voltage [V]		
P729	Torque [%]		
P730	Field [%]		
P731	Parameter set		
P732	Phase U current [A]	S	
P733	Phase V current [A]	S	
P734	Phase W current [A]	S	

Parameter No. [Array]	Name	Supervisor	Actual status and displayed values
INFORMATION (6.1.8), read only			
P735	Speed encoder [rpm]	S	
P736	D.c. link voltage [V]		
P737	Usage rate brake resistor [%]		
P738 [-01…-02]	Usage rate motor [%]		
P739 [-01…-03]	Heat sink temperature [°C]		
P740 [-01…-13]	Process data Bus In [hex]	S	
P741 [-01…-10]	Process data Bus Out [hex]	S	
P742	Database version	S	
P743	Inverter ID [kW]		
P744	Configuration [hex]		
P747	Inverter voltage range 230/400V		
P748	Status CANopen * [hex]		
	*) System bus		
P749	Status DIP switches [hex]		
P750	Stat. overcurrent	S	
P751	Stat. overvoltage	S	
P752	Stat. mains failure	S	
P753	Stat. overtemperature	S	
P754	Stat. parameter loss	S	
P755	Stat. system error	S	
P756	Stat. timeout	S	
P757	Stat. customer error	S	
P760	Actual current	S	
P799 [-01…-05]	Op. hrs. last fault 1...5 [h]		

6.3.2 Parameter overview, I/O extension

Parameter No. [Array]		Name	Factory setting	Super visor	Setting after commissioning
BASIC PARAMETERS (Section 6.2.1)					
P150		Set relays	0		
P152		Factory setting	0		
P153	[-01]	Min. system bus cycle time *(SDO)*	10		
P153	[-02]	Min. system bus cycle time *(PDO)*	5		
P160		Set analog output	-0.1		
P161	[-01]	Filter time	100		
P161	[-02]	Filter time	100		
P161	[-03]	Filter time	0		
P161	[-04]	Filter time	2		
P161	[-05]	Filter time	2		
P161	[-06]	Filter time	2		
P161	[-07]	Filter time	2		
P161	[-08]	Filter time	0		
P161	[-09]	Filter time	0		
P162		Send broadcast	0		
P163		Inversion of Analog Out	0		
INFORMATION (Section 6.2.2)					
P170	... [-01]	Actual error 1 (actual present fault)			
P170	... [-02]	Actual error 2 (Last fault)			
P171	[-01]	Software version (Version number)			
P171	[-02]	Software version 2 (Revision number)			
P171	[-03]	Software version 3 (Special version)			
P172		Configuration			
P173		Option status			
P174		State of digital inputs			
P175		State of relays			
P176	[-01]	Current voltage (AIN1)			
P176	[-02]	Current voltage (AIN2)			
P176	[-03]	Current voltage (AOUT)			

7 Operating status messages

In case of deviation from the normal operating state, frequency inverters and Technology Units generate a message according to the cause. A differentiation is made between warnings and error messages. If the frequency inverter is in a "switch-on block" status, the cause of this can also be displayed.

Display of the Technology Unit messages is carried out via parameter (P170). The messages generated for the freqency inverter are displayed in the relevant array of the parameter (P700).

Frequency inverter switch-on block

If the frequency inverter is in the status "Not ready" or "Switch-on block", the cause is displayed in the third array element of parameter (P700) (as of software version V1.2 R0)

Display is only possible with the NordCon software or the ParameterBox (SK PAR-3H).

Warning messages

Warning messages are generated (as of software version V1.2 R0) as soon as a defined limit is reached, which does not however result in the frequency inverter being switched off. These messages can be displayed via array element [-02] in parameter (P700) until either the cause of the warning is no longer present or the frequency inverter has gone into fault status with an error message.

Error messages

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

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

1. Switching the mains off and on again,
2. By an appropriately programmed digital input (P420 = Function 12),
3. by switching of the “enable” on the frequency inverter to Low (if no digital input is programmed for acknowledgement),
4. by a Bus acknowledgement or
5. by P506, the automatic error acknowledgement.

An error message can only be acknowledged if its direct cause is no longer present.

Device LEDs:	As supplied, various LEDs (green/red/yellow) are externally visible. These indicate the actual status of the device (Section 5.1.3.1 / 5.1.3.2)
FI / DS LED:	This LED (Section 5.1.3.2) is dual-colour and can therefore indicate both a ready or an error status of the FI. **Green** indicates the standby status and the presence of mains voltage. During operation an increasingly rapid flashing code indicates the degree of overload of the FI output. **Red** indicates the presence of an error by flashing with a frequency which corresponds to the number code of the fault (Section 7.2).

7.1 SimpleBox display

The **SimpleBox** displays an error with its number and the prefix "E". In addition the actual error can be displayed in array element [-01] of parameter (P700). The last error messages are stored in parameter P701. Further information on the FI status when errors occur 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 OK key.

Warnings are indicated by the prefix "C" ("Cxxx") and cannot be acknowledged. They disappear automatically if the cause is no longer present or the frequency inverter has gone into "Fault" status. If a warning occurs during parameterisation, display of the message is suppressed.

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

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

7.2 Table of possible error messages

7.2.1 Table of possible frequency inverter error messages

<table>
<tr><th colspan="2">Display in the SimpleBox</th><th rowspan="2">Error
Text in the Parameter Box</th><th rowspan="2">Cause
Remedy</th></tr>
<tr><th>Group</th><th>Details in P700[-01] / P701</th></tr>
<tr><td rowspan="2">E001</td><td>1.0</td><td>Inverter overtemperature
(inverter heat sink)</td><td rowspan="2">Error signal from output stage module (static)
Reduce ambient temperature <50°C or <40°C (see also Section 8 Technical data).
Check control cabinet ventilation
Increase ambient temperature, > - 25</td></tr>
<tr><td>1.1</td><td>Internal FI overtemperature
(interior of inverter)</td></tr>
<tr><td rowspan="3">E002</td><td>2.0</td><td>Motor overtemperature PTC
(from thermistor)</td><td>Motor temperature sensor has triggered
Reduce motor load
Increase motor speed
Use external motor fan</td></tr>
<tr><td>2.1</td><td>Motor overtemperature I²t

<u>Only</u> if I²t- motor (P535) is programmed.</td><td>I²t motor has triggered
Reduce motor load
Increase motor speed</td></tr>
<tr><td>2.2</td><td>Ext. brake resistor overtemperature
Overtemperature via digital input (P420 […])={13}</td><td>Temperature monitor has triggered
Digital input is Low</td></tr>
</table>

Display in the SimpleBox: Group	Details in P700[-01] / P701	Error Text in the Parameter Box	Cause Remedy	
E003	**3.0**	**Overcurrent I²t limit**	Rectifier I^2t limit has triggered, e.g. > 1.5 x I_n for 60s (Please also note P504) Continuous overload at inverter output	
	3.1	**Overcurrent, chopper U^2t**	U^2t limit for brake chopper has triggered (Attainment of 1.5x the value for a period of 60s) (Please also note P555, P556, P557) Avoid overcurrent in braking resistance	
	3.2	**Overcurrent IGBT** monitoring 125%	De-rating (power reduction) 125% overcurrent for 50ms Brake chopper current too high for fan drives: enable flying start circuit (P520)	See also Section 9.5
	3.3	**Overcurrent IGBT fast** monitoring 150%	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 (Section 8)	
	4.1	**Overcurrent measurement**	P537 (pulse current switch-off) was reached 3x within 50ms (only possible if P112 and P536 are disabled) FI is overloaded Check motor data (P201 … P209)	
E005	**5.0**	**Overvoltage, Ud**	Frequency inverter link circuit voltage is too high Reduce energy return by means of a braking resistance Extend braking time (P103) If necessary, set switch-off mode (P108) with delay (not for lifting equipment) Extend quick stop time (P426)	
	5.1	**Overvoltage mains**	Mains voltage is too high Please check 380V-20% … 480V+10% or 200 … 240V ± 10%	
E006	**---**	**reserved**		
E007	**---**	**reserved**		

Display in the SimpleBox		Error	Cause
Group	Details in P700[-01] / P701	Text in the Parameter Box	Remedy
E008	**8.0**	**Parameter lost** (EEPROM - Maximum value exceeded)	Error in EEPROM data Software version of the stored data set not compatible with the software version of the FI. **NOTE:** Faulty parameters are automatically reloaded (factory setting). EMC interferences (see also E020)
	8.1	**Inverter ID error**	EEPROM faulty
	8.2	**External EEPROM error**	--
	8.3	**EEPROM KSE error** (Customer interface incorrectly identified (customer's interface equipment))	The upgrade level of the frequency inverter was not correctly identified. Switch mains voltage off and on again.
	8.4	**EEPROM internal error** (Database version incorrect)	
	8.5	**No EEPROM detected**	
	8.6	**EEPROM copy is used**	
	8.7	**EEPROM copy differs**	
	8.8	**EEPROM is blank**	
	8.9	**EEP Controlbox too small**	
E009	**---**	**reserved**	

Display in the SimpleBox: Group	Details in P700[-01] / P701	Error Text in the Parameter Box	Cause Remedy
E010	**10.0**	**Bus timeout** (Telegram timeout / Bus off 24V int. CANbus)	Data transfer is faulty. Check P513. Check external bus connection. Check bus protocol program process. Check Bus master. Check 24V supply of internal CAN/CANopen Bus. *Nodeguarding* error (internal CANopen) *Bus Off* error (internal CANbus)
	10.2	**Bus timeout Option** (External bus module telegram time-out)	Telegram transfer is faulty. Check external connection. Check Bus Protocol program process. Check Bus master.
	10.4	**Initiation error, Option** (External bus module initialisation failure)	Check P746. Bus module not correctly plugged in. 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** (External bus module)	Further details can be found in the relevant additional BUS operating instructions. I/O extension: Incorrect measurement of the input voltage or undefined provision of the output voltage due to error in reference voltage generation. Short circuit at analog output
	10.8	**Error, Option** (External module communication failure)	Connection fault / error in the external component
	10.9	**Missing Option /P120**	Module entered in P120 is not available.
E011	**11.0**	**Control terminals (Customer Unit)** (analog/digital converter error)	Internal Customer Unit (internal data bus) faulty or disturbed by radio emissions (EMC). Check control terminals connection for short-circuit. Minimise EMC interference through separate laying of control and power cables. Device and shielding must be well earthed.

Display in the SimpleBox Group	Details in P700[-01] / P701	Error Text in the Parameter Box	Cause Remedy
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<.
	12.1	**Limit motor /Customer**	The drive switch-off limit P534 [01] has triggered. Reduce load on motor. Set a higher value in (P534 [-01]).
	12.2	**Limit generator**	The generator switch-off limit (P534 [-02]) has triggered. Reduce load on motor. Set a 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
	12.8	**Analog Input minimum**	Switch-off due to undershooting of the 0% adjustment value (P402) with setting (P401) "0-10V with switch-off after fault 1" or "... 2"
	12.9	**Analog Input maximum**	Switch-off due to overshooting of the 100% adjustment value (P402) with setting (P401) "0-10V with switch-off after fault 1" or "... 2"
E013	**13.0**	**Encoder error**	No signal from encoder Check 5V sensor if available. Check supply voltage of encoder.
	13.1	**Speed slip error**	The slip speed error limit was reached. Increase setting in P327.
	13.2	**Disconnection control**	The slip error monitoring was triggered; the motor could not follow the setpoint. Check motor data P201-P209! This data is very important for the current controller. Check motor circuit. If necessary, check the encoder setting P300 and the following parameters in Servo mode. Increase setting value for torque limit in P112. Increase setting value for current limit in P536.
E014		See BU0210 (Supplementary instructions for POSICON functionality)	

Display in the SimpleBox Group	Display in the SimpleBox Details in P700[-01] / P701	Error Text in the Parameter Box	Cause Remedy
E015	**15.0**	**Wrong software version**	Check software version
	15.1	**P watchdog**	System error in program execution, triggered by EMC interference. Please comply with wiring guidelines in Section 2.5. Use additional external mains filter. (Section 9.3 / 9.4 EMC) FI must be very well earthed.
	15.2	**P stack overflow**	
	15.3	**P stack underflow**	
	15.4	**Undefined P opcode**	
	15.5	**P Protected Instruct**	
	15.6	**P illegal WordAccess**	
	15.7	**P illegal InstAccess**	
	15.8	**P Program memory error**	
E016	**16.0**	**Motor phase error**	A motor phase is not connected. Check P539 Check motor connections
	16.1	**Magnetisation Current Watch**	Required excitation current not achieved at moment of switch-on. Check P539 Check motor connections
E018	**18.0**	**Safety circuit**	The *safe pulse block* was triggered while the frequency inverter was being enabled. Only available in SK 215E and SK 235E. Details in Manual BU 0230 (www.nord.com).
E019	**19.0**	**Parameter identification**	Automatic identification of the connected motor was unsuccessful Check motor connections Check preset motor data (P201 … P209)
	19.1	**Motor star-/ delta circuit incorrect**	

Display in the SimpleBox Group	Details in P700[-01] / P701	Error Text in the Parameter Box	Cause Remedy
E020 E021	**20.0**	**reserved**	System error in program execution, triggered by EMC interference. Please comply with wiring guidelines in Section 2.5. Use additional external mains filter. (Section 9.3 / 9.4 EMC) FI must be very well earthed.
	20.1	**Watchdog**	
	20.2	**Stack overflow**	
	20.3	**Stack underflow**	
	20.4	**Undefined opcode**	
	20.5	**Protected Instruction**	
	20.6	**Illegal word access**	
	20.7	**Illegal Instruction Access**	
	20.8	**Program memory error** (EEPROM error)	
	20.9	**reserved**	
	21.0	**NMI error** (not used by hardware)	
	21.1	**PLL error**	
	21.2	**ADU error**	
	21.3	**PMI error**	
	21.4	**Userstack overflow**	

7.2.2 Table of possible error messages in the I/O extension module

Error number Group	Details in P170	Error Text in the Parameter Box	Cause Remedy
E1000	**1000**	**EEPROM error**	EMC interference on the SPI bus Module faulty
	1030	**System bus, Bus Off**	Check connections and cables Ensure 24V power supply Check Bus master.
E2000	**2000**	**DIP changed/fault**	DIP switch configuration changed during operation
	2001	**DIP invalid configuration**	Illegal DIP switch setting Check DIP switch setting. Note coding of analog inputs and outputs!
	2010	**Analog output fault**	Check switching of 10V reference voltage Short circuit of analog output Analog output overload (max. 10mA) Calibration error (P152) A range error has occurred during measurement of the correction values The measured values could not be saved in the EEPROM

7.3 Table of possible warning messages

Display in the SimpleBox		Warning	Cause
Group	Details in P700 [-02]	Text in the Parameter Box	Remedy
C001	**1.0**	**Inverter overtemperature** (inverter heat sink)	Warning from output stage module (static) Reduce ambient temperature <50°C or <40°C (see also Section 8 Technical data). Check control cabinet ventilation
C002	**2.0**	**Motor overtemperature PTC**	Warning from motor temperature sensor (triggering threshold reached) Reduce motor load Increase motor speed Use external motor fan
	2.1	**Motor overtemperature I²t** (Only if I^2t- motor (P535) is programmed.)	Warning: Motor I^2t monitoring (Attainment of 1.3x the rated current for the period specified in (P535)) Reduce motor load Increase motor speed
	2.2	**Ext. brake resistor overtemperature** Overtemperature via digital input (P420 […])={13}	Warning: Temperature monitor has triggered Digital input is Low
C003	**3.0**	**Overcurrent I²t limit**	Warning: Rectifier I^2t limit, (e.g. output current > NFI current rating) (Attainment of 1.3x the inverter current rating for a period of 60 s) Continuous overload at inverter output (Please also note P504)
	3.1	**Overcurrent, chopper U^2t**	Warning: U^2t limit for brake chopper has triggered (Attainment of 1.3x the value for a period of 60s) (Please also note P555, P556, P557) Avoid overcurrent in braking resistance
	3.5	**Torque current limit**	Warning: torque current limit reached (P112)
	3.6	**Current limit**	Warning: current limit reached (P536)

Display in the SimpleBox		Warning	Cause
Group	Details in P700 [-02]	Text in the Parameter Box	Remedy
C004	**4.1**	**Overcurrent measurement**	Warning: Pulse switch-off is active The limiting value for the activation of the pulse switch-off (P537) has been reached (only possible if P112 and P536 are switched off) FI is overloaded Check motor data (P201 … P209)
C012	**12.1**	**Limit motor /Customer**	Warning: 80% of the drive switch-off limit (P534 [-01]) has been exceeded. Reduce load on motor. Set a higher value in (P534 [-01]).
	12.2	**Limit generator**	Warning: 80% of the generator switch-off limit (P534 [-02]) has been exceeded. Reduce load on motor. Set a 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

7.4 Table of possible reasons for the operating status "Switch-on block"

Group	Details in P700 [-03]	Reason Text in the Parameter Box	Cause Remedy
I000	**0.1**	**Voltage blocked by IO**	With the function "Block voltage" the parameterised input (P420 / P480) is set to Low Set input to "High" Check signal cable (broken cable)
	0.2	**Quick stop by IO**	With the function "Quick stop" the parameterised input (P420 / P480) is set to Low Set input to "High" Check signal cable (broken cable)
	0.3	**Voltage blocked by bus**	With bus operation (P509): Control word Bit 1 "Low"
	0.4	**Quick stop by bus**	With bus operation (P509): Control word Bit 2 "Low"
	0.5	**Enable at start**	Enable signal (control word, Dig I/O or Bus I/O) was already present during the initialisation phase (after mains "ON" or control voltage "ON"). Only give enable signal after completion of initialisation (i.e. when the FI is on standby) Activation of "Automatic start" (P428)
I006	**6.0**	**Charging error**	Charging relay not actuated, because Mains / link voltage too low Mains voltage failure Evacuation run activated (Parameter (P420) / (P480))
I014	**14.4**	**Absolute encoder error**	Absolute encoder not ready

8 Technical data

8.1 General data Frequency inverter series SK 200E

Function	Specification
Output frequency	0.0 … 400.0Hz
Pulse frequency	3.0 … 16.0kHz, standard setting = 6kHz Power reduction > 8kHz for 115/230V device, >6kHz for 400V device.
Typical overload capacity	150% for 60s, 200% for 3.5s
Protective measures against	Overtemperature of the frequency inverter, overvoltage and undervoltage Short-circuit, earthing fault, overload, idling
Regulation and control	Sensorless current vector control (ISD), linear V/f characteristic curve, automatic flux adaptation (energy-saving function)
Motor temperature monitoring	I^2t motor, PTC / Bimetal switch
Digital input	4x, Low 0-5V, High 14-30V, R_i = 9.5kΩ, C_i = 10nF, cycle time = 4ms
Electrical isolation	Control terminals
Control outputs — Digital output:	18-30V DC (according to VI 24V), max. 200mA, max. 100kΩ load
Brake rectifier:	max. 0.5A choke voltage, voltage according to mains
Interfaces	Standard: RS 485 (USS), RS 232 (Single Slave), System bus Option: Profibus, CANopen, DeviceNet, AS-Interface
Efficiency of frequency inverter	approx. 95% according to size
Storage and transport temperature	-25°C … +60 / 70°C
Operating / ambient temperature	-25°C … +50°C, according to operating mode (Details: Section 8.3) ATEX: -20…+40°C (Details: Section 2.9)
Long-term storage	Connect the FI and the 24V modules to the mains voltage for 60 minutes at the latest after one year. Connect the FI and all other modules to be supplied with 24V to the 24V control voltage for 60 minutes at the latest after one year. Maintain this cycle throughout the storage period.
Protection class	IP55, optional IP66
Max. Installation altitude above sea level	Up to 1000m: No power reduction 1000...4000m: 1%/ 100m power reduction (up to 2000m overvoltage cat. 3) 2000...4000m: Only overvoltage category 2 is complied with, external overvoltage protection at the mains input is necessary
Waiting period between two power-up cycles	60 sec for all devices in normal operating cycle
Connection terminals — Mains/motor/brake resistance	$4mm^2$ flexible with wiring sleeves, $6mm^2$ with rigid cable (Terminal screw tightening torque 1.2...1.5Nm)
Connection terminals — Control unit /System bus	$2.5mm^2$, with wiring sleeves $1.5mm^2$ (Terminal screw tightening torque 1.2...1.5Nm)
Connection terminals — RS485 / RS232	1x RJ12 (6-pin)
External 24V supply voltage	18…30V DC, at least 200...800mA according to load

8.2 General data for mains/setpoint modules

Mains/setpoint modules (SK CU4/TU4-24V-..., SK TU4-POT-...)		
Analog setpoint input / PI input	0/2 ... 10V, 0/4 ... 20mA (if necessary with 500Ω burden), scalable	
Analog setpoint resolution	10 bit based on measurement range	
Analog output	0/2 ... 10V, 0/4 ... 20mA scalable	
Setpoint consistency	Analog < 1% Digital < 0.02%	
Level of radio interference suppression	B	
Input voltage	1~ 100V -10% … 240V +10% (SK xU4-…-123-B) 1~ 380V -20% … 500V +10% (SK xU4-…-140-B)	
Output voltage	24V DC ± 10%	
Max. permissible continuous output current	420 mA	
Protective measures against	Short circuit	Overtemperature, overload (limited monitoring)

8.3 Electrical data for frequency inverter

The following table lists the electrical data for series SK200E frequency inverters. The details based on measurement series for the operating modes are for orientation purposes and may deviate in practice. The measurement series were made at the rated speed with 4-pole NORD standard motors

The following factors have a particular influence on the determined limiting values:

Wall mounting

- Installation location
- Influence from adjacent devices
- Additional air currents

and also with

Motor mounted

- type of motor used,
- size of motor used
- speed of self-ventilated motors
- use of external fans

NOTE

The powers stated for the operating modes are only a rough categorisation

The current values are more reliable details for the selection of the correct frequency inverter/motor combination!

More detailed information can be obtained from Getriebebau Nord.

8.3.1 Electrical data 1~115V

		Size 1		Size 2	
Device type:	SK 2xxE…	-250-112-O	-370-112-O	-550-112-O	-750-112-O
Rated motor power	230V	0.25 kW	0.37 kW	0.55 kW	0.75 kW
(4-pole standard motor)	240V	1/3 hp	½ hp	¾ hp	1 hp
Mains voltage		1 AC 110 ... 120V, ± 10%, 47 ... 63Hz			
Output voltage		3 AC 0 – 220 ... 240V			
Nominal output current at 230V	rms [A]	1.7	2.2	3.0	4.0
Min. braking resistor		75 Ω	75 Ω	75 Ω	75 Ω
Recommended braking resistance	Section 2.3.1	100 Ω	100 Ω	100 Ω	100 Ω
Typical input current at 115V	rms [A]	8.9 A	11 A	13.1 A	20.1 A
Rec. mains fuse	slow-blowing [A]	16 A	16 A	16 A	25 A
Motor-mounted (ventilated)					
maximum continuous power / max. continuous current:					
	S1-50°C	0.25kW / 1.6A	0.25kW / 1.6A	0.37kW / 2.6A	0.37kW / 2.6A
	S1-40°C	0.25kW / 1.7A	0.25kW / 1.8A	0.55kW / 3.0A	0.55kW / 3.0A
	S1-30°C	0.25kW / 1.7A	0.37kW / 2.0A	0.55kW / 3.0A	0.55kW / 3.4A
Maximum permissible ambient temperature with rated output current					
S1		47°C	23°C	40°C	11°C
S3 70% switch-on duration 10min		50°C	35°C	50°C	25°C
S6 70% switch-on duration 10min (100% / 20%Mn)		50°C	30°C	45°C	20°C
Wall-mounted (unventilated)					
maximum continuous power / max. continuous current:					
	S1-50°C	0.25kW / 1.6A	0.25kW / 1.6A	0.55kW / 3.0A	0.55kW / 3.0A
	S1-40°C	0.25kW / 1.7A	0.37kW / 2.0A	0.55kW / 3.0A	0.55kW / 3.3A
	S1-30°C	0.25kW / 1.7A	0.37kW / 2.1A	0.55kW / 3.0A	0.55kW / 3.6A
Maximum permissible ambient temperature with rated output current					
S1		48°C	36°C	50°C	16°C
S3 70% switch-on duration 10min		50°C	40°C	50°C	30°C
S6 70% switch-on duration 10min (100% / 20%Mn)		50°C	40°C	50°C	25°C

8.3.2 Electrical data 1~230V

		Size 1			Size 2	
Device type:	SK 2xxE…	-250-123-A	-370-123-A	-550-123-A	-750-123-A	-111-123-A
Rated motor power	230V	0.25 kW	0.37 kW	0.55 kW	0.75 kW	1.1 kW
(4-pole standard motor)	240V	1/3 hp	½ hp	¾ hp	1 hp	1½ hp
Mains voltage		1 AC 200 ... 240V, ± 10%, 47 ... 63 Hz				
Output voltage		3 AC 0 - Mains voltage				
Rated output current at 230V	rms [A]	1.7	2.2	2.9	4.0	5.5
Min. braking resistor		75 Ω	75 Ω	75 Ω	75 Ω	75 Ω
Recommended braking resistance	Section 2.3.1	100 Ω	100 Ω	100 Ω	100 Ω	100 Ω
Typical input current at 230V	rms [A]	3.9	5.8	7.3	10.2	14.7
Rec. mains fuse	slow-blowing [A]	10	10	16	16	16
Motor-mounted (ventilated)						
maximum continuous power / max. continuous current:						
	S1-50°C	0.25kW / 1.6A	0.25kW / 1.8A	0.37kW / 2.5A	0.55kW / 3.4A	0.75kW / 4.3A
	S1-40°C	0.25kW / 1.7A	0.37kW / 2.0A	0.55kW / 2.8A	0.55kW / 3.7A	0.75kW / 4.8A
	S1-30°C	0.25kW / 1.7A	0.37kW / 2.2A	0.55kW / 2.9A	0.75kW / 4.0A	1.10kW / 5.4A
Maximum permissible ambient temperature with rated output current						
S1		49°C	33°C	36°C	35°C	29°C
S3 70% switch-on duration 10min		50°C	45°C	45°C	45°C	40°C
S6 70% switch-on duration 10min (100% / 20%Mn)		50°C	40°C	40°C	40°C	35°C
Wall-mounted (unventilated)						
maximum continuous power / max. continuous current:						
	S1-50°C	0.25kW / 1.5A	0.37kW / 2.2A	0.37kW / 2.7A	0.75kW / 4.0A	0.75kW / 4.3A
	S1-40°C	0.25kW / 1.7A	0.37kW / 2.2A	0.55kW / 2.9A	0.75kW / 4.0A	0.75kW / 4.8A
	S1-30°C	0.25kW / 1.7A	0.37kW / 2.2A	0.55kW / 2.9A	0.75kW / 4.0A	1.10kW / 5.3A
Maximum permissible ambient temperature with rated output current						
S1		44°C	50°C	42°C	50°C	27°C
S3 70% switch-on duration 10min		50°C	50°C	45°C	50°C	40°C
S6 70% switch-on duration 10min (100% / 20%Mn)		45°C	50°C	45°C	50°C	35°C

8.3.3 Electrical data 3~230V

		Size 1				
Device type:	SK 2xxE…	-250-323-A	-370-323-A	-550-323-A	-750-323-A	-111-323-A
Rated motor power	230V	0.25 kW	0.37 kW	0.55 kW	0.75 kW	1.1 kW
(4-pole standard motor)	240V	$^{1}/_{3}$ hp	½ hp	¾ hp	1 hp	1½ hp
Mains voltage		3 AC 200 ... 240V, ± 10%, 47 ... 63 Hz				
Output voltage		3 AC 0 - Mains voltage				
Rated output current at 230V	rms [A]	1.7	2.2	3.0	4.0	5.5
Min. braking resistor		100 Ω	100 Ω	100 Ω	100 Ω	100 Ω
Recommended braking resistance	Section 2.3.1	200 Ω	200 Ω	200 Ω	200 Ω	200 Ω
Typical input current at 230V	rms [A]	1.4	1.9	2.6	3.5	5.1
Rec. mains fuse	slow-blowing [A]	10	10	10	10	16
Motor-mounted (ventilated)						
maximum continuous power / max. continuous current:						
	S1-50°C	0.25kW / 1.7A	0.37kW / 2.2A	0.55kW / 3.0A	0.75kW / 4.0A	1.10kW / 5.5A
Maximum permissible ambient temperature with rated output current						
S1		50°C	50°C	50°C	50°C	50°C
S3 70% switch-on duration 10min		50°C	50°C	50°C	50°C	50°C
S6 70% switch-on duration 10min (100% / 20%Mn)		50°C	50°C	50°C	50°C	50°C
Wall-mounted (unventilated)						
maximum continuous power / max. continuous current:						
	S1-50°C	0.25kW / 1.7A	0.37kW / 2.2A	0.55kW / 2.8A	0.55kW / 2.8A	0.55kW / 3.4A
	S1-40°C	0.25kW / 1.7A	0.37kW / 2.2A	0.55kW / 3.0A	0.55kW / 3.5A	0.75kW / 4.2A
	S1-30°C	0.25kW / 1.7A	0.37kW / 2.2A	0.55kW / 3.0A	0.75kW / 4.0A	0.75kW / 4.8A
Maximum permissible ambient temperature with rated output current						
S1		50°C	50°C	48°C	32°C	20°C
S3 70% switch-on duration 10min		50°C	50°C	50°C	40°C	30°C
S6 70% switch-on duration 10min (100% / 20%Mn)		50°C	50°C	50°C	35°C	25°C

		Size 2		Size 3	
Device type:	SK 2xxE…	-151-323-A	-221-323-A	-301-323-A	-401-323-A
Rated motor power	230V	1.5 kW	2.2 kW	3.0 kW	4.0 kW
(4-pole standard motor)	240V	2 hp	3 hp	4 hp	5 hp
Mains voltage		3 AC 200 ... 240V, ± 10%, 47 ... 63 Hz			
Output voltage		3 AC 0 - Mains voltage			
Rated output current at 230V	rms [A]	7.0	9.5	12.5	16.0
Min. braking resistor	Accessories	62 Ω	62 Ω	33 Ω	33 Ω
Recommended braking resistance	Section 2.3.1	200 Ω	200 Ω	100 Ω	100 Ω
Typical input current at 230V	rms [A]	6.6	9.1	11.8	15.1
Rec. mains fuse	slow-blowing [A]	16	20	20	25
Motor-mounted (ventilated)					
maximum continuous power / max. continuous current:					
	S1-50°C	1.50kW / 7.0A	1.50kW / 9.2A	3.0kW / 12.5A	3.0kW / 14.5A
	S1-40°C	1.50kW / 7.0A	2.20kW / 9.5A	3.0kW / 12.5A	4.0kW / 16.0A
Maximum permissible ambient temperature with rated output current					
S1		50°C	49°C	50°C	46°C
S3 70% switch-on duration 10min		50°C	50°C	50°C	47°C
S6 70% switch-on duration 10min (100% / 20%Mn)		50°C	50°C	50°C	47°C
Wall-mounted (unventilated)					
maximum continuous power / max. continuous current:					
	S1-50°C	0.55kW / 3.8A	0.75kW / 4.7A	1.1kW / 6.8A	1.1kW / 6.8A
	S1-40°C	0.75kW / 4.8A	1.10kW / 5.8A	1.5kW / 8.7A	1.5kW / 8.7A
	S1-30°C	1.10kW / 5.7A	1.50kW / 6.7A	2.2kW / 10.4A	2.2kW / 10.4A
Maximum permissible ambient temperature with rated output current					
S1		15°C	6°C	18°C	-4°C
S3 70% switch-on duration 10min		25°C	20°C	30°C	0°C
S6 70% switch-on duration 10min (100% / 20%Mn)		20°C	10°C	25°C	0°C

8.3.4 Electrical data 3~400V

		Size 1				
Device type:	SK 2xxE…	-550-340-A	-750-340-A	-111-340-A	-151-340-A	-221-340-A
Rated motor power	400V	0.55 kW	0.75 kW	1.1 kW	1.5 kW	2.2 kW
(4-pole standard motor)	480V	¾ hp	1 hp	1½ hp	2 hp	3 hp
Mains voltage		3 AC 380 ... 500V, -20% / +10%, 47 ... 63 Hz				
Output voltage		3 AC 0 - Mains voltage				
Rated output current at 400V	rms [A]	1.7	2.3	3.1	4.0	5.5
Min. braking resistor		200 Ω	200 Ω	200 Ω	200 Ω	200 Ω
Recommended braking resistance	Section 2.3.1	400 Ω	400 Ω	400 Ω	400 Ω	400 Ω
Typical input current at 400V	rms [A]	1.6	2.2	2.9	3.7	5.7
Rec. mains fuse	slow-blowing [A]	10	10	10	10	10
Motor-mounted (ventilated)						
maximum continuous power / max. continuous current:						
	S1-50°C	0.55kW / 1.7A	0.75kW / 2.3A	1.10kW / 3.1A	1.50kW / 4.0A	2.20kW / 5.5A
Maximum permissible ambient temperature with rated output current						
S1		50°C	50°C	50°C	50°C	50°C
S3 70% switch-on duration 10min		50°C	50°C	50°C	50°C	50°C
S6 70% switch-on duration 10min (100% / 20%Mn)		50°C	50°C	50°C	50°C	50°C
Wall-mounted (unventilated)						
maximum continuous power / max. continuous current:						
	S1-50°C	0.55kW / 1.7A	0.75kW / 2.3A	0.75kW / 2.8A	0.75kW / 2.8A	0.75kW / 2.8A
	S1-40°C	0.55kW / 1.7A	0.75kW / 2.3A	1.10kW / 3.1A	1.10kW / 3.3A	1.10kW / 3.3A
	S1-30°C	0.55kW / 1.7A	0.75kW / 2.3A	1.10kW / 3.1A	1.50kW / 3.9A	1.50kW / 3.9A
Maximum permissible ambient temperature with rated output current						
S1		50°C	50°C	45°C	29°C	1°C
S3 70% switch-on duration 10min		50°C	50°C	50°C	40°C	15°C
S6 70% switch-on duration 10min (100% / 20%Mn)		50°C	50°C	50°C	35°C	5°C

		Size 2		Size 3	
Device type:	SK 2xxE…	-301-340-A	-401-340-A	-551-340-A	-751-340-A
Rated motor power	400V	3.0 kW	4.0 kW	5.5 kW	7.5 kW
(4-pole standard motor)	480V	4 hp	5 hp	7½ hp	10 hp
Mains voltage		3 AC 380 ... 500V, -20% / +10%, 47 ... 63 Hz			
Output voltage		3 AC 0 - Mains voltage			
Rated output current at 400V	rms [A]	7.5	9.5	12.5	16.0
Min. braking resistor		110 Ω	110 Ω	68 Ω	68 Ω
Recommended braking resistance	Section 2.3.1	200 Ω	200 Ω	200 Ω	200 Ω
Typical input current at 400V	rms [A]	7.0	8.3	11.7	15.0
Rec. mains fuse	slow-blowing [A]	16	16	20	25
Motor-mounted (ventilated)					
maximum continuous power / max. continuous current:					
	S1-50°C	2.2kW / 5.5A	3.0kW / 8.0A	4.0kW / 11.8A	5.5kW / 13.8A
	S1-40°C	3.0kW / 7.5A	4.0kW / 9.5A	5.5kW / 12.5A	7.5kW / 16.0A
Maximum permissible ambient temperature with rated output current					
S1		43°C	41°C	48°C	43°C
S3 70% switch-on duration 10min		45°C	45°C	50°C	45°C
S6 70% switch-on duration 10min (100% / 20%Mn)		45°C	41°C	50°C	45°C
Wall-mounted (unventilated)					
maximum continuous power / max. continuous current:					
	S1-50°C	1.1kW / 3.1A	1.5kW / 4.0A	1.5kW / 5.3A	2.2kW / 6.3A
	S1-40°C	1.5kW / 4.0A	1.5kW / 4.9A	2.2kW / 6.9A	3.0kW / 7.9A
	S1-30°C	1.5kW / 4.8A	2.2kW / 5.7A	3.0kW / 8.4A	4.0kW / 9.4A
Maximum permissible ambient temperature with rated output current					
S1		-3°C	-20°C	1°C	-18°C
S3 70% switch-on duration 10min		0°C	-5°C	15°C	-5°C
S6 70% switch-on duration 10min (100% / 20%Mn)		0°C	-15°C	5°C	-10°C

8.3.5 Electrical data for UL certification

The data given in this section must be taken into account in order to comply with UL certification or cUL certification. Details of the certification conditions can be found in Section 1.5.2.

The details for the rated current output refer to an ambient temperature of 40°C with operation under the rated conditions (4-pole, 50Hz ventilated motor).

Size 1 / 2 – 1~115V mains					
Device type:	SK 2xxE…	-250-112-O	-370-112-O	-550-112-O	-750-112-O
Rated motor power	110V	0.25 kW	0.37 kW	0.55 kW	0.75 kW
(4-pole standard motor)	120V	$^{1}/_{3}$ hp	½ hp	¾ hp	1 hp
FLA **1 AC** min. mains fuse	[A]	8.9 A	11 A	13.1 A	20.1 A
Max. mains fuse	RK5 or faster fuses, min 115V	30 A	30 A	30 A	30 A
	Bussmann	FRS-R-30	FRS-R-30	FRS-R-30	FRS-R-30
	Circuit breaker* min. 115V	25 A	25 A	25 A	25 A
Rated output current at 40°C	Motor mounted	1.7A	1.7A	3.0A	3.0A
	Wall mounting	1.7A	2.0A	3.0A	3.3A

*Circuit Breaker (inverse time trip type) as per UL489

Size 1 / 2 – 1~230V mains						
Device type:	SK 2xxE…	-250-123-A	-370-123-A	-550-123-A	-750-123-A	-111-123-A
Rated motor power	220V	0.25 kW	0.37 kW	0.55 kW	0.75 kW	1.1 kW
(4-pole standard motor)	240V	$^{1}/_{3}$ hp	½ hp	¾ hp	1 hp	1½ hp
FLA **1 AC** min. mains fuse	[A]	4.0	6.1	7.9	10.2	14.7
Max. mains fuse	RK5 or faster fuses, min 230V	10 A	10 A	10 A	30 A	30 A
	Bussmann	FRS-R-10	FRS-R-10	FRS-R-10	FRS-R-30	FRS-R-30
	Circuit breaker* min. 230V	10 A	10 A	10 A	25 A	25 A
Rated output current at 40°C	Motor mounted	1.7A	2.0A	2.6A	3.7A	4.4A
	Wall mounting	1.7A	2.2A	2.9A	4.0A	4.8A

*Circuit Breaker (inverse time trip type) as per UL489

Size 1 – 3~230V mains						
Device type:	SK 2xxE…	-250-323-A	-370-323-A	-550-323-A	-750-323-A	-111-323-A
Rated motor power	220V	0.25 kW	0.37 kW	0.55 kW	0.75 kW	1.1 kW
(4-pole standard motor)	240V	1/3 hp	½ hp	¾ hp	1 hp	1½ hp
FLA **3 AC** min. mains fuse	[A]	1.4	1.9	2.6	3.5	5.1
Max. mains fuse	RK5 or faster fuses, min 230V	5.0 A	5.0 A	10 A	10 A	10 A
	Bussmann	FRS-R-5	FRS-R-5	FRS-R-10	FRS-R-10	FRS-R-10
	Circuit breaker* min. 230V	5.0 A	5.0 A	10 A	10 A	10 A
Rated output current at 40°C	Motor mounted	1.7A (45°C)	2.2A (45°C)	3.0A (45°C)	4.0A (45°C)	5.5A (45°C)
	Wall mounting	1.7A (45°C)	2.2A (45°C)	3.0A (45°C)	3.5A	4.0A

*Circuit Breaker (inverse time trip type) as per UL489

Size 2 / 3 - 3~230V mains					
Device type:	SK 2xxE…	-151-323-A	-221-323-A	-301-323-A	-401-323-A
Rated motor power	220V	1.5 kW	2.2 kW	3.0 kW	4.0 kW
(4-pole standard motor)	240V	2 hp	3 hp	4 hp	5 hp
FLA **3 AC** min. mains fuse	[A]	6.6	9.1	11.7	14.9
Max. mains fuse	RK5 or faster fuses, min 230V	10 A	30 A	30 A	30 A
	Bussmann	FRS-R-10	FRS-R-30	FRS-R-30	FRS-R-30
	Circuit breaker* min. 230V	10 A	25 A	25 A	25 A
Rated output current at 40°C	Motor mounted	7.0A (45°C)	9.5A (45°C)	12.5A (45°C)	16.0A (45°C)
	Wall mounting	4.8A	5.5A	8.0A	8.0A

*Circuit Breaker (inverse time trip type) as per UL489

Size 1 - 400V mains						
Device type:	SK 2xxE…	-550-340-A	-750-340-A	-111-340-A	-151-340-A	-221-340-A
Rated motor power	380V	0.55 kW	0.75 kW	1.1 kW	1.5 kW	2.2 kW
(4-pole standard motor)	460 … 480V	¾ hp	1 hp	1½ hp	2 hp	3 hp
FLA **3 AC** min. mains fuse	[A]	1.6	2.2	2.9	3.7	5.7
Max. mains fuse	RK5 or faster fuses, min 230/400V	5.0 A	5.0 A	10 A	10 A	10 A
	Bussmann	FRS-R-5	FRS-R-5	FRS-R-10	FRS-R-10	FRS-R-10
	Circuit breaker* min. 230/400V	5.0 A	5.0 A	10 A	10 A	10 A
Rated output current at 40°C	Motor mounted	1.7A (45°C)	2.3A (45°C)	3.1A (45°C)	4.0A (45°C)	5.5A (45°C)
	Wall mounting	1.7A (45°C)	2.3A (45°C)	3.1A (45°C)	3.3A	3.3A

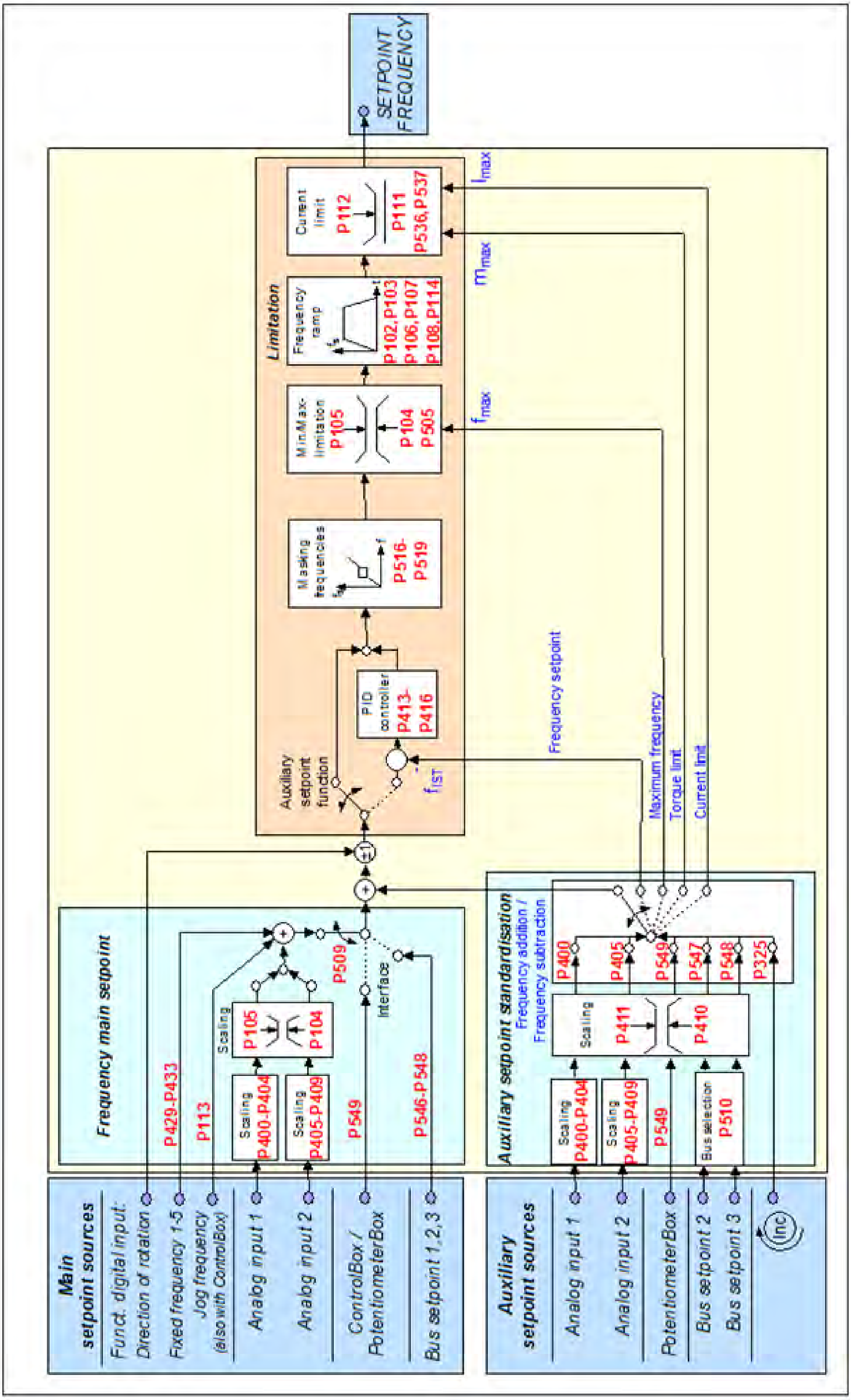
*Circuit Breaker (inverse time trip type) as per UL489

Size 2 / 3 - 400V mains					
Device type:	SK 2xxE…	-301-340-A	-401-340-A	-551-340-A	-751-340-A
Rated motor power	380V	3.0 kW	4.0 kW	5.5 kW	7.5 kW
(4-pole standard motor)	460 … 480V	4 hp	5 hp	7½ hp	10 hp
FLA **3 AC** min. mains fuse	[A]	7.7	9.6	12.7	16.6
Max. mains fuse	RK5 or faster fuses, min 230/400V	10 A	30 A	30 A	30 A
	Bussmann	FRS-R-10	FRS-R-30	FRS-R-30	FRS-R-30
	Circuit breaker* min. 230/400V	10 A	25 A	25 A	25 A
Rated output current at 40°C	Motor mounted	7.5A (45°C)	9.5A (41)	12.5A (45°C)	16.0A (43)
	Wall mounting	4.0A	4.9A	6.9A	7.9A

*Circuit Breaker (inverse time trip type) as per UL489

9 Additional information

9.1 Setpoint processing in the SK200E



9.2 Process controller

The process controller is a PI controller, with which it is possible to limit the controller output. In addition, the output is standardised to a percentage of a master setpoint value. This provides the possibility of controlling an upstream drive unit with the master setpoint value and adjusting it with the PI controller.

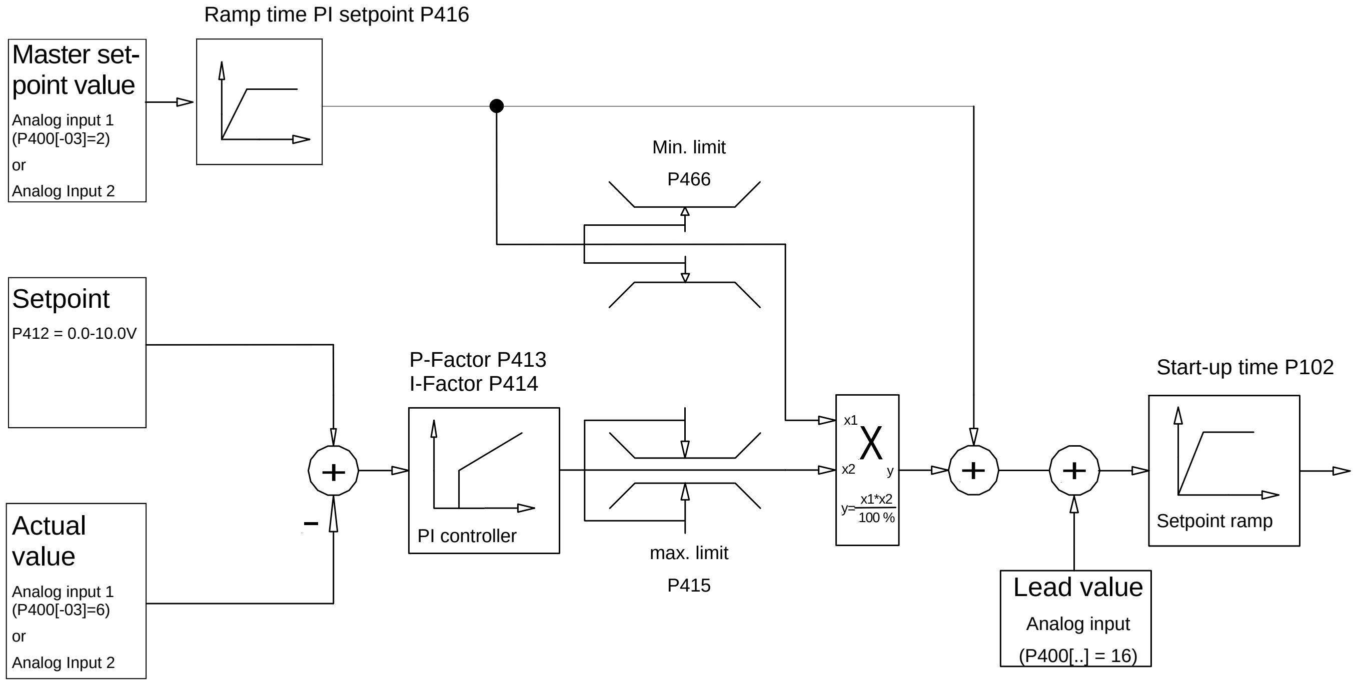
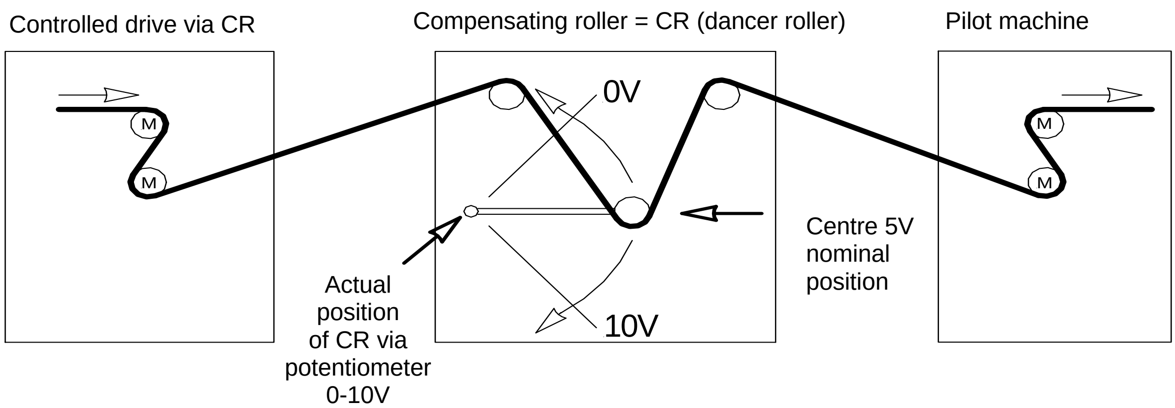
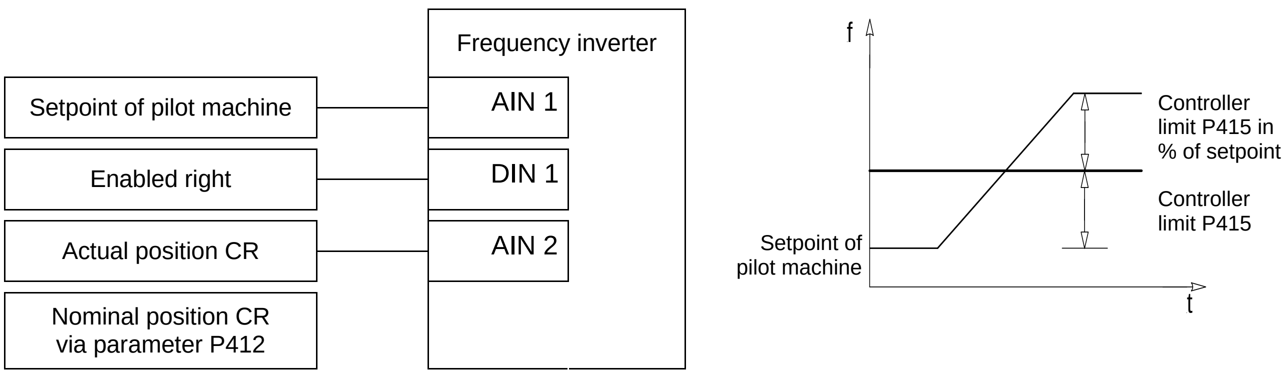


Fig.: Process controller flow-chart

9.2.1 Process controller application example





9.2.2 Process controller parameter settings

(Example: Setpoint frequency: 50 Hz, control limits: +/- 25%)

P105 (Maximum frequency) [Hz] : $\geq Setpointfrq.[Hz] + \left(\frac{Setpointfrq.[Hz] \times P415[\%]}{100\%} \right)$

Example: $\geq 50Hz + \frac{50Hz \times 25\%}{100\%} =$ **62,5Hz**

P400 [-01] (Funct. Analog input1) : **"2""** (frequency addition)

P411 (Setpoint frequency) [Hz] : Setpoint frequency with 10V at analog input 1

Example: **50 Hz**

P412 (Process controller setpoint) : Central setting of compensating roller / factory setting **5V** (adjust if necessary)

P413 (P-controller) [%] : factory setting **10%** (adjust if necessary)

P414 (I-controller) [%/ms] : recommended **100**%/s

P415 (Limit +/-) [%] : Control limit (see above)

Note: Parameter P415 is used as a control limit after the PI controller.

Example: **25%** of setpoint

P416 (Ramp time PI setpoint) [s] : factory setting **2s** (if necessary match to controller characteristics)

P420 [-01] (Funct. Digital input 1) : **"1"**Enable right

P400 [-02] (Funct. Analog input 2) : **"6"**PI process controller actual value

9.3 Electromagnetic compatibility

All electrical equipment that have an intrinsic, independent function and are placed on the market as individual units for users from January 1996 must comply with the EU directive EU/89/336. There are three different ways for manufacturers to display compliance with this directive:

1. *EC declaration of conformity*

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

2. *Technical documentation*

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

3. *EC type test certificate* (This method only applies to radio transmitter equipment.)

   SK 205E/215E/225E/235E frequency inverters only have an intrinsic function when they are connected to other equipment (e.g. with a motor). The basic units cannot therefore carry the CE mark, which would confirm compliance with the EMC Directive. Precise details are therefore given below about the EMC behaviour of this product, based on the proviso that it is installed according to the guidelines and instructions described in this documentation.

Class A, Group 2: General, for industrial environments

Complies with the EMC standard for power drives EN 61800-3, for use in **secondary environments (industrial)** and when **not generally available**.

Class A, Group 1: Interference suppressed, for industrial environments

In this operating class, the manufacturer can certify that his equipment meets the requirements of the EMC directive for industrial environments with respect to their EMC behaviour in power drives. The limit values correspond to the basic standards EN 61000-6-2 and EN 61000-6-4 for interference immunity and interference emissions in industrial environments.

Class B, Group 1: Interference suppressed for domestic, commercial and light industrial environments

In this operating class, the manufacturer can certify that his equipment meets the requirements of the EMC directive for domestic, commercial and light industrial environments with respect to their EMC behaviour in power drives. The limit values correspond to the basic standards EN 61000-6-2 and EN 61000-6-4 for interference immunity and interference emissions.

ATTENTION

NORDAC SK 2xxE frequency inverters **are only intended for commercial applications**. They are therefore not subject to the requirements of the standard EN 61000-3-2 for radiation of harmonics.

This device produces high frequency interference, which may make additional suppression measures necessary in **domestic environments**.

9.4 EMC limit value classes

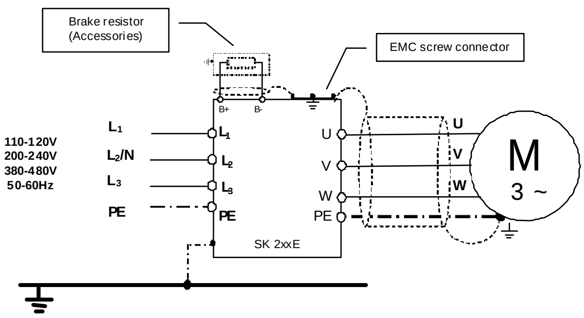
Please note that these limit value classes are only reached if the standard pulse frequency (6kHz) is being used and the length of the shielded motor cable does not exceed the permissible limits.

In addition, it is essential to use wiring suitable for EMC. The motor cable shielding must be applied on both sides (frequency inverter shield angle and the metal motor terminal box).

Device type Max. motor cable, shielded	**Jumper position** See Sections 2.7.5 and 2.7.6	Cable emissions 150kHz - 30 MHz Class A 1 ⇒ C2	 Class B 1 ⇒ C1
SK 2x5E, motor-mounted	Jumper set	5m	-
SK 2x5E wall-mounted	Jumper set	5m	-

Overview of the standards, which according to product standard EN 61800-3 are applicable as testing and measuring methods for electric drives whose speed can be altered:		
Emission of interference		
Emission from cables (interference voltage)	EN 55011	A 1 or C2
		-
Radiated emissions (Interference field strength)	EN 55011	A 1 or C2
		-
Interference immunity EN 61000-6-1, EN 61000-6-2		
ESD, discharge of static electricity	EN 61000-4-2	6kV (CD), 8kV (AD)
EMF, high frequency electro-magnetic fields	EN 61000-4-3	10V/m; 80 - 1000MHz
Burst on control cables	EN 61000-4-4	1kV
Burst on mains and motor cables	EN 61000-4-4	2kV
Surge (phase-phase / phase-ground)	EN 61000-4-5	1kV / 2kV
Cable-led interference due to high frequency fields	EN 61000-4-6	10V, 0.15 - 80MHz
Voltage fluctuations and drops	EN 61000-2-1	+10%, -15%; 90%
Voltage asymmetries and frequency changes	EN 61000-2-4	3%; 2%

Wiring recommendations for mounting near to motor



9.5 Reduced output power

The SK 200E frequency inverter series is designed to handle certain overload situations. For example, 1.5x overcurrent can be used for 60 sec. For approx. 3.5 sec a 2x overcurrent is possible. A reduction of the overload capacity or its time must be taken into account in the following circumstances:

- Output frequencies < 2Hz and constant voltages (needle stationary)
- Pulse frequencies greater than the rated pulse frequency (P504)
- Increased mains voltage > 400V
- Increased heat sink temperature

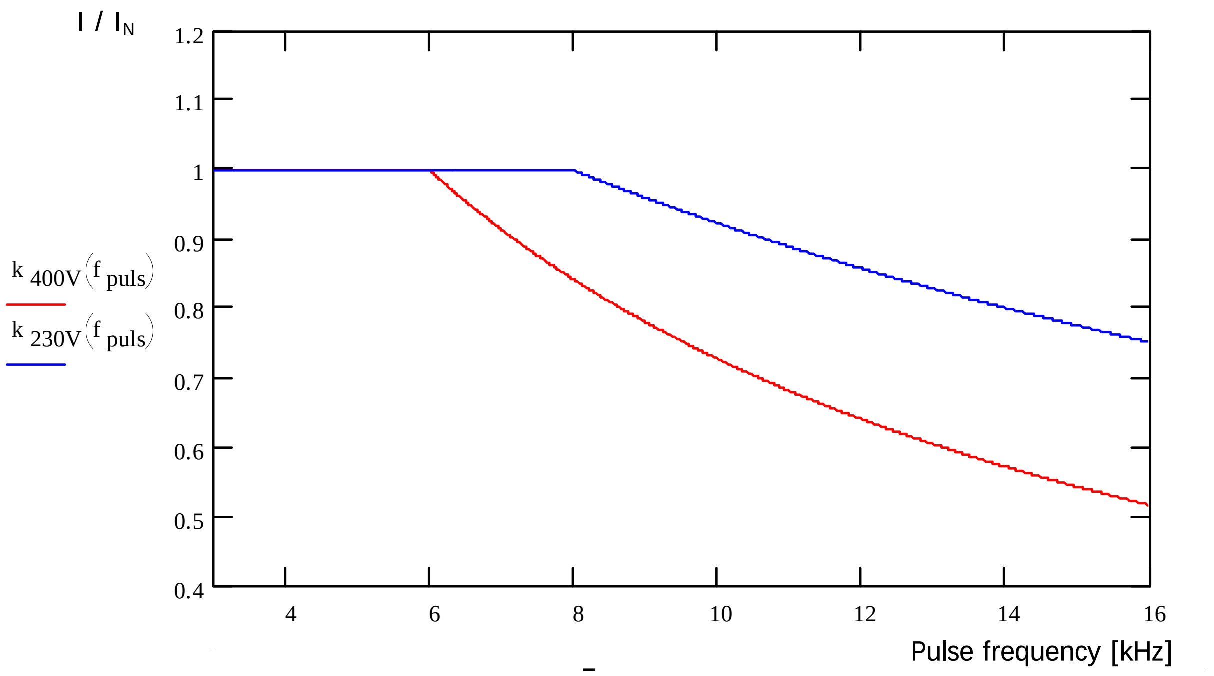
On the basis of the following characteristic curves, the particular current / power limitation can be read off.

9.5.1 Increased heat dissipation due to pulse frequency

This illustration shows how the output current must be reduced, depending on the pulse frequency for 230V and 400V devices, in order to avoid excessive heat dissipation in the frequency inverter.

For 400V devices, the reduction begins at a pulse frequency above 6kHz. For 230V devices, the reduction begins at a pulse frequency above 8kHz.

Even with increased pulse frequencies the frequency inverter is capable of supplying its maximum peak current, however only for a reduced period of time. The diagram shows the possible current load capacity for continuous operation.



9.5.2 Reduced overcurrent due to time

The possible overload capacity changes depending on the duration of an overload. Several values are cited in this table. If one of these limiting values is reached, the frequency inverter must have sufficient time (with low utilisation or without load) in order to regenerate itself.

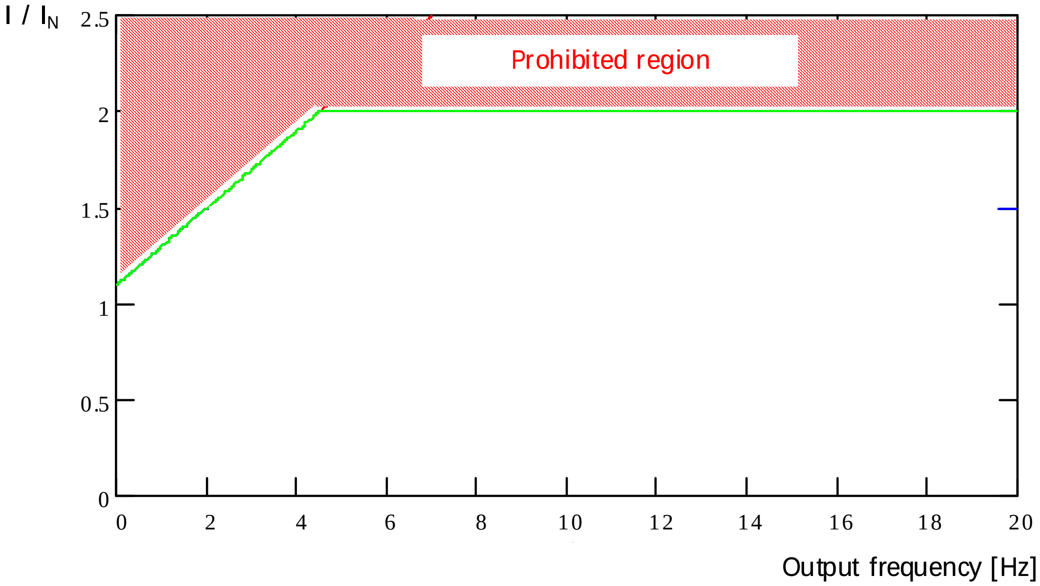
If operated repeatedly in the overload region at short intervals, the limiting values stated in the tables are reduced.

230V devices: Reduced overload capacity (approx.) due to pulse frequency (P504) and time						
Pulse frequency [kHz]	Time [s]					
	> 600	60	30	20	10	3.5
3...8	110%	150%	170%	180%	180%	200%
10	103%	140%	155%	165%	165%	180%
12	96%	130%	145%	155%	155%	160%
14	90%	120%	135%	145%	145%	150%
16	82%	110%	125%	135%	135%	140%

400V devices: Reduced overload capacity (approx.) due to pulse frequency (P504) and time						
Pulse frequency [kHz]	Time [s]					
	> 600	60	30	20	10	3.5
3...6	110%	150%	170%	180%	180%	200%
8	100%	135%	150%	160%	160%	165%
10	90%	120%	135%	145%	145%	150%
12	78%	105%	120%	125%	125%	130%
14	67%	92%	104%	110%	110%	115%
16	57%	77%	87%	92%	92%	100%

9.5.3 Reduced overcurrent due to output frequency

To protect the power unit at low output frequencies (<4.5Hz) a monitoring system is provided, with which the temperature of the IGBTs (*integrated gate bipolar transistor*) due to high current is determined. In order to prevent current being taken off above the limit shown in the diagram, a pulse switch-off (P537) with a variable limit is introduced. At a standstill, with 6kHz pulse frequency, current above 1.1x the nominal current cannot be taken off.



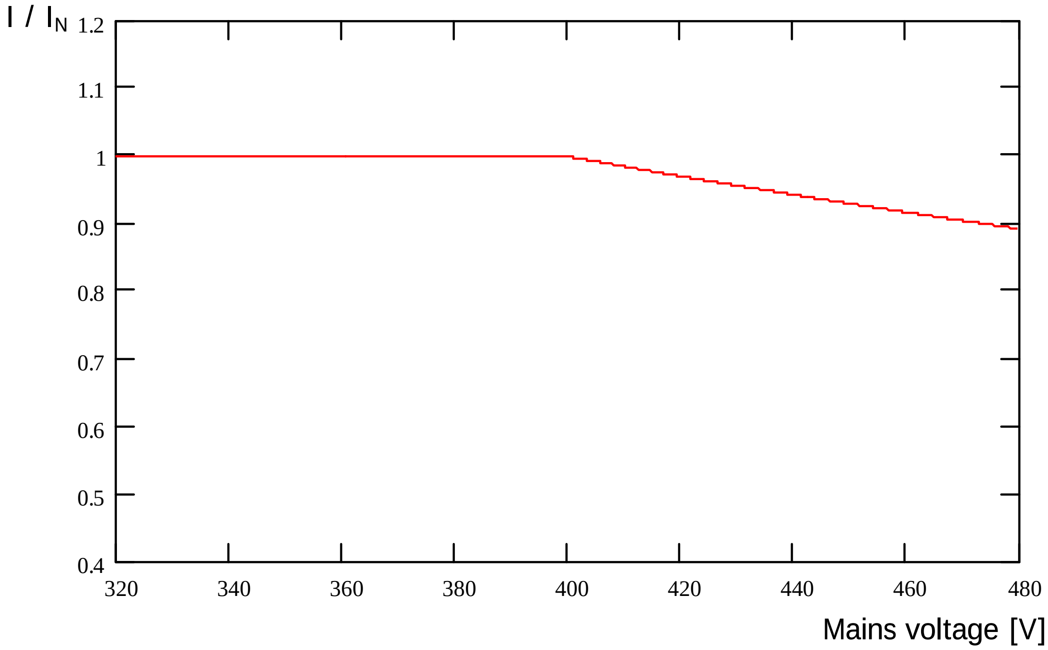
The upper limiting values for the various pulse frequencies can be obtained from the following tables. In all cases, the value (0.1…1.9) which can be set in parameter P537, is limited to the value stated in the tables according to the pulse frequency. Values below the limit can be set as required.

230V devices: Reduced overload capacity (approx.) due to pulse frequency (P504) and output frequency							
Pulse frequency [kHz]	Output frequency [Hz]						
	4.5	3.0	2.0	1.5	1.0	0.5	0
3...8	200%	170%	150%	140%	130%	120%	110%
10	180%	153%	135%	126%	117%	108%	100%
12	160%	136%	120%	112%	104%	96%	95%
14	150%	127%	112%	105%	97%	90%	90%
16	140%	119%	105%	98%	91%	84%	85%

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

9.5.4 Reduced output current due to mains voltage

The devices are designed with thermal characteristics according to the rated output currents. Accordingly, for lower mains voltages, higher currents cannot be taken off in order to maintain the stated power constant. For mains voltages above 400v there is a reduction of the permissible continuous output current, which is inversely proportional to the mains voltage, in order to compensate for the increased switching losses.



9.5.5 Reduced output current due to the heat sink temperature

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

9.6 Operation with FI circuit breakers

With SK 200E frequency inverters (except 115V devices) leakage currents of > 40mA are to be expected with an active mains filter. If possible, an FI circuit breaker for the protection of personnel should not be used.

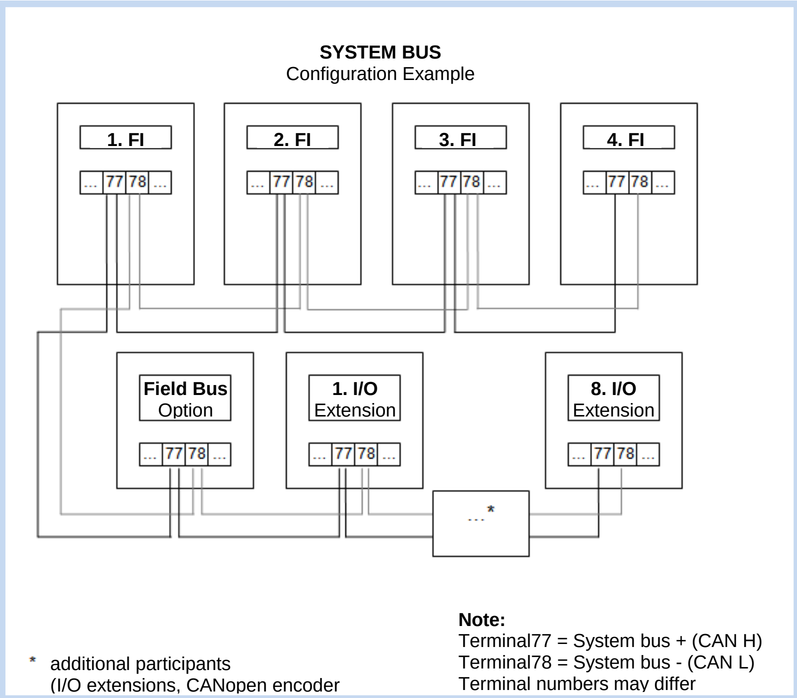
If the frequency inverter is to be used with an FI circuit breaker for the protection of personnel, the leakage currents to earth must be reduced to 10 - 20 mA by means of jumpers. However, with "operation on an IT network" the FI loses its specified degree of interference protection.

Further details can be found in Section 2.7.5 - 2.7.6.

9.7 System bus

Frequency inverters and components of the SK 200E series communicate with each other via the system bus. This bus system is a CAN bus with a Canopen protocol. Up to four frequency inverters and their associated components (field bus module, absolute encoder, I/O modules etc.) can be connected to the system bus. Integration of the components into the bus does not require any BUS-specific knowledge on the part of the user.

It is only necessary to take care that the correct physical structure of the bus system and the correct addressing of the participants are complied with.



The connection of the individual NORD components is described in this manual (See section 2.8.2, 3.4, and 3.5).

Physical structure

Standard	CAN
Bus length	20m with a wire cross section of 0.25mm² (AWG23)
Structure	preferably linear
Spur cables	possible, (max. 6m)
Termination resistors	120Ω, 250mW at both ends of a system bus (with SK 200E-… or SK xU4-… via DIP switches)
Baud rate	250kBaud - preset

Addressing

If several frequency inverters are connected to a system bus, these devices must be assigned with unique addresses. For preference, this is carried out via the DIP switches on the underside of the SK200E (Section 5.1.2). For the use of CANopen absolute encoders, the encoders must be assigned to the relevant FI via the node ID. If, for example, there are one encoder and four frequency inverters on the system bus and the encoder is to operate with FI3, the node ID 37 must be set on the encoder, see the following table.

Frequency inverter	Addressing via DIP switches		Resulting Node ID Frequency inverter	Node ID Absolute value encoder
	DIP 2	DIP 1		
FI1	OFF	OFF	32	33
FI2	OFF	ON	34	35
FI3	ON	OFF	36	37
FI4	ON	ON	38	39

For field bus modules, no assignment of addresses is necessary. The module identifies all the frequency inverters automatically. Access to the individual inverters is via the field bus master (SPS). Details of how this is carried out are explained in the relevant bus instructions.

I/O extensions must be assigned to the relevant frequency inverter. This is carried out by means of a DIP switch on the I/O module. A special case for the I/O extensions is the "Broadcast" mode. In this mode, the data of the I/O extension (analog values, inputs etc.) are sent to all inverters simultaneously. Via the parameterisation in each individual frequency inverter, a decision is made as to which of the received values are to be used. Further details of the settings can be obtained from this manual (See also Section 3.4.3 or 3.5.4).

NOTE

Care must be taken that each address is only assigned once. In a CAN-based network double assignment of addresses may lead to misinterpretation of the data and therefore undefined activities in the system.

Integration of devices from other manufacturers

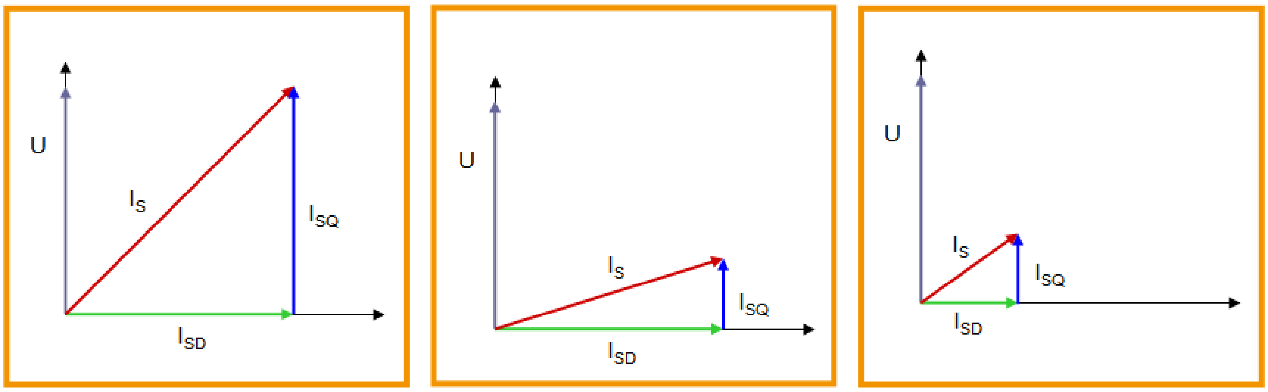
In principle, the integration of other devices into this bus system is possible. These must support the CANopen protocol and a 250kBaud baud rate. The address range (Node ID) 1 to 4 is reserved for additional CANopen masters. All other participants must be assigned addresses between 50 and 79.

9.8 Energy efficiency

NORDAC frequency inverters have very low energy requirements and are therefore very efficient. In addition, by means of "Automatic flux adaptation" (parameter (P219)), the SK 200E provides a facility for improving the energy efficiency of the entire drive unit (especially in applications with partial loads).

According to the torque required, the excitation current is reduced by the frequency inverter or the motor torque to the actual level required by the drive unit. The resulting reduction in current consumption, which may be considerable, and the optimisation of cos φ to≈ 1 even in the partial load range makes a significant contribution to energy and network optimisation.

Here, a parameterisation which deviates from the factory setting (= 100%) is only permissible for applications which require rapid torque changes. (For details see Section 6.1.3 parameter (P219))



I_S = Motor current vector (line current) **I_{SD}** = Excitation current vector (magnetisation current) **I_{SQ}** = Load current vector

	No flux adaptation	With flux adaptation
Motor under full load	Motor under partial load	

WARNING

This function is not suitable for lifting applications or applications with frequent or large load changes and parameter (P219) must be left at the factory setting (100%).

9.9 Motor data - characteristic curves

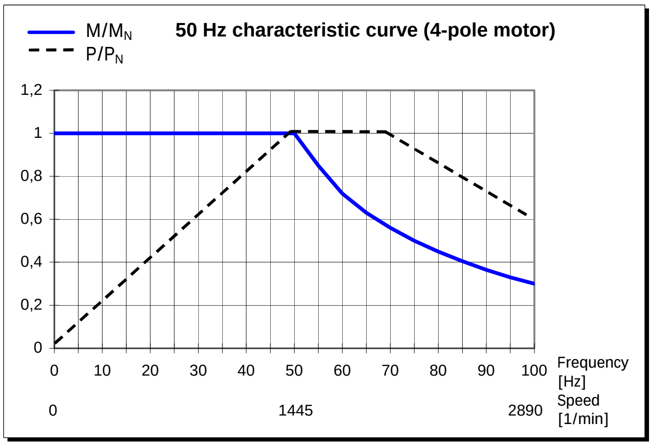
9.9.1 50Hz characteristic curve

(→ Adjustment range 01:10:00)

a) 115V / 230V frequency inverter

For 50Hz operation, the motor can be used at the rated torque up to its rating point of 50Hz/230V. In spite of this, operation above 50Hz is possible, however the output torque reduces in a non-linear manner (see following diagram). Above the rating point the motor enters its field reduction range, as with an increase of frequency above 50Hz, the voltage can not be increased above 230V. Due to the mains voltage, only max. 230V are available.

Up to a power of 4 kW, the following data refer to a 230/400V motor winding.



Frequency inverter type		Parameterisation data for frequency inverter							
		F_N [Hz]	n_N [min^{-1}]	I_N [A]	U_N [V]	P_N [kW]	cos φ	Circuit	R_{St} [Ω]
SK…71S/4	TI 4 - SK 2xxE-250-x23-A*	50	1380	1,4	230	0,25	0,77	Delta	36,50
SK…71L/4	TI 4 - SK 2xxE-370-x23-A*	50	1360	1,9	230	0,37	0,77	Delta	23,80
SK…80S/4	TI 4 - SK 2xxE-550-x23-A*	50	1375	2,63	230	0,55	0,73	Delta	15,10
SK…80L/4	TI 4 - SK 2xxE-750-x23-A*	50	1375	3,63	230	0,75	0,74	Delta	10,20
SK…90S/4	TI 4 - SK 2xxE-111-x23-A	50	1385	4,81	230	1,1	0,78	Delta	6,28
SK…90L/4	TI 4 - SK 2xxE-151-323-A	50	1385	6,3	230	1,5	0,80	Delta	4,37
SK…100L/4	TI 4 - SK 2xxE-221-323-A	50	1440	9,03	230	2,2	0,74	Delta	2,43
SK…100LA/4	TI 4 - SK 2xxE-301-323-A	50	1410	12	230	3,0	0,8	Delta	1,81
SK…112M/4	TI 4 - SK 2xxE-401-323-A	50	1445	14,4	230	4,0	0,8	Delta	1,14

* the same data apply for the use of the 115V version of the SK2xxE

Frequency inverter type		Power data at rating point		
		P_B [kW]	n_B [minP^{-1P}]	M_B [Nm]
SK…71S/4	TI 4 - SK 2xxE-250-x23-A*	0,25	1380	1,73
SK…71L/4	TI 4 - SK 2xxE-370-x23-A*	0,37	1360	2,6
SK…80S/4	TI 4 - SK 2xxE-550-x23-A*	0,55	1375	3,82
SK…80L/4	TI 4 - SK 2xxE-750-x23-A*	0,75	1375	5,21
SK…90S/4	TI 4 - SK 2xxE-111-x23-A	1,1	1385	7,58
SK…90L/4	TI 4 - SK 2xxE-151-323-A	1,5	1385	10,34
SK…100L/4	TI 4 - SK 2xxE-221-323-A	2,2	1440	14,59
SK…100LA/4	TI 4 - SK 2xxE-301-323-A	3,0	1410	20,32
SK…112M/4	TI 4 - SK 2xxE-401-323-A	4,0	1445	26,44

* the same data apply for the use of the 115V version of the SK2xxE

b) 400V frequency inverter

For 50Hz operation, the motor can be used at the rated torque up to its rating point of 50Hz/400V. In spite of this, operation above 50Hz is possible, however the output torque reduces in a non-linear manner (see following diagram). Above the rating point the motor enters its field reduction range, as with an increase of frequency above 50Hz, the voltage can not be increased above 400V. Due to the mains voltage, only max. 400V are available.

Up to a power of 2.2W, the following data refer to a 230/400V motor winding. Above 3kW the data is based in 400/690V windings.

Frequency inverter type		**Parameterisation data for frequency inverter**							
		F_N [Hz]	n_N [min^{-1}]	I_N [A]	U_N [V]	P_N [kW]	cos φ	Circuit	R_{St} [Ω]
SK…80S/4	TI 4 - SK 2xxE-550-340-A	50	1375	1,52	400	0,55	0,73	Star	15,10
SK…80L/4	TI 4 - SK 2xxE-750-340-A	50	1375	2,10	400	0,75	0,74	Star	10,20
SK…90S/4	TI 4 - SK 2xxE-111-340-A	50	1385	2,78	400	1,1	0,78	Star	6,28
SK…90L/4	TI 4 - SK 2xxE-151-340-A	50	1385	3,64	400	1,5	0,80	Star	4,37
SK…100L/4	TI 4 - SK 2xxE-221-340-A	50	1440	5,22	400	2,2	0,74	Star	2,43
SK…100LA/4	TI 4 - SK 2xxE-301-340-A	50	1410	6,9	400	3,0	0,8	Delta	5,45
SK…112M/4	TI 4 - SK 2xxE-401-340-A	50	1445	8,3	400	4,0	0,8	Delta	3,44
SK…132S/4	TI 4 - SK 2xxE-551-340-A	50	1445	11,4	400	5,5	0,81	Delta	2,27
SK…132M/4	TI 4 - SK 2xxE-751-340-A	50	1445	14,8	400	7,5	0,84	Delta	1,45

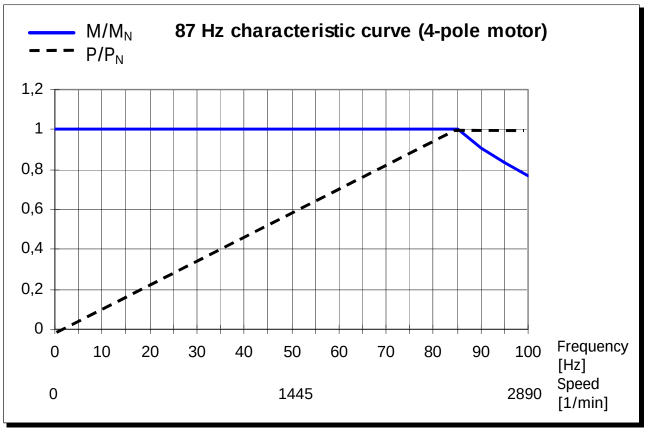
Frequency inverter type		**Power data at rating point**		
		P_B [kW]	n_B [minP^{-1P}]	M_B [Nm]
SK…80S/4	TI 4 - SK 2xxE-550-340-A	0,55	1375	3,82
SK…80L/4	TI 4 - SK 2xxE-750-340-A	0,75	1375	5,21
SK…90S/4	TI 4 - SK 2xxE-111-340-A	1,1	1385	7,58
SK…90L/4	TI 4 - SK 2xxE-151-340-A	1,5	1385	10,34
SK…100L/4	TI 4 - SK 2xxE-221-340-A	2,2	1440	14,59
SK…100LA/4	TI 4 - SK 2xxE-301-340-A	3,0	1410	20,32
SK…112M/4	TI 4 - SK 2xxE-401-340-A	4,0	1445	26,44
SK…132S/4	TI 4 - SK 2xxE-551-340-A	5,5	1445	36,5
SK…132M/4	TI 4 - SK 2xxE-751-340-A	7,5	1445	49,6

9.9.2 87Hz characteristic curve (only 400V devices)

(→ Adjustment range 01:17:00)

The 87Hz characteristic curve is an extension of the speed adjustment range with a constant rated torque for the motor. In order to implement this, the following points must be fulfilled:

- Delta motor circuit with 230/400V motor windings
- Frequency inverter with an operating voltage of **3~400V**
- The output current of the frequency inverter must be greater than the delta current of the motor used (Guide value → frequency inverter power ≥ √3 x motor power)



In this configuration the motor has a rated operating point at 230V/50Hz and an extended operating point at 400V/87Hz. This increases the power of the drive unit by a factor of √3. The rated torque of the motor remains constant up to a frequency of 87Hz. Operation of the 230V winding with 400V is not critical, as the insulation is designed for a test voltage of >1000V.

NOTE: The following motor data applies for standard motors with 230/400V windings.

Frequency inverter type	Parameterisation data for frequency inverter							
	F_N [Hz]	n_N[min^{-1}]	I_N [A]	U_N [V]	P_N [kW]	cos φ	Circuit	R_{St} [Ω]
SK…71S/4 TI 4 - SK 2xxE-550-340-A	50	1380	1,32	230	0,25	0,77	Delta	36,50
SK…71L/4 TI 4 - SK 2xxE-750-340-A	50	1360	1,91	230	0,37	0,75	Delta	23,80
SK…80S/4 TI 4 - SK 2xxE-111-340-A	50	1375	2,63	230	0,55	0,73	Delta	15,10
SK…80L/4 TI 4 - SK 2xxE-151-340-A	50	1375	3,64	230	0,75	0,74	Delta	10,20
SK…90S/4 TI 4 - SK 2xxE-221-340-A	50	1385	4,81	230	1,1	0,78	Delta	6,28
SK…90L/4 TI 4 - SK 2xxE-301-340-A	50	1385	6,30	230	1,5	0,80	Delta	4,37
SK…100L/4 TI 4 - SK 2xxE-401-340-A	50	1440	9,03	230	2,2	0,74	Delta	2,43
SK…100LA/4 TI 4 - SK 2xxE-551-340-A	50	1410	12	230	3,0	0,8	Delta	1,81
SK…112M/4 TI 4 - SK 2xxE-751-340-A	50	1445	14,4	230	4,0	0,8	Delta	1,14

Frequency inverter type	Power data at rating point		
	P_B [kW]	n_B [min^{-1}]	M_B [Nm]
SK…71S/4 TI 4 - SK 2xxE-550-340-A	0,43	2475	1,65
SK…71L/4 TI 4 - SK 2xxE-750-340-A	0,64	2455	2,49
SK…80S/4 TI 4 - SK 2xxE-111-340-A	0,95	2470	3,67
SK…80L/4 TI 4 - SK 2xxE-151-340-A	1,3	2470	5,01
SK…90S/4 TI 4 - SK 2xxE-221-340-A	1,9	2480	7,32
SK…90L/4 TI 4 - SK 2xxE-301-340-A	2,6	2480	10,01
SK…100L/4 TI 4 - SK 2xxE-401-340-A	3,8	2535	14,32
SK…100LA/4 TI 4 - SK 2xxE-551-340-A	5,2	2505	20,1
SK…112M/4 TI 4 - SK 2xxE-751-340-A	6,9	2540	26,1

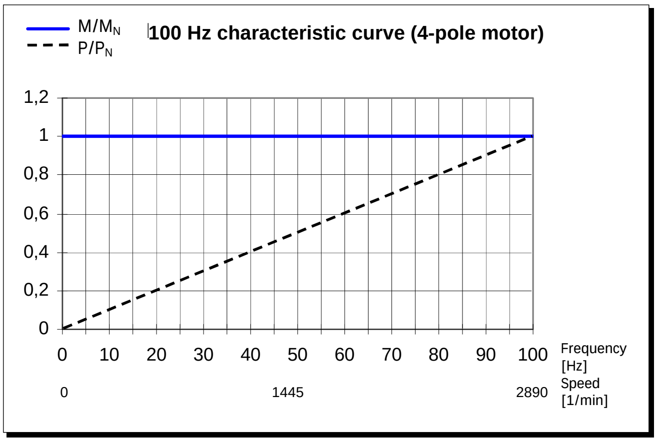
9.9.3 100Hz characteristic curve (only 400V devices)

(→ Adjustment range 1:20)

For a large speed adjustment range up to a ratio of 1:20 an operating point of 100Hz/400V may be selected. For this, special motor data is necessary (see below), which deviates from the normal 50Hz data. Care must be taken that a constant torque is produced over the entire adjustment range, however this is smaller than the rated torque for 50Hz operation.

In addition to the large speed adjustment range, a further benefit is the better temperature characteristic of the motor. In the low output speed range an external fan is not strictly necessary.

NOTE: The following motor data applies for standard motors with 230/400V windings.



Frequency inverter type	Parameterisation data for frequency inverter							
	F_N [Hz]	n_N [min^{-1}]	I_N [A]	U_N [V]	P_N [kW]	cos φ	Circuit	R_{St} [Ω]
SK…71S/4 TI 4 - SK 2xxE-550-340-A	100	2855	1,2	400	0,37	0,79	Delta	40,60
SK…71L/4 TI 4 - SK 2xxE-550-340-A	100	2860	1,8	400	0,55	0,75	Delta	22,70
SK…80S/4 TI 4 - SK 2xxE-750-340-A	100	2885	2,4	400	0,75	0,77	Delta	16,20
SK…80L/4 TI 4 - SK 2xxE-111-340-A	100	2900	3,0	400	1,1	0,75	Delta	10,80
SK…90S/4 TI 4 - SK 2xxE-151-340-A	100	2925	3,6	400	1,5	0,74	Delta	6,40
SK…90L/4 TI 4 - SK 2xxE-221-340-A	100	2920	4,9	400	2,2	0,79	Delta	4,67
SK…100L/4 TI 4 - SK 2xxE-301-340-A	100	2940	6,7	400	3	0,77	Delta	2,43
SK…100LA/4 TI 4 - SK 2xxE-401-340-A	100	2935	8,7	400	4	0,8	Delta	1,96
SK…112M/4 TI 4 - SK 2xxE-551-340-A	100	2945	11,4	400	5,5	0,82	Delta	1,2
SK…132S/4 TI 4 - SK 2xxE-751-340-A	100	2955	15,6	400	7,5	0,82	Delta	0,74

Frequency inverter type	Power data at rating point		
	P_B [kW]	n_B [min^{-1}]	M_B [Nm]
SK…71S/4 TI 4 - SK 2xxE-550-340-A	0,37	2855	1,23
SK…71L/4 TI 4 - SK 2xxE-550-340-A	0,55	2860	1,83
SK…80S/4 TI 4 - SK 2xxE-750-340-A	0,75	2885	2,48
SK…80L/4 TI 4 - SK 2xxE-111-340-A	1,1	2900	3,62
SK…90S/4 TI 4 - SK 2xxE-151-340-A	1,5	2925	4,90
SK…90L/4 TI 4 - SK 2xxE-221-340-A	2,2	2920	7,20
SK…100L/4 TI 4 - SK 2xxE-301-340-A	3,0	2940	9,75
SK…100LA/4 TI 4 - SK 2xxE-401-340-A	4,0	2935	13,0
SK…112M/4 TI 4 - SK 2xxE-551-340-A	5,5	2945	18,0
SK…132S/4 TI 4 - SK 2xxE-751-340-A	7,5	2955	24,3

9.10 Standardisation of setpoint/actual values

The following table contains details for the standardisation of typical setpoint and actual values. This information relates to the parameters (P400), (P418), (P543), (P546), (P740) or (P741).

Name	Analog signal		Bus signal						
Setpoint {Function}	Value range	Standardisation	Value range	Max. value	Type	100% =	-100% =	Standardisation	Limit absolute
Setpoint frequency {01}	0-10V (10V=100%)	P104 … P105 (min - max)	±100%	16384	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * $S_{Setpoint}$[Hz]/P105	P105
Frequency addition {02}	0-10V (10V=100%)	P410 … P411 (min - max)	±200%	32767	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * $S_{Setpoint}$[Hz]/P411	P105
Frequency subtraction {03}	0-10V (10V=100%)	P410 … P411 (min - max)	±200%	32767	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * $S_{Setpoint}$[Hz]/P411	P105
Minimum frequency {04}	0-10V (10V=100%)	50Hz* U_{AIN}(V)/10V	0…200%	32767	INT	4000_{hex} 16384_{dec}	/	50Hz* Bus setpoint/4000_{hex}	P105
Maximum frequency {05}	0-10V (10V=100%)	100Hz* U_{AIN}(V)/10V	0…200%	32767	INT	4000_{hex} 16384_{dec}	/	100Hz* Bus setpoint/4000_{hex}	P105
Actual value Process controller {06}	0-10V (10V=100%)	P105* U_{AIN}(V)/10V	±100%	16384	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * $S_{Setpoint}$[Hz]/P105	P105
Setpoint Process controller {07}	0-10V (10V=100%)	P105* U_{AIN}(V)/10V	±100%	16384	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * $S_{Setpoint}$[Hz]/P105	P105
Torque current limit {11}, {12}	0-10V (10V=100%)	P112* U_{AIN}(V)/10V	0…100%	16384	INT	4000_{hex} 16384_{dec}	/	4000_{hex} * I[A]/P112	P112
Current limit {13}, {14}	0-10V (10V=100%)	P536* U_{AIN}(V)/10V	0…100%	16384	INT	4000_{hex} 16384_{dec}	/	4000_{hex} * I[A]/P536	P536
Ramp time {15}	0-10V (10V=100%)	10s* U_{AIN}(V)/10V	0…200%	32767	INT	4000_{hex} 16384_{dec}	/	10s * Bus setpoint/4000_{hex}	20s
Actual values {Function}									
Actual frequency {01}	0-10V (10V=100%)	P105* U_{AOut}(V)/10V	±100%	16384	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * f[Hz]/P105	
Speed {02}	0-10V (10V=100%)	P202* U_{AOut}(V)/10V	±200%	32767	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * n[rpm]/P202	
Current {03}	0-10V (10V=100%)	P203* U_{AOut}(V)/10V	±200%	32767	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * f[Hz]/P105	
Torque current {04}	0-10V (10V=100%)	P112* 100/ √((P203)²-(P209)²)* U_{AOut}(V)/10V	±200%	32767	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * I_q[A]/(P112)*100/ √((P203)²-(P209)²)	
Master value setpoint frequency {19} … {21}	0-10V (10V=100%)	P105* U_{AOut}(V)/10V	±100%	16384	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * f[Hz]/P105	
Speed from speed encoder {22}	0-10V (10V=100%)	P201/ (60/number of pole pairs)* U_{AOut}(V)/10V	±100%	16384	INT	4000_{hex} 16384_{dec}	$C000_{hex}$ -16385_{dec}	4000_{hex} * n[rpm]/ P201/(60/number of pole pairs)	

9.11 Maintenance and servicing information

In normal use, NORDAC SK 200E frequency inverters are maintenance free. Please note the "general data" in Section 8.1.

If the frequency converter is being used in a dusty environment, then the cooling-vane surfaces should be regularly cleaned with compressed air. If air intake filters have been built into the control cabinet, then these should also be regularly cleaned or replaced.

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 (rating plate) at hand.

Repairs

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

NORD Electronic DRIVESYSTEMS GmbH

Tjüchkampstraße 37

26605 Aurich, Germany

For queries about repairs, please contact:

Getriebebau NORD GmbH & Co. KG

Tel.: 04532 / 401-515

Fax: 04532 / 401-555

If a frequency inverter is sent in for repair, no liability can be accepted for any added components, e.g. such as mains cables, potentiometer, external displays, etc.!

Please remove all non-original parts from the frequency inverter.

NOTE

If possible, the reason for returning the component/device should be stated. If necessary, at least one contact for queries should be stated.

This is important in order to keep repair times as short and efficient as possible.

On request you can also obtain a suitable return goods voucher from Getriebebau NORD.

Internet information

You can also find the comprehensive manuals in German and in English on our Internet site.

www.nord.com

9.12 Abbreviations in this Manual

AS (AS1) AS Interface

BR .... Brake resistor

EEPROM Non-volatile memory

EMC ...... Electromagnetic compatibility

FI .... Frequency inverter

FI-(switch) Leakage current circuit breaker

I/O .... In-/ Out (Input / Output)

ISD .... Field current (current vector control)

LED .... Light-emitting diode

S .... Supervisor parameter, P003

SH .... "Safe Stop" function

SW .... Software version, P707

10 Keyword index

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Part No. 607 2002 / 1310

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