

## MANUAL

# **NORDAC *trio* SK300E**

Frequency inverter

**SK 300E-370-323-B ... SK 300E-111-323-B**

(1~ 200 - 240V, 0.37 - 1.1kW)

**SK 300E-370-323-B ... SK 300E-221-323-B**

(3~ 200 - 240V, 0.37 - 2.2kW)

**SK 300E-550-340-B ... SK 300E-401-340-B**

(3~ 380 - 480V, 0.55 - 4.0kW)



BU 0300 EN

# Getriebebau NORD

DRIVESYSTEMS GmbH & Co. KG





## NORDAC trio SK 300E Frequency inverter



### Safety and operating instructions for frequency inverters (as per: Low voltage guideline 73/23/EEC )

#### 1. General information

During operation, frequency inverters may have, depending on their protection class, live, bare, moving or rotating parts or hot surfaces.

Unauthorised removal of covers, improper use, incorrect installation or operation leads to the risk of serious personal injury or material damage.

Further information can be found in this documentation.

All transportation, installation and 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 erection, installation, commissioning and operation of this product and who have the relevant qualifications for their work.

#### 2. Intended use

Frequency inverters are components intended for installation in electrical systems or machines.

When being installed in machines, the drive power converter cannot be commissioned (i.e. implementation of the proper use) until it has been ensured that the machine meets the provisions of the EC directive 89/392/EEC (machine directive); EN 60204 must also be complied with.

Commissioning (i.e. implementation of the proper use) is only permitted when the EMC directive (89/336/EEC) is complied with.

The frequency inverters meet the requirements of the low voltage directive 73/23/EEC. The harmonised standards in prEN 50178/DIN VDE 0160, together with EN 60439-1/VDE 0660 Part 500 and EN 60146/VDE 0558 were applied for the frequency inverter.

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

#### 3. Transport, storage

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

Climatic conditions in line with prEN 50178 must be complied with.

#### 4. Installation

The installation and cooling of the equipment must be implemented as per the regulations in the corresponding documentation.

The frequency inverters must be protected against impermissible loads. In particular, no components must be bent and/or the insulation distances changed during transport and handling. Touching of electronic components and contacts must be avoided.

Frequency inverters have electrostatically sensitive components that can be easily damaged by incorrect handling. Electrical components must not be mechanically damaged or destroyed (this may cause a health hazard!).

#### 5. Electrical connection

When working on frequency inverters which are connected to high voltages, the applicable national accident prevention regulations must be complied with (e.g. VBG 4).

The electrical installation must be implemented as per the applicable regulations (e.g. cable cross-section, fuses, earth 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 frequency inverter documentation. These instructions must also always be observed for drive frequency inverters CE approval. Compliance with the limit values specified in the EMC regulations is the responsibility of the manufacturer of the system or machine.

#### 6. Operation

Systems where frequency inverters are installed must be equipped, where necessary, with additional monitoring and protective equipment as per the applicable safety requirements, e.g. legislation concerning technical equipment, accident prevention regulations, etc. Modifications to the frequency inverters using the operating software are permitted.

After the frequency inverter is disconnected from the power supply, live equipment components and power connections should not be touched immediately because of possibly charged capacitors. Comply with the applicable information signs located on the frequency inverter.

All covers must be kept closed during operation.

#### 7. Maintenance and repairs

The manufacturer documentation must be complied with.

**These safety instructions must be kept in a safe place!**

## Documentation

Designation: BU 0300 EN  
 Part. No.: 607 30 01  
 Device series: NORDAC *trio* SK 300E

## Version list

Designation of previous issues	SW status	Comments
BU 0300 DE, August 2005	V 1.6 R0	First issue
BU 0300 DE, December 2005	V 1.8 R0	3~230V implemented, plug-in design
BU 0300 DE, March 2006 Part. No. 607 3001 / 1306	V 1.8 R2	Wall mounting kit, technology units upgraded, parameters supplemented, Harting connector, ATEX Zone 22, Differentiation between IP55 and IP66 design
BU 0300 DE, June 2007 Part. No. 607 3001 / 2307	V 1.8 R2	Technical data of relay function changed, 5V max. 275mA, analogue setpoint input resistance, new SK PAR-2H / -2E version, UL data
BU 0300 DE, January 2008 Part. No. 607 3001 / 1208	V 1.9 R0	Incorporation of 1~230V operation, new braking resistors, UL data updated, P551 corrected

## Published by

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## Intended use of the frequency inverter

**Compliance** with the operating instructions is the **requirement for error-free operation** and the fulfilment of any warranty claims. **You must first read these operating instructions** before working with the device!

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

The trio SK 300E 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.

The trio SK 300E frequency inverters are devices for stationary installation on machines. All details regarding technical data and permissible conditions at the installation site must be complied with.

Commissioning (implementation of the intended use) is not permitted until it has been ensured that the machine complies with the EMC directive 89/336/EEC and that the conformity of the end product meets the machine directive 89/392/EEC (note EN 60204).

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## 1 General information

The construction series **NORDAC trio SK 300E** is a combination of geared motor and fully functional frequency inverter, with which process-based solutions can be implemented for decentral system concepts. The microprocessor-controlled frequency inverters are used to control the speed of three-phase asynchronous motors.

These devices are provided with sensorless vector current control system which constantly ensures an optimised voltage-to-frequency ratio based on the simulated operation of a single three-phase asynchronous motor. This has the following significance for the drive: Peak start-up and overload torques at constant speed.

Due to the modular technology units and customer units, this device series can be customised to meet individual requirements of customers.

Due to the numerous setting options, all three-phase motors can be operated. The output ranges from **0.55 to 4.0kW** (3~ 380V...480V), **0.37 to 2.2kW** (3~ 200V...240V) and **0.37 to 1.1kW** (1~ 200V...240V) with integrated line filter. The overload capacity is 150% for 30 seconds and 3 seconds for 200% peak loads.

The manual is based on the device software V1.9 R0 (P707) of the NORDAC trio SK 300E. 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>).

### 1.1 Overview

Properties of the basic device:

- High starting torque and precise motor speed control setting with sensorless current vector control
- Integrated EMC line filter for limit curve B1 as per EN55011
- Automatic measurement of stator resistance possible
- Integrated brake chopper for 4 quadrant drive
- Integrated controller for electromechanical motor brake
- 1 x digital input, 1 x relay message
- Additional customer unit modules with further inputs
- RS485 interface on M12 plug and on terminal
- Two separate parameter sets which are switchable online

The characteristics of the basic device with an additional technology unit or customer unit are described in Chapter 3, 'Options'.

### 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 implement a thorough assessment.

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

### 1.3 Scope of Delivery

Standard version:

- Frequency inverter, including adapter unit, attached to the motor (or geared motor) or the frequency inverter without adapter unit
- Protection class IP55 / IP66 (state when ordering)
- Blanking cover for technology unit slot (Chap. 3.2.9 )
- Integrated line filter for limit curve B1 as per EN55011 for frequency inverter installed on motor, A1 when mounted close to motor (Chap. 9.6 )
- Integrated brake chopper
- CD-ROM containing the manuals

Available accessories:

- Wall mounting kit (Chap. 2.2 )
- Braking resistor, for energy feedback (Chap. 2.7 )
- Interface converter RS232 → RS485 (additional description BU 0010)
- Various connector cables (Chap. 4.1 )
- NORD CON, PC parameterisation software (Chap. 5)
- ParameterBox, external operating panel with LCD clear text display, handheld variant SK PAR-2H or for control cabinet installation SK PAR-2E (Chap. 4; additional description BU 0040)

#### Technology unit, Chap. 3.2 :

<b>SK TU2-CTR</b>	ControlBox Detachable control panel, 4-figure 7-segment LED display, keyboard
<b>SK TU2-POT</b>	PotentiometerBox Additional module with switch (R/L) and infinitely variable potentiometer
<b>SK TU2-PBR</b>	Profibus, additional module for Profibus communication (1.5 MBaud)
<b>SK TU2-PBR-24V</b>	Profibus with external 24V supply (12 Mbaud)
<b>SK TU2-PBR-KL</b>	Profibus, screwed connection terminal with cover
<b>SK TU2-CAO</b>	CANopen, fieldbus interface
<b>SK TU2-DEV</b>	DeviceNet, fieldbus interface
<b>SK TU2-IBS</b>	InterBus, fieldbus interface
<b>SK TU2-AS1</b>	AS interface

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**NOTE:** Additional fieldbus manuals are available – BU 0020 ... BU 0090.

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#### Customer unit, Chap. 3.3 :

<b>SK CU2-BSC</b>	Basic I/O, medium number of control signals
<b>SK CU2-STD</b>	Standard I/O, high number of control signals

#### Note



Both a separate frequency inverter SK 300E (adapter unit must be ordered separately!) and an adapter unit for adaptation to the existing motor can be supplied as spare parts.

## 1.4 Safety and installation information

NORDAC *trio* SK 300E frequency inverters are equipment 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 work may only be carried out by qualified specialist electricians and with the electrical supply to the equipment disconnected. The manual must always be available for these persons and must be complied with.
- Local regulations for installation of electrical systems and accident prevention regulations must be complied with.
- The device may carry a dangerous voltage for up to 5 minutes after being switched off. The equipment may only be opened or the cover removed 5 minutes after the equipment has been disconnected from the power supply. All covers must be replaced before the mains voltage is switched back on again.
- Even during motor standstill (e.g. caused by a release 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 synonymous with electrical separation from the mains.



- **Warning**, under certain settings the frequency inverter can start 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 that comply with local regulations for large leak currents (> 3.5mA). VDE 0160 requires the installation of a second earthing conductor or an earthing conductor cross-section of at least 10mm<sup>2</sup>.
- Normal **FI-circuit breakers** are not suitable as the sole protection in three-phase frequency inverters when local regulations do not permit a possible DC proportion in the fault current. The FI circuit breaker must be an all-mains sensitive FI circuit breaker (type B) as per EN 50178 / VDE 0160.

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### 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

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### ATTENTION

The power unit can continue to carry voltages for up to 5 minutes after being switched off at the mains. Inverter terminals, motor cables and motor terminals may still be live!



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

### DANGER TO LIFE!

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

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**CAUTION**

- Only qualified specialist personnel are allowed entry and access to the device!
- The equipment may only be used for the purpose intended by the manufacturer. Unpermitted modifications and the use of spare parts and additional equipment that has not be bought from or recommended by the equipment manufacturer can lead to fire, electric shock and injury.
- Keep these operating instructions in an accessible location and ensure that every operator uses it!

## 1.5 Approvals

### 1.5.1 UL/cUL certification

„Suitable for use on a circuit capable of delivering not more than 5000rms symmetrical Amperes, 200...240Volts / 380...480Volts maximum, when protected by class J fuses, 600 Volts rated as described in Chapter 9.4”

Use 60/75° copper conductors only.

The UL/cUL certification only applies for a maximum ambient temperature of 40°C.

Wiring terminals shall be marked to indicate the proper connections and tightening torque:

Terminal	Tightening torque	Cable cross-section
Main supply (Molex 72 / Weko 983)	1,1 Nm / 10 lb-in	2,5 mm <sup>2</sup> / 20-12 AWG
Control terminals / MFR (Phönix MKDSN 1,5)	0,6 Nm / 5,3 lb-in	1,5 mm <sup>2</sup> / 30-14AWG
Motor / Brake (Phönix GMKDS 3)	0,6 Nm / 5,3 lb-in	1,5 mm <sup>2</sup> / 30-12AWG



*UL File: E171342*

### 1.5.2 European EMC guideline

If the NORDAC *trio* SK 300E is installed according to the recommendations of these operating instructions, it meets all EMC directive requirements, in accordance with the EMC product standard for motor-operated systems EN 61800-3.



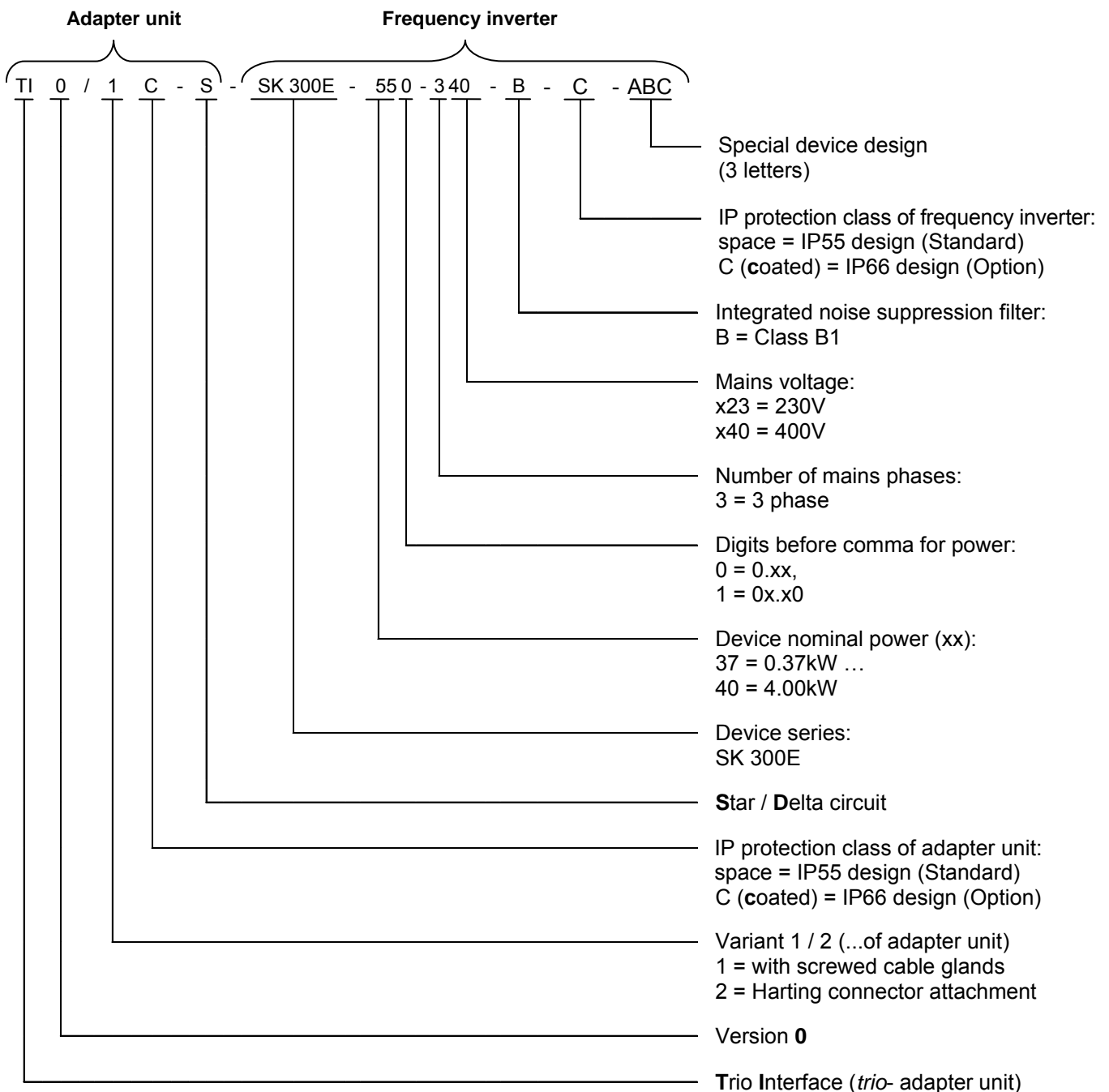
## 1.6 Nomenclature / Type code

The **NORDAC *trio* SK 300E** frequency inverter has the same nomenclature as other NORDAC frequency inverters. The information contained therein can be determined in the same way. The type classification of the frequency inverter contains the device type, the nominal output, data on mains voltage, the noise suppression filter, protection class and any special device designs. The nomenclature of the adapter unit, which represents the link between the motor and frequency inverter, can be found in the designation of the geared motor. This clearly identifies a drive unit with SK 300E. The nomenclature contains the abbreviation of the adapter unit, version and variant of the components, the protection class and the motor winding circuits.

### NOTE



The nomenclature must always be provided in orders and for service and support cases!



## 1.7 Design with protection class IP55 / IP66

The frequency inverter **NORDAC trio SK 300E** can be ordered in any size and therefore any power stage with the protection classes IP55 (Standard) or IP66 (Option).

The protection class IP66 must always be included in the order when ordering!

There are no restrictions in both protection classes regarding the function of the available adapter units, technology units or customer units (see the applicable chapters). The type designation of the SK 300E and the modules in the protection class IP66 is given an additional code "**-C**" (coated → coated board) to differentiate the IP55 and IP66 protection classes.

### IP55 design:

The IP55 design of the SK 300E is generally available as the **standard** design. Both variants (motor-integrated, close to motor) are available here. In addition, all adapter units, technology units and customer units are available for this design.

### IP66 design:

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

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#### Note



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

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#### Special measures:

- Coated circuit boards
- Low pressure tests
  - A free M12 screwed connection is required for low pressure testing. Following successful testing, a membrane valve is inserted here. These screw connections are therefore not available to the customer.
- Membrane valve for pressure compensation during temperature changes

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#### Note



It must be ensured in the IP66 design that the cable lines and cable connections are carefully matched so that no leaks occur in the SK 300E or any other problems occur that could affect the maintenance of the IP66 protection class!

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## 2 Assembly and installation

### 2.1 Motor-integrated and close to motor layouts

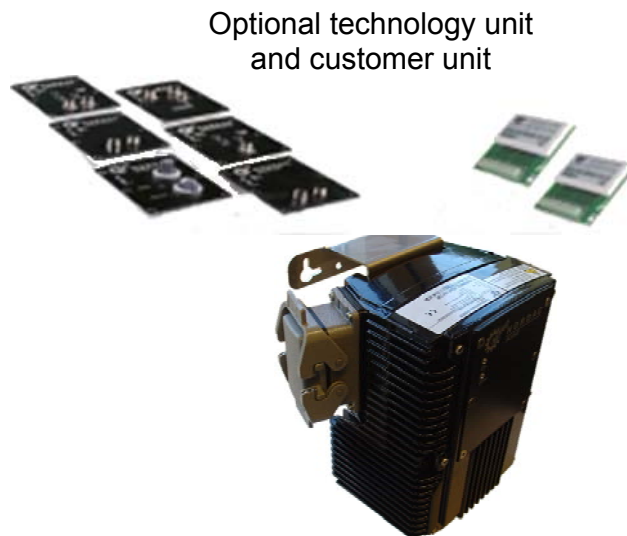
#### **Motor-integrated layout:**

In the motor-integrated version, the SK 300E frequency inverter is mounted directly on the motor with an adapter unit (SK T1 0/1 or 0/2) and is therefore integrated in the drive. This version is the standard version.



#### **Close to motor design:**

The close to motor SK 300E design means that the frequency inverter can be mounted close to the motor, i.e. on a wall or a machine scaffold for example. A wall-mounting kit is required for this (see Chap. 2.2).



## 2.2 Wall mounting kit

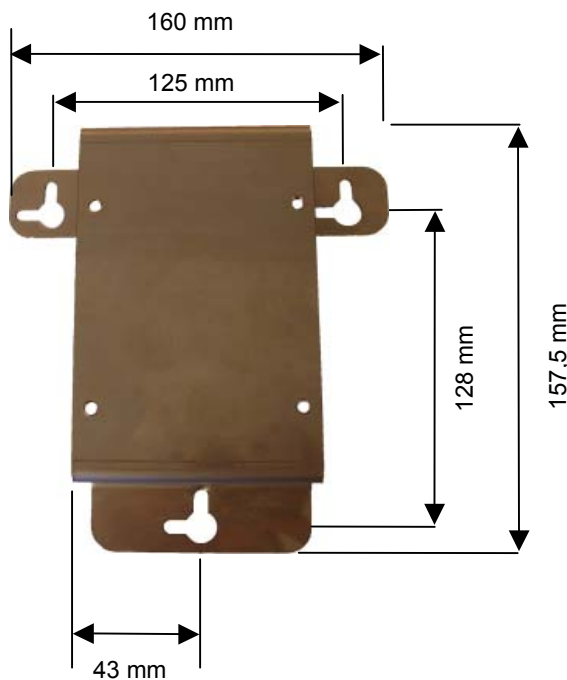
(SK WMK-DA1, Part. No. 275115100)

The geared motor and inverter can be installed separately, using the wall mounting kit, so that the SK 300E can be used close to the motor. With this option the frequency inverter can be mounted directly on a wall or machine scaffold with a very high protection class of IP55 / IP66.

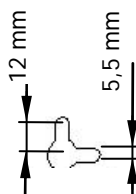


### Installation

The wall mounting kit must be fitted using the hole pattern below.



Fastening holes in detail:



### Commissioning

The wall-mounting kit (SK WMK-DA1) is a modular design system, i.e. an adapter unit must be selected first (SK TI 0/1 or SK TI 0/2) so that the SK 300E frequency inverter can be fitted to the wall-mounting kit.

When delivered, the wall-mounting kit with the SK 300E is ready for connection to mains, motor and control cables. The frequency inverter only needs to be pushed on after the cables are connected.

Different datasets from the frequency inverter and "electronic name plate" will be displayed in the operating display (E8.6) and by the red LED during initial commissioning only. This display serves to inform the operator; the message is acknowledged by an Enable signal and the datasets are then synchronised. After the factory settings are loaded (P523) and the motor data are set, the frequency inverter is ready to be switched on.

Module contents



### Note



Data for power derating in the close to motor version at high ambient temperatures can be found in Chap. 9.1 General Data.

## 2.3 Installation

An adapter unit with the correct connection terminals and appropriate plug-in connections for the frequency inverter is always required for the SK 300E. There are two types of adapter unit, the SK TI 0/1 (-C) and SK TI 0/2 (-C), and their different properties are described in the following chapters.

The adapter units are both suitable for the inverter sizes 1 and 2.

### 2.3.1 Adapter unit SK TI 0/1

(SK TI 0/1, Part. No. 275115010)

(SK TI 0/1-C, Part. No. 275175010)

The adapter units **SK TI 0/1** and **SK TI 0/1-C** are cast enclosures which are fitted with different sizes of cable glands on both sides. They are fully fitted with blind plugs.

The following are available:

3 screw connections M12 (e.g. brake cable), 2 connections in the SK TI 0/1-C

4 screw connections M20 (e.g. supply voltage)

1 screw connection M16 (for connection socket M12 of the ParameterBox SK PAR-2H)

Components of the adapter unit TI 0/1:



Cast enclosure



CIU - customer interface unit



M12 socket



Cable for motor  
U-V-W connection



Cable for motor PTC



Screw accessories

#### ATTENTION



The adapter unit SK TI 0/1 is available for the protection class IP55 and the adapter unit SK TI 0/1-C for IP66. Otherwise, the functionality and dimensions of both adapter units are identical. However **special measures** (see Chap. 1.7) are implemented in the IP66 version to maintain this protection class.

### 2.3.2 Adapter unit SK TI 0/2

(SK TI 0/2, Part. No. 275115020)  
 (SK TI 0/2-C, Part. No. 275175020)

The adapter units **SK TI 0/2** and **SK TI 0/2-C** have 2 mounting flanges on the sides to which various adapter plates with different types of cable glands or motor connectors can be mounted. The standard design always has 2 x M12 screw connections and an adapter plate with the following screw connections on the one side:

2 screw connections M20 (e.g. supply voltage)

1 screw connection M16 (for connection socket M12 of the ParameterBox SK PAR-2H)

The adapter plate with the screw connections is located at III in the standard design.



Cast enclosure



CIU - customer interface unit



M12 socket



Cable for motor  
U-V-W connection



Cable for motor PTC



Screw accessories

#### ATTENTION



The adapter unit SK TI 0/2 is available for the protection class IP55 and the adapter unit SK TI 0/2-C for IP66. Otherwise, the functionality and dimensions of both adapter units are identical. However **special measures** (see Chap. 1.7) are implemented in the IP66 version to maintain this protection class.

### 2.3.3 Motor connector variants



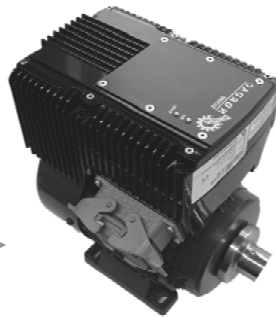
Harting HAN 10E



Harting HAN Q8

#### Motor-mounted (motor-integrated)

**EITHER:**  
Power input (LE)  
 → Mains voltage



#### Wall mounting

**EITHER:**  
Power input (LE)  
 → Mains voltage



**OR:**  
Motor output (MA)  
 → Motor line



or motor connector (MA)  
 → Motor connection



Motor connector	Nomenclature	Function	Part. No.
HAN 10E	H10E LE	Power input	275135000
	H10E MA	Motor output	275135020
HAN Q8	HQ8 LE	Power input	275135030
	HQ8 MA	Motor output	275135050



### 2.3.4 Adapter plates for SK TI 0/2

The other side of the cast enclosure is available without adapter plate in the standard version. This allows various adapter plates with different types of cable glands or system connectors to be mounted (e.g. Harting connector). In addition, it is possible to mount the components listed in the table below to the respective mounting flanges, replacing the standard adapter plate:

**Important! Generally, only the mounting of one system connector is possible!**

#### Optional adapter plates:

**SK DA 4x M16,**  
Part No. 075119000



**SK DA 1x M25, 2x M16,**  
Part No. 075119020



**SK DA 2x M20, 1x M16,**  
Part No. 075119010



**SK DA Blindplatte,**  
Part No. 075119040



	Type	Part. No.
Adapter plates	SK DA 4x M16	275119000
	SK DA 2xM20, 1xM16	275119010
	SK DA 1xM25, 2xM16	275119020
	SK DA Blind plate	275119040

### 2.3.5 Mounting the adapter unit

The SK 300E frequency inverter and the (SK TI 0/1 (-C) or SK TI 0/2 (-C)) adapter unit are always completely mounted and tested when a *trio* drive (gears + motor + frequency inverter) is delivered. The adapter unit can also be ordered separately for subsequent mounting on an existing motor or to replace an older motor-mounted *trio* frequency inverter.

#### Note



However, the IP66-conform SK 300E must be mounted at NORD as special measures have to be implemented. IP66 components retrofitted on site cannot ensure that this protection class is guaranteed.

The module "Adapter unit" (SK TI 0/1 (-C) or SK TI 0/2 (-C)) contains the following components:

- Cast enclosure (dependent on type of adapter unit)
- customer interface unit (circuit board)
- M12 socket with system connector for RS485 interface
- Screw accessories for attaching the customer interface unit
- Pre-fabricated cable for motor and PTC connections

#### Procedures:

1. Screw the M12 socket into the connection unit in the cast enclosure, ensuring that it is tight.
2. Mount the cast enclosure on the terminal box stub of the NORD motor with the existing screws in place of the terminal box. Position the cast enclosure with the dome facing the motor A-side. Retain the motor's terminal block. Check the adaptability for different motor manufacturers.
3. After the bridges for the correct motor circuit are set, connect the pre-fabricated cables for motor connection and PTC connection to the respective connection points on the motor.
4. After the cables for the motor connection and PTC are connected to the appropriate terminals on the customer interface unit (pin assignment, see Chap. 2.6.1 ), the customer interface must be mounted with the screw accessories in the cast enclosure. It must be ensured that the insulation foil lies on the inner side of the cast enclosure dome. Both tabs must be pointing to the inside of the cast enclosure.
5. Connect the M12 socket system connector to the appropriate slot (see Fig. 2)

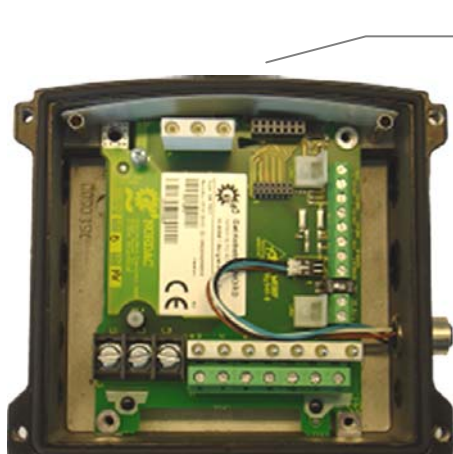


Fig. 1: Complete adapter unit

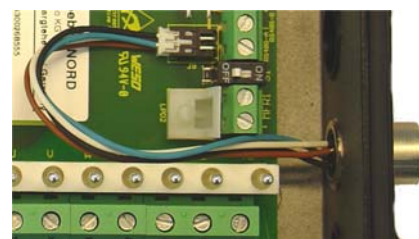


Fig. 2: M12 socket connection

### 2.3.6 Mounting the SK 300E frequency inverter

The frequency inverter must first be removed before it can be electrically connected. To do this, undo the 4 fastening screws (Fig. 1) so that the frequency inverter can be lifted off vertically (Fig. 2). After connecting the supply voltage, the frequency inverter must be vertically reattached (Fig. 3), beginning with the plugs on the rating plate side which ensure that the inverter is positioned correctly. Further information about attaching customer units can be found in **Chap. 3.3.3 “Mounting the customer unit”**

In order to achieve the maximum protection class IP55 / IP66, it must be ensured that all fastening screws of the frequency inverter are tightened in the specified sequence from screw 1 to screw 4 and with the torque specified in the table below. Use appropriate screwed connections for the connection line cable cross-section.

Dissipation of heat generated by the inverter occurs via convection. The driven motor must have normal ventilation. Heat dissipation must not be hindered by significant contamination.

A cover plate with 2 LEDs is normally located on the top side of the frequency inverter. These LEDs show the status of the frequency inverter. Note that the green LED constantly lights when the mains voltage is applied, and the red LED according to the error message, e.g. 5 flashes - pause - 5 flashes, etc. for the error E005.

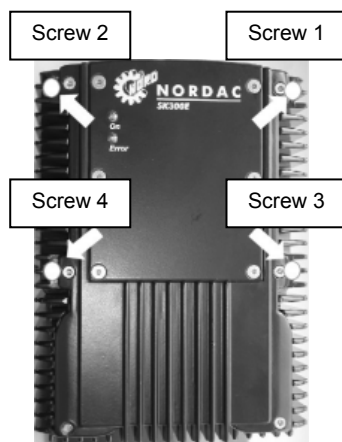


Fig.1: Fastening screws



Fig.2: Removing the SK 300E

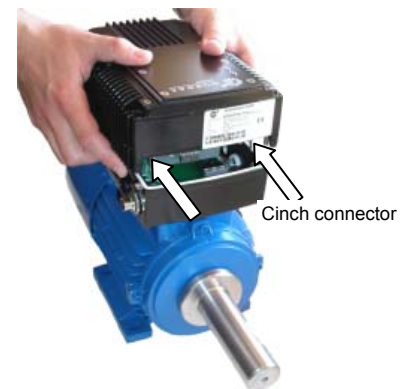


Fig.3: Attaching the SK 300E

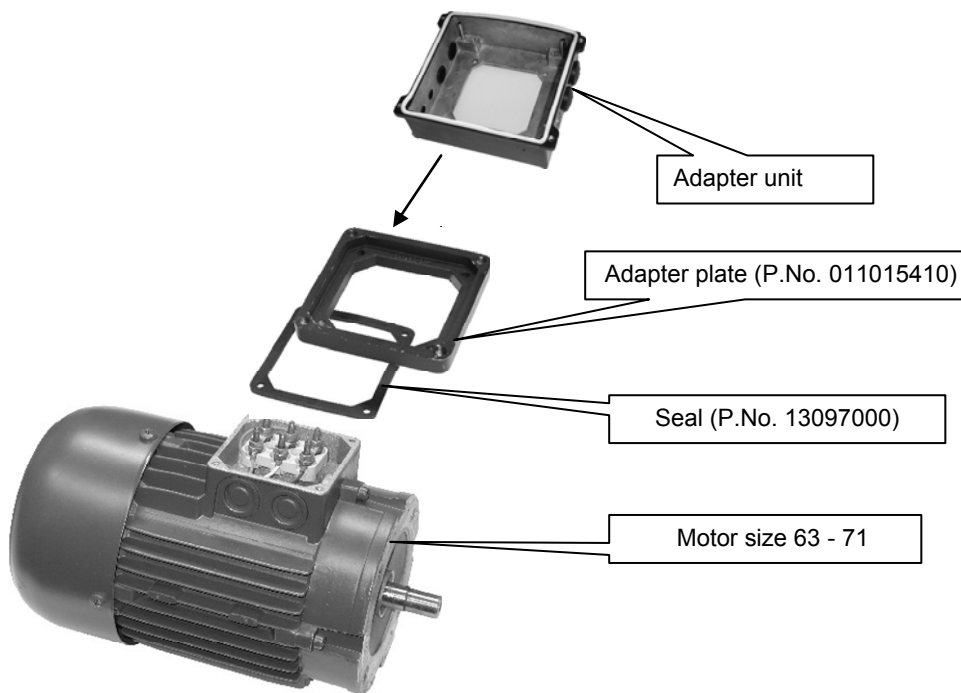
Frequency inverter size	Screw size	Tightening torque
S 1	M5 x 35	3.5Nm ± 20%
S 2	M5 x 50	3.5Nm ± 20%

### 2.3.7 Retrofitting an SK 300E frequency inverter

The SK 300E frequency inverter can only be mounted on existing motors when the dimensions of the terminal box stub matches the dimensions of the adapter unit SK TI 0/1 (-C) or SK TI 0/2 (-C). In order to guarantee the maximum protection class IP55 / IP66 of the frequency inverter for the entire *trio* unit, the protection class of the motor must be modified accordingly.

The adapter unit can be directly attached to size 80 - 100 NORD motors, an additional adapter plate/spacer with additional seal/cable is required for the sizes 63 - 71 and 112.

NORD motor sizes	SK 300E attachment	Part. No.	
SK 63- 71	Attachment with adapter plate 63 – 71	011015410	
	(+ additional frame seal)	013097000	
SK 80 - 100	Direct attachment of adapter unit		
SK 112	Attachment with spacer S 112	013035450	Kit 075115120
	(+ additional terminal box - frame seal)	013097000	
	Cable kit SK 300E for motor S 112	075115090	



**Important! The adaptability for other types of motor must be checked individually!**

If a *trio* SK 300E is fitted on site without assistance on an existing motor, the notes regarding **Adapter unit assignment** in **Chap. 2.6.1** must be complied with.

### 2.4 Painting

The SK 300E frequency inverter and the corresponding adapter unit are covered in a black powder coating. These components **may not be painted over!!!** The geared motor is painted separately.

## 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. Should limit values in excess of the EMC guidelines be required, then the following guidelines may be useful.

- (1) Ensure that all devices are securely earthed using short earthing cables that have large cross-sections and which are connected to a common earthing point or earthing rail. It is especially important that every control device connected to the frequency inverters (e.g. an automation device) is connected, using a short cable with large cross-section, to the same earthing point as the inverter itself. Flat conductors (e.g. metal clamps) are preferable, as they have a lower impedance at high frequencies.
- (2) The PE cable for the motor controlled via the frequency inverter should be connected directly to the earthing connection linked to the enclosure together with the PE for the relevant frequency inverter feeder. The presence of a central earthing bar in the control cabinet and the grouping together of all PE conductors to this bar normally ensures safe operation.
- (3) Where possible, shielded cables should be used for control loops. Carefully terminate cable ends and ensure that the wires do not run over longer sections unshielded.
- (4) The shields of analogue setpoint cables should only be earthed on one side on the frequency inverter.
- (5) 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.
- (6) Ensure that the contactors in the cabinet are interference protected, either by RC circuits in the case of DC contactors or by free-wheeling diodes for AC contactors, **whereby the interference traps 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.
- (7) Use shielded or armoured cable for the load connections and earth the shielding/armour at both ends (if the motor is not integrated). If possible, directly at the inverter PE.
- (8) A noise suppression filter is always present in the standard device. If the frequency inverter is mounted directly on the motor, then noise suppression grade Class B1 is achieved. If the frequency inverter is mounted close to the motor (e.g. wall mounted), noise suppression grade Class A1 is achieved with a motor cable length of up to 15m (shielded cable).
- (9) Select the lowest possible pulse frequency. This reduces the intensity of the electromagnetic interference generated by the frequency inverter.

**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 case should they be laid in the same protective pipes/installation ducts.

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

## 2.6 Electrical connection

**WARNING** THESE DEVICES MUST BE EARTHED.



Safe operation of the devices presupposes that qualified personnel mount and operate it in compliance with the instructions provided in these operating instructions.

In particular, the general and regional mounting and safety regulations for work on high voltage systems (e.g. VDE) must be complied with as must the regulations concerning professional use of tools and the use of personal protection equipment.

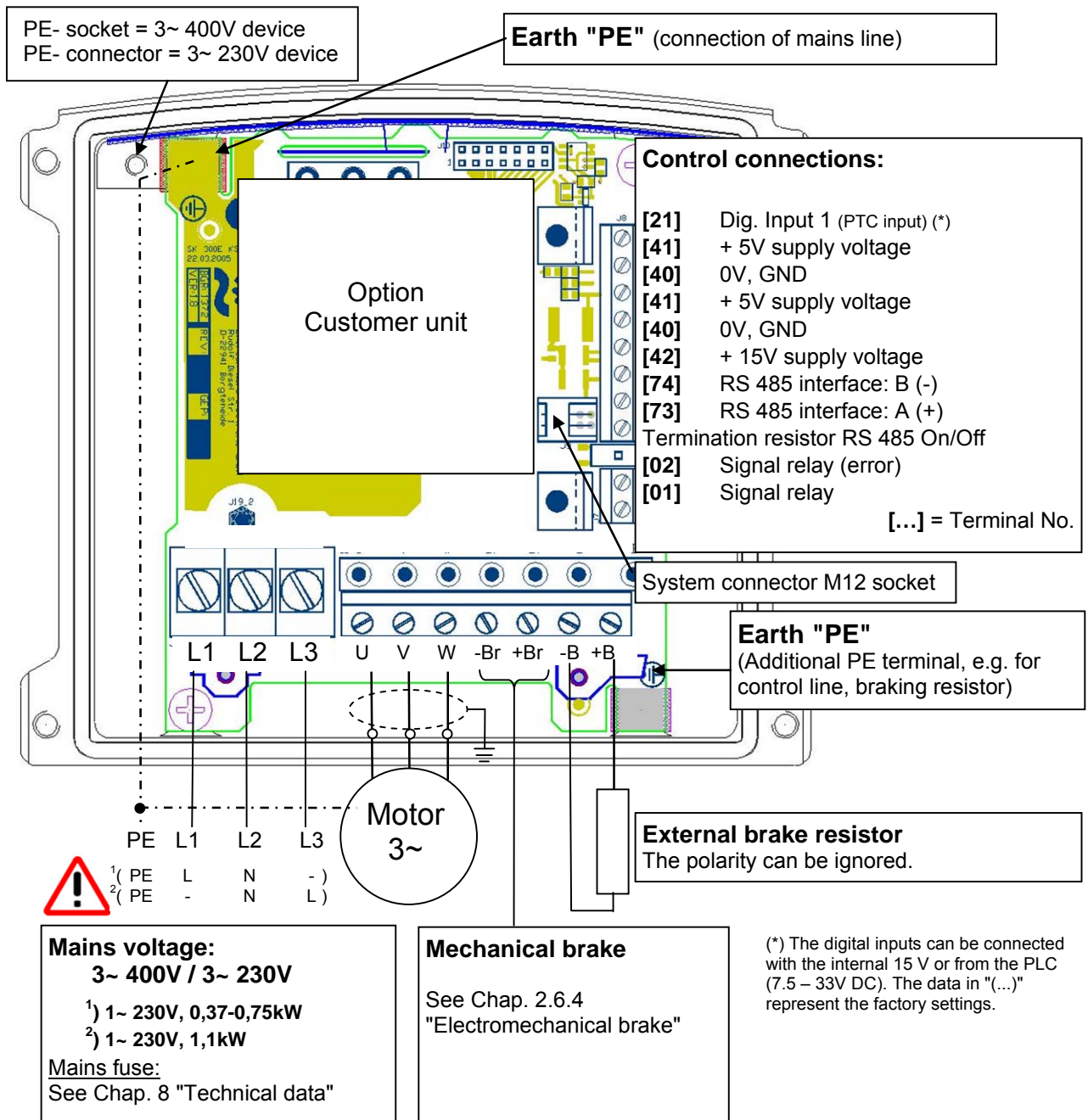
Dangerous voltages can be present at the line input and the motor connection terminals even when the inverter is switched off. Always use insulated screwdrivers on these terminal fields.

Ensure that the input voltage source is not live before setting up or changing connections to the unit.

**Ensure that the motor is designed for the correct connection current.**

### 2.6.1 Assignments for the adapter unit

Maximum capacity			
	Supply voltage + 5V	max. 275 mA	
	Supply voltage + 15V	max. 100 mA	
	Signal relay	max. 24V / 500 mA	
Connection terminal data	Type	Tightening torque	Cable cross-section
Mains connection	Molex 72 / Weko 983	1.1 Nm / 10 lb-in	2.5 mm <sup>2</sup> / 20-12 AWG
Controller connections	MFR: Phönix MKDSN 1.5	0.6 Nm / 5.3 lb-in	1.5 mm <sup>2</sup> / 30-14 AWG
Motor connection Mechanical brake Brake resistor	Phönix GMKDS 3	0.6 Nm / 5.3 lb-in	1.5 mm <sup>2</sup> / 30-12 AWG
Cable connections	M12 - M16 - M20 - M25	2.5 - 6 - 8.5 - 10Nm	



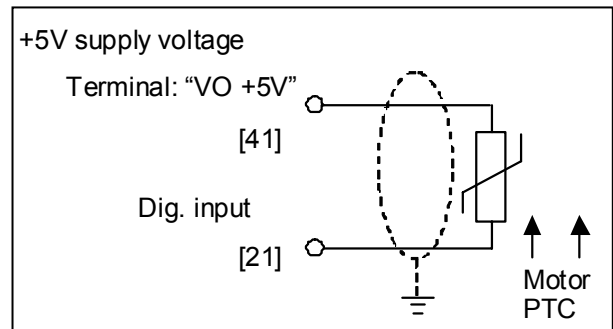
### 2.6.2 Important information for single phase operation (1~230V)

1. Mains supply is implemented via terminals L1 (L) and L2 (N) for 0.37-0.75kW SK 300E, or L3 (L) and L2 (N) for 1.1kW SK 300E.  
This is important for the correct function of the brake rectifier, amongst others.
2. Higher input currents occur with single phase operation. (Chap. 9.2)
3. The mains voltage monitoring must be switched off (Parameter P538 = 0).

### 2.6.3 Motor temperature protection

The only reliable motor over-temperature protection is a temperature sensor installed inside the motor winding (PTC resistor, PTC) This can be connected to a digital input and evaluated. A Klixon (bimetal switch) is also possible.

Normally, the motor of a *trio* SK 300E is equipped with a PTC resistor. In the basic frequency inverter configuration (without customer unit), 1 digital input is available. This should normally be used as the PTC input and is set up as the factory setting.



Switching on can take place directly with the supply voltage (P428 "Automatic start up" 2 = immediate with mains), via a bus connection, with the ParameterBox, the potentiometer option or with the NORD CON operating software. If additional control signals are required, then the device must be upgraded with a customer unit (Basic I/O - SK CU2-BSC, Standard I/O - SK CU2-STD).

If a different digital input is used for the PTC when a customer unit is added, then the relevant parameter P420...P424 of the digital input must be set to the set value 13.

### 2.6.4 Electromechanical motor brake

An output voltage is generated by the frequency inverter at the terminals -Br/+Br to actuate an electromechanical motor brake (see Chap. 2.6.1 Assignments for the adapter unit). This is dependent on the supply voltage present in the frequency inverter. The allocation is as follows:

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

The allocation of the correct brake or brake coil voltage must be taken into account in the design with reference to the frequency inverter mains voltage.



## 2.7 Brake resistor

During dynamic braking (frequency reduction) of a three-phase motor, electrical energy is returned to the inverter. In order to avoid overcurrent switch-off of the frequency inverter, the integrated brake chopper can convert the returned energy into heat by connecting an external braking resistor.

2 screw connections, which should be fitted with the appropriate seals, are enclosed for mounting the braking resistor on the frequency inverter (M20 for the cable and M12 for the holder).

Suitable installation material is provided to mount the brake resistor on the adapter unit TI 0/2.



### 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.

### Contents of the module (TI 0/1)



**Braking resistor**



**Screw connections,**  
for fastening the  
braking resistor

Frequency inverter type	Resistor type	Resistance	Continuous rating	*) Pulse output (approx.)	Connection leads, 400mm	Protection type
SK 300E-550-340-B ... SK 300E-151-340-B	SK BR3-120/100-TI 0/1 Part. No. 275140010	120 Ω	100 W	1.0 kW	FEP AWG 14/19 wh,gy; PTFE AWG 12/19 gn	IP67
SK 300E-221-340-B ... SK 300E-401-340-B	SK BR3-82/200-TI 0/1 Part. No. 275140020	82 Ω	200 W	2.0 kW		
SK 300E-550-340-B ... SK 300E-151-340-B	SK BR3-120/100-TI 0/2 Part. No. 275140030	120 Ω	100 W	1.0 kW		
SK 300E-221-340-B ... SK 300E-401-340-B	SK BR3-82/200-TI 0/2 Part. No. 275140040	82 Ω	200 W	2.0 kW		

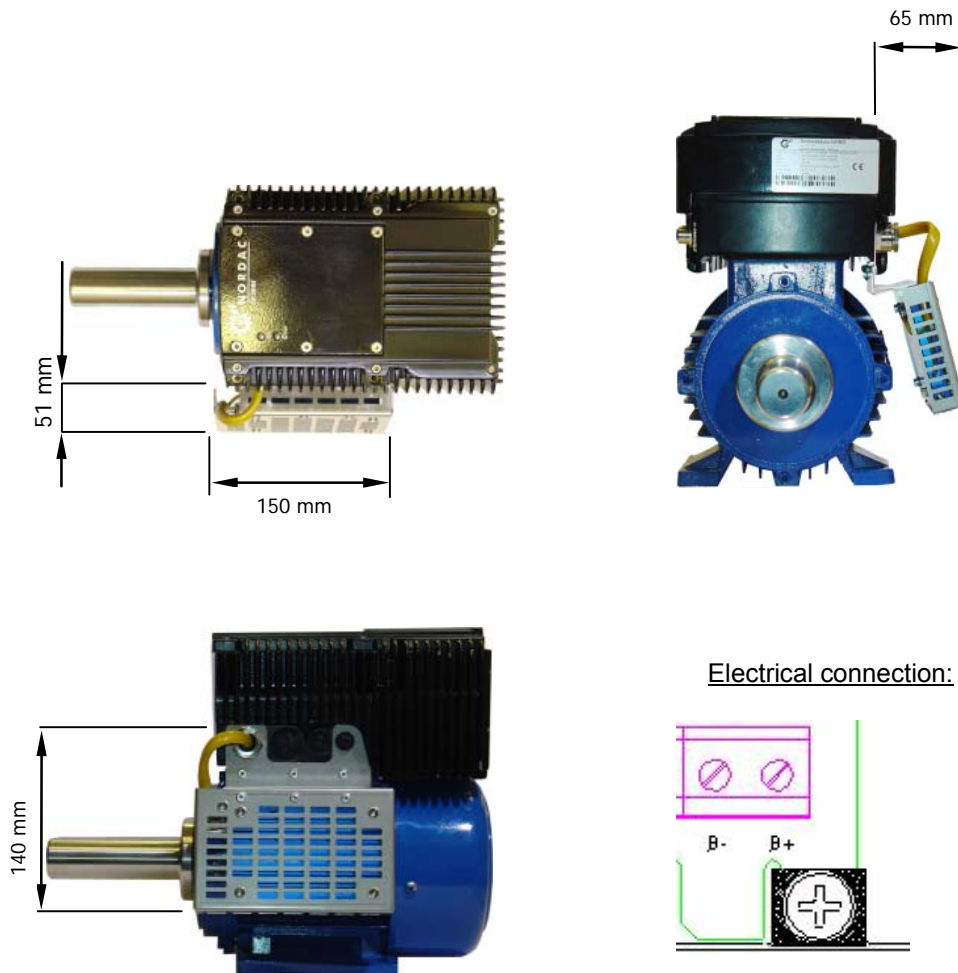
\*) permitted, depending on application, max. 5% ED / 120s (700VDC)

### 2.7.1 BR dimensions

Frequency inverter type	Resistor type	L	W	D	Hole spacing
SK 300E-550-340-B ... SK 300E-151-340-B	SK BR3-120/100-TI 0/1	150	160	65	75
SK 300E-221-340-B ... SK 300E-401-340-B	SK BR3-82/200-TI 0/1	255	160	65	75
SK 300E-550-340-B ... SK 300E-151-340-B	SK BR3-120/100-TI 0/2	150	160	75	82
SK 300E-221-340-B ... SK 300E-401-340-B	SK BR3-82/200-TI 0/2	255	160	75	82

All dimensions in [mm]

**Dimensions** (here for frequency inverter size 1 and TI 0/1):



Wire colour	Connector terminal
Brown	+B
White	-B
Green/Yellow	PE

→ See also Chap. 2.6.1 "Assignments for the adapter unit"

## 2.8 ATEX Zone 22 for SK 300E (400V devices only)

### General information

The NORDAC *trio* SK 300E can be used in hazardous areas with a suitable modification. It is important that all safety information given in the operating instructions are strictly complied with for person and property reasons. This is essential to avoid hazards and damage.

### Qualified personnel

It is assumed that all work regarding transport, mounting, installation, commissioning and maintenance is carried out by qualified personnel. Qualified personnel are those persons who, based on their education, experience, training and knowledge of applicable standards, specifications, accident prevention regulations and operating conditions, are authorised to implement the relevant activities required to commission the frequency inverter. In addition, knowledge of first aid measures and the local rescue facilities is necessary.

---

#### ATTENTION



All work must be carried out only when the system is in an electrically voltage-free state.

If the frequency inverter is connected to a motor and a gear, the Ex designations of the motor and gear must also be taken into account!

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### Safety information

The increased danger in areas with combustible dust requires that the general safety and commissioning instructions are strictly complied with. The drive must comply with the specifications in the **Project outline No. 6052101**. Explosive dust concentrations can cause explosions if ignited by hot or sparking objects and this can cause severe or even lethal injuries to persons and significant damage to property.

It is absolutely essential that the persons authorised to use these motors and frequency inverters in hazardous areas are trained in their correct use.

---

#### ATTENTION



The mains voltage must always be switched off and secured against being switched on again before opening the frequency inverter to connect the electrical lines or any other work!

Higher temperatures than the maximum permitted surface temperature of the enclosure may be present inside the frequency inverter and motor. The frequency inverter must therefore never be opened in hazardous dust atmospheres or removed from the motor!

Unpermitted high dust deposits may not be allowed to build up as they restrict the cooling of the frequency inverter!

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**Note: Repairs must only be carried out by Getriebbau NORD.**

### 2.8.1 Modified SK 300E for compliance with category 3D

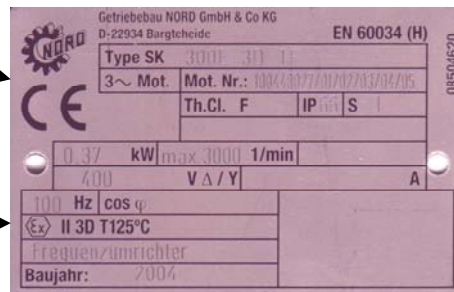
Only a modified frequency inverter is permissible for operating an SK 300E in the ATEX Zone 22. This modification may only be implemented by NORD. The category 3D SK 300E can be recognised by the closed technology unit cover (no LEDs) and by the rating plate on the outside of the frequency inverter.



SK 300E with mounted rating plate and without LEDs

**Data on rating plate:**

Type SK: 300E 3D TF  
 Mot. No.: Parts No. FI / Ident. No. FI  
 IP: 55  
 KW: According to frequency inverter rating plate  
 rpm: max. 3000  
 V D/Y: 400 (FI supply voltage)  
 Hz: max. 100  
 S: 1 (only with SK300E-201-340-B = 3)  
 II 3D T125°C: Frequency inverter  
 Year of manufacture: Month/Year



**Ex** II 3D T125°C

### 2.8.2 Options for ATEX Zone 22

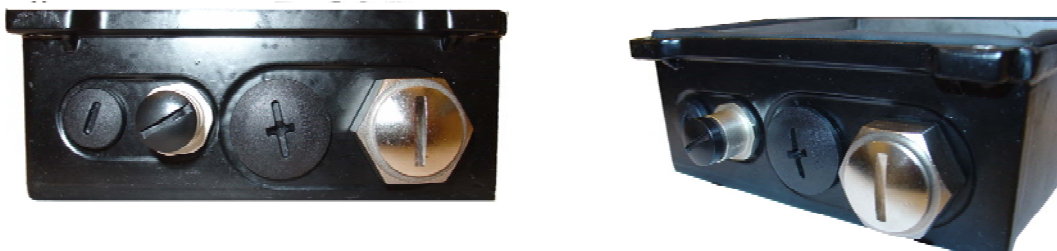
To ensure an ATEX-conform NORDAC *trio* SK 300E system, permission for hazardous areas must be available for the optional modules.

- All SK TU2-... technology units are **not** authorised.
- All SK CU2-... customer units are authorised.
- ParameterBox for operation is authorised.
- SK ATX-POT ATEX potentiometer is authorised.
- External braking resistor SK BR3-120/100-TI 0/1 is **not** authorised.
- Adapter unit SK TI 0/2 for Harting attachment is **not** authorised.

### 2.8.2.1 ATEX potentiometer

(SK ATX-POT, Part. No. 275142000)

The 3D category SK 300E can be equipped with an ATEX-conform potentiometer which can be used for setpoint adjustments (e.g. speed) on the device. The potentiometer is inserted in one of the M20 screw connections.



The selected setpoint can be adjusted with a screwdriver. This component meets the ATEX requirements due to the screw-on sealing cap. Continuous operation is only permitted with closed sealing cap.

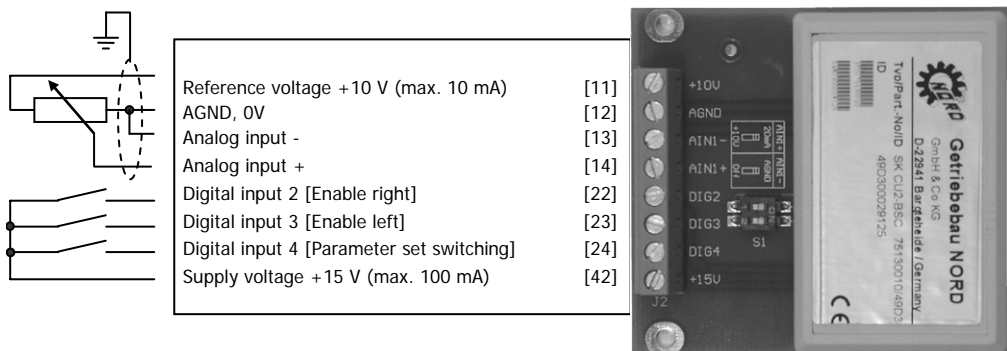


Resistance of potentiometer 10 kOhm

Wire colour on potentiometer	Name	Terminal
Red	+10V	[11]
Black	AGND /0V	[12]
Green	Analog input+ Analog input 1	[14]

**NOTE: When using a potentiometer with the frequency inverter SK 300E, a customer unit Basic I/O or Standard I/O is always required!**

**Example assignment for a Basic I/O (SK CU2-BSC):**



### 2.8.3 Commissioning information

The frequency inverter and motor are suitable for use in Zone 22 according to their designation - non-conductive dusts.

The designation is as follows:



In Zone 22, the cable entries must meet at least protection class IP 55. Unused apertures must be sealed with blind plugs (minimum protection class IP 55).


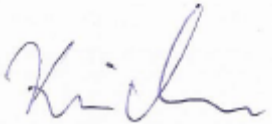

The motors are protected against overheating by the frequency inverter. This is implemented by evaluation of the motor PTC by the frequency inverter. To ensure this function, the digital input 1 must be set to the function "PTC" (P420 = 13). In addition, it must be ensured that a NORD motor is selected from the motor list (P200). If a motor from a different manufacturer is used, the motor parameter data (P201 to P207) must be compared with the motor name plate. In addition, the frequency inverter must be parameterised so that the motor cannot be operated with a speed greater than 3000 rpm. The "maximum frequency" for a four pole motor must be set to a value smaller than or equal to 100Hz (P105 ≤ 100). The maximum permissible drive speed of the gears must also be taken into account here. In addition, the "I<sup>2</sup>t-Motor" monitoring must be switched on in parameter P535=1.

#### Necessary parameter settings in overview:

Parameter	Setting value	Factory setting	Description
<b>P105</b> Maximum frequency	≤ 100 Hz	[50]	This data is based on a four pole motor. Normally, the value may only be so big that a motor speed of 3000 rpm is not exceeded.
<b>P200</b> Motor list	Select the appropriate motor output	[0]	If a NORD motor is used, the preset motor data can be called up.
<b>P201 – P207</b> Motor data	Data as per name plate	[xxx]	If a motor from another manufacturer is used, the motor data on the rating plate must be entered.
<b>P420</b> Function Dig. input 1	[13] PTC input	[13]	The digital input 1 must be parameterised as the PTC to ensure temperature monitoring of the motor.
<b>P535</b> I <sup>2</sup> t motor	[1] switched on	[0]	The I <sup>2</sup> t monitoring of the motor must be switched on.

**Note:** Details regarding the permissible option modules for hazardous areas (ATEX Zone 22) with the frequency inverter NORDAC *trio* SK 300E can be found in Chap. 2.8.2.

## 2.8.4 EC declaration of conformity

<b>Getriebebau NORD GmbH &amp; Co. KG</b> Rudolf-Diesel-Str. 1, D-22941 Bargteheide, Germany Phone: +49 (0) 4532-401-0 Fax: +49 (0) 4532-401-555 <a href="http://www.nord.com">http://www.nord.com</a>																						
<b>Declaration of EC-Conformity</b>  in the sense of the directive 94/9/EC annex VI																						
Getriebebau Nord GmbH & Co. KG herewith declares, that the inverters of the product range  <p align="center">- SK 300E-xxx-340-B-3D-T125 -</p> product classification: group II, category 3D (zone 22), temperature class: 125 °C  are conform with the following regulation:  <table border="0"> <tr> <td><b>Directive on</b></td> <td align="right"><b>94/9/EC</b></td> </tr> <tr> <td><b>equipment and protective systems</b></td> <td></td> </tr> <tr> <td><b>for use in explosive atmospheres</b></td> <td></td> </tr> </table> Applied Standards: <table border="0"> <tr> <td>EN 50281-1-1:1998</td> <td>Electrical apparatus for use in the presence of combustible dust</td> </tr> <tr> <td>EN 50281-1-2:1998</td> <td>Electrical apparatus for use in the presence of combustible dust</td> </tr> <tr> <td>EN 50014:1997</td> <td>Electrical apparatus for potentially explosive atmospheres General requirements</td> </tr> <tr> <td>EN 60034-5:2001</td> <td>Specification for degrees of protection provided by enclosure (IP-Code)</td> </tr> <tr> <td>EN 60529:1991</td> <td>Specification for degrees of protection provided by enclosure (IP-Code)</td> </tr> </table> <b>Other important and necessary documentation:</b> <table border="0"> <tr> <td>Project outline</td> <td>No. 6052101 Enterprise of explosion-proof motors of the category 3D in accordance with RL 94/9/EC at frequency inverters</td> </tr> <tr> <td>Supplement to the Operating Instructions</td> <td>BU 0310 GB, no. 6073101/4704 Instructions for the starting-up and maintenance</td> </tr> </table> <b>Bargteheide, 01.03.2004</b>			<b>Directive on</b>	<b>94/9/EC</b>	<b>equipment and protective systems</b>		<b>for use in explosive atmospheres</b>		EN 50281-1-1:1998	Electrical apparatus for use in the presence of combustible dust	EN 50281-1-2:1998	Electrical apparatus for use in the presence of combustible dust	EN 50014:1997	Electrical apparatus for potentially explosive atmospheres General requirements	EN 60034-5:2001	Specification for degrees of protection provided by enclosure (IP-Code)	EN 60529:1991	Specification for degrees of protection provided by enclosure (IP-Code)	Project outline	No. 6052101 Enterprise of explosion-proof motors of the category 3D in accordance with RL 94/9/EC at frequency inverters	Supplement to the Operating Instructions	BU 0310 GB, no. 6073101/4704 Instructions for the starting-up and maintenance
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 <hr/> U. Küchenmeister General Manager	 <hr/> By proxy, F. Wiedemann Technical Manager inverters																					

### 3 Options

#### 3.1 Modular options

By combining different modules for display, control and parameterisation, the NORDAC 300E can be easily adapted to various demands.

Modules are available for processing analogue and digital signals as well as all common fieldbus systems.

Alphanumerical display and operating modules can be used for simple start-up. For more complex tasks, various connections to a PC or an automation system can be selected.

**Technology units (Technology Unit, SK TU2-..., SK TU2-...-C)** are located on top of the frequency inverter and are accessible from the outside - they are used for manual control or parameterisation, or they can provide connection to fieldbus systems.

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#### ATTENTION



The technology units **SK TU2-...** are available for protection class IP55 and technology units **SK TU2-...-C** for IP66. It must be noted that the functionality and dimensions of the technology units are identical for the IP55 and IP66 versions. However, **special measures** (see Chap. 1.7) are implemented in the IP66 version to maintain this protection class.

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**Customer units (Customer Unit, SK CU2-..., SK CU2-...-C)** are installed inside the frequency inverter. They enable control with digital and analogue signals.

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#### ATTENTION



The customer units **SK CU2-...** are available for protection class IP55 and customer units **SK CU2-...-C** for IP66. It must be noted that the functionality and dimensions of the customer units are identical for the IP55 and IP66 versions. However, **special measures** (see Chap. 1.7) are implemented in the IP66 version to maintain this protection class.

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#### WARNING



Modules should not be inserted or removed unless the device is free of voltage. The slots may only be used for the applicable modules.

Installation of a technology unit separate from the frequency inverter is not possible. It must be connected directly to the frequency inverter.

#### NOTE

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Further detailed information can be found in the Options manuals. - [www.nord.com](http://www.nord.com) -



### 3.2 Technology unit overview

Technology units are optional modules and are screwed onto the top of the frequency inverter. Versions with protection class IP55 (Standard) and IP66 (optional) are available. Functionality and dimensions of the technology unit are essentially identical in the IP55 and IP66 versions, however special measures are implemented for the IP66 version (see Chap. 1.7).

Technology unit	Protection type	Description	Data
ControlBox <b>SK TU2-CTR</b> Part. No.: 275130130	IP55	Used for commissioning, parameterisation, configuration and control of the frequency inverter.	4-figure, 7-segment LED display Keyboard
ControlBox <b>SK TU2-CTR-C</b> Part. No.: 275170130	IP66		
PotentiometerBox <b>SK TU2-POT</b> Part. No.: 275130060	IP55	For direct control of the frequency inverter without additional installation or setting	1 potentiometer 0...100 % 1 switch left-0-right
PotentiometerBox <b>SK TU2-POT-C</b> Part. No.: 275170060	IP66		
Profibus module <b>SK TU2-PBR</b> Part. No.: 275130070	IP55	This option enables control of the NORDAC trio SK 300E via the serial Profibus DP port.	Profibus interface Baud rate: 1.5 MBit/s 2x 5 pin M12 system connectors
Profibus module <b>SK TU2-PBR-C</b> Part. No.: 275170070	IP66		
Profibus module <b>SK TU2-PBR-KL</b> Part. No.: 275130065	IP55	This option enables control of the NORDAC trio SK 300E via the serial Profibus DP port.	Profibus interface Baud rate: 1.5 MBit/s 8 pin terminal
Profibus module <b>SK TU2-PBR-KL-C</b> Part. No.: 275170065	IP66		
Profibus module <b>SK TU2-PBR-24V</b> Part. No.: 275130110	IP55	This option enables control of the NORDAC trio SK 300E via the serial Profibus DP port. An additional external 24V supply voltage is required.	Profibus interface Baud rate: 12 MBit/s 2x 5 pin M12 system connectors 1 external 24 V power supply
Profibus module <b>SK TU2-PBR-24V-C</b> Part. No.: 275170110	IP66		
InterBus module <b>SK TU2-IBS</b> Part. No.: 275130080	IP55	This interface enables control of the NORDAC trio SK 300E via the serial InterBus port.	InterBus interface Baud rate: 500 KBit/s 2x 5 pin M12 system connectors
InterBus module <b>SK TU2-IBS-C</b> Part. No.: 275170080	IP66		

Technology unit	Protection type	Description	Data
DeviceNet module <b>SK TU2-DEV</b> Part. No.: 275130090	IP55	This interface enables control of the NORDAC trio SK 300E via the serial CANbus port with the DeviceNet protocol.	DeviceNet interface Baud rate: 500 KBit/s 1x 5 pin M12 system connector
DeviceNet module <b>SK TU2-DEV-C</b> Part. No.: 275170090	IP66		
CANopen module <b>SK TU2-CAO</b> Part. No.: 275130100	IP55	This interface enables control of the NORDAC trio SK 300E via the serial CANbus port with the CANopen protocol.	CANopen interface Baud rate: up to 1 MBit/s 2x 5 pin M12 system connectors
CANopen module <b>SK TU2-CAO-C</b> Part. No.: 275170100	IP66		
AS interface module <b>SK TU2-AS1</b> Part. No.: 275130120	IP55	This interface enables the control of sensors and actuators. In addition, the NORD trio SK 300E can be parameterised via the AS interface.	AS interface 2 x 2 M12 5 pin sockets / connectors
AS interface module <b>SK TU2-AS1-C</b> Part. No.: 275170120	IP66		

**ATTENTION**



The technology units **SK TU2-...** are available for protection class IP55 and technology units **SK TU2-...-C** for IP66. It must be noted that the functionality and dimensions of the technology units are identical for the IP55 and IP66 versions. However, **special measures** (see Chap. 1.7) are implemented in the IP66 version to maintain this protection class.

### 3.2.1 Mounting the technology unit

The **mounting** of the technology unit must be implemented as follows:

1. Switch off the mains voltage, observe the waiting period.
2. Undo the 6 fastening screws on the **blind plate** and remove the blind plate (see Fig. 1 on next page).
3. Attach the PE connection on the inside of the technology unit being mounted (see Fig. 2 on next page). Fit the seal together with the **technology unit** on the surface of the frequency inverter. Ensure that the multipoint connector has full contact.
4. Lightly tighten all 6 fastening screws.
5. Now tighten the 6 fastening screws in the specified sequence from 1 to 6 (see Fig. 1 on next page) and with the torque given in the table.

Frequency inverter size	Screw size	Tightening torque
Size 1	M4 x 8	1.5Nm ± 20%
Size 2		

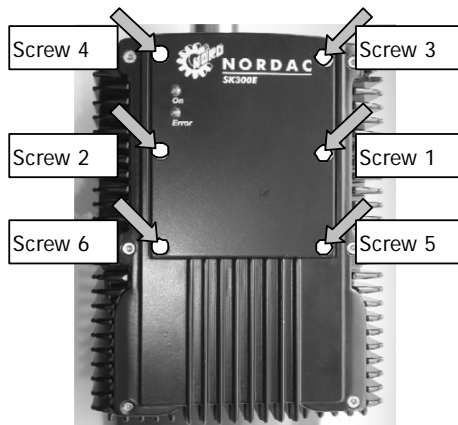


Fig. 1: Technology unit fastening screws

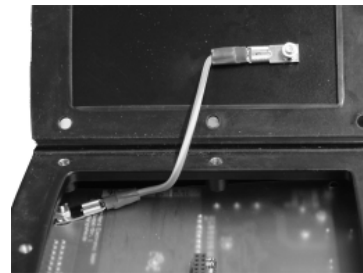


Fig. 2: PE connection on the technology unit

#### ATTENTION



Operation is not permitted if there is no secure PE connection to the frequency inverter and to the technology unit!

### 3.2.2 ControlBox

(SK TU2-CTR, Part. No. 275130130)  
 (SK TU2-CTR-C, Part. No. 275170130)

This option is used as a simple parameterisation, display and control tool for the frequency inverter SK 300E.

Features:

- 4-figure, 7-segment LED display
- Direct control of a frequency inverter
- Display of the active parameter set and operating values



After mounting the ControlBox and switching on the mains supply, horizontal dashes are displayed in the 4 figure, 7 segment display. This display signals the operational readiness of the frequency inverter.

If a jog frequency is preset in parameter P113, the display alternates between 0.0Hz and the value in P113.

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


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

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#### NOTE

The digital frequency setpoint is factory set to 0Hz. To check whether the drive
















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 implemented by qualified personnel, strictly in accordance with the warning and safety information.

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

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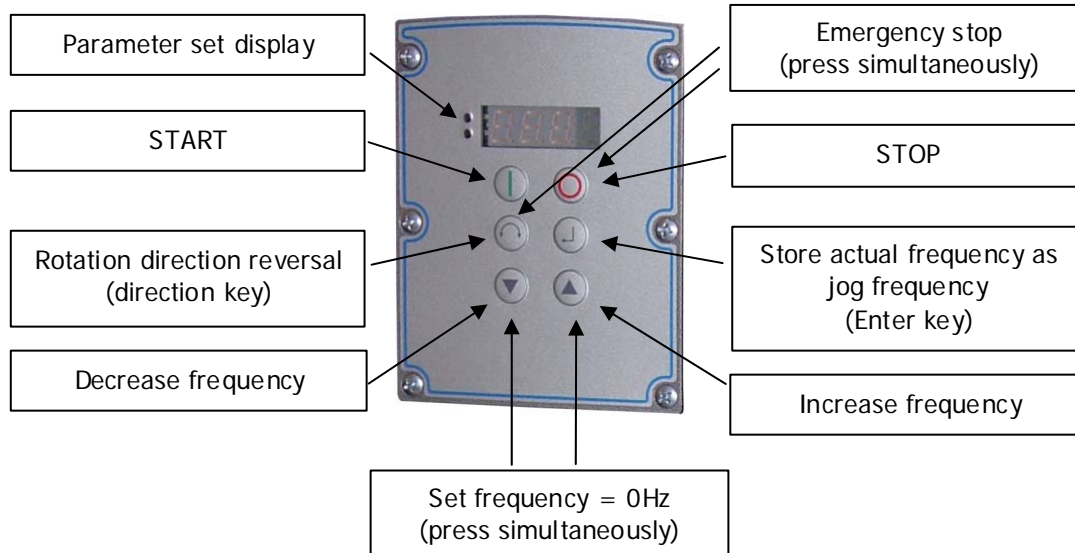
**ControlBox functions:**

	Switching on 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 must = 0.
	a) To switch off (block) the frequency inverter during operation. The output frequency is reduced to the absolute minimum frequency (P505) and the frequency inverter shuts down. b) During parameterisation, the operating value display P000 (starting display after mains ON) can be called up from any parameter.
<b>7-segment LED display</b>	a) Shows the current operating value set during operation (selection in P001) or an error code. b) During parameterisation, the parameter numbers or the parameter values are shown. When switched off, but operational, four dashes " _ _ _ _ " are displayed or, if a setpoint frequency > 0Hz is set in P113, this value will flash.
<b>LEDs</b>   1  2	a) The LEDs signal the actual operating parameter set during operation. b) During parameterisation, the parameter set being parameterised is displayed. <div style="text-align: center; margin-top: 10px;">  1      = P1       1   2                                       2      = P2         </div>
	a) The motor rotation direction changes when this key is pressed. "Rotation to the left" is indicated by a minus sign. <b>Attention !</b> Take care when operating pumps, screw conveyors, ventilators, etc. Block the key with parameter P540. b) To cancel a value changed during parameterisation mode, press this key.
	a) Press key to increase the frequency. b) During parameterisation, the parameter number or parameter value is increased
	a) Press the key to reduce the frequency. b) During parameterisation, the parameter number or parameter value is reduced.
	a) Press "ENTER" to store a changed parameter value, or to switch between parameter number and parameter value.  <b>NOTE:</b> If a changed value is not to be stored, the  key can be used to exit the parameter without storing the change. b) When operating with the keyboard control, the actual frequency value can be saved in parameter P113 Jog frequency. This is then the starting value when the START key is used to enable.

### **Controlling the frequency inverter with the ControlBox**

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

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





#### **Parameter set display:**



The LEDs indicate in the display the actual operating parameter set and during parameterisation ( $\neq$  P000) the actual parameter set being parameterised.

The parameter set can also be changed during operation via the parameter P100 (control via ControlBox).

#### **Frequency setpoint:**










The actual 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  and permanently stored in P113 as the jog frequency by pressing the ENTER key.

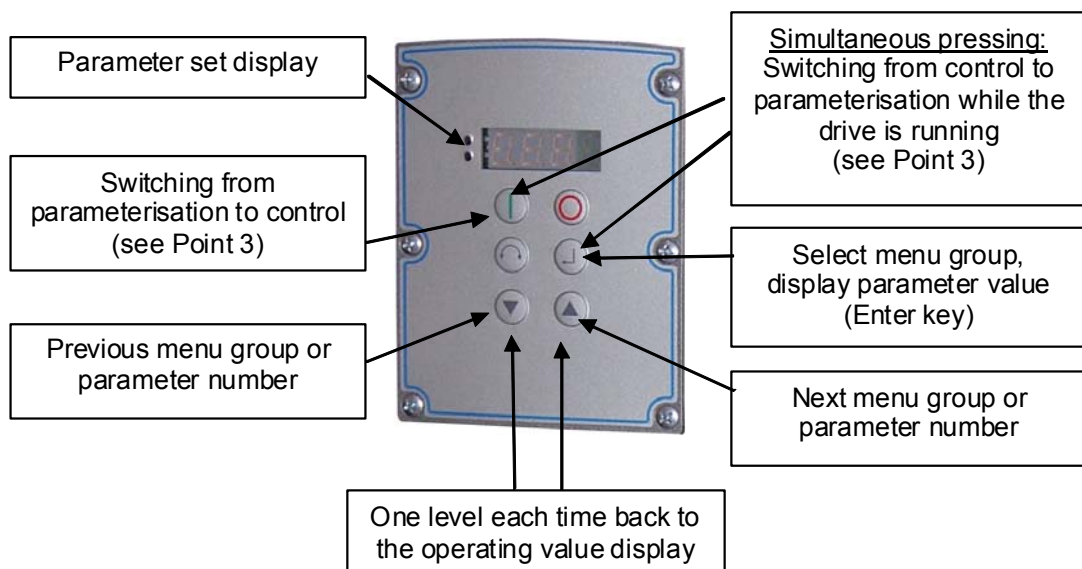
#### **Emergency stop:**

By simultaneously pressing the STOP key  and the "Change direction key" , an emergency stop can be initiated.



## Parameterisation with the ControlBox

The **parameterisation** of the frequency inverter can take place in the 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 ) via the ControlBox, control terminals or a serial interface, it is still possible to switch to the parameterisation mode directly from the operating value display with the value keys  or . → p 0 0 1 ... p 9 9 9
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 0 1 / p 9 9 9
3. If the frequency inverter is enabled via the ControlBox (START key ) , the parameterisation mode can be reached by pressing the START and ENTER keys ( + ) simultaneously.
4. Switching back to the control mode is achieved by pressing the START key .



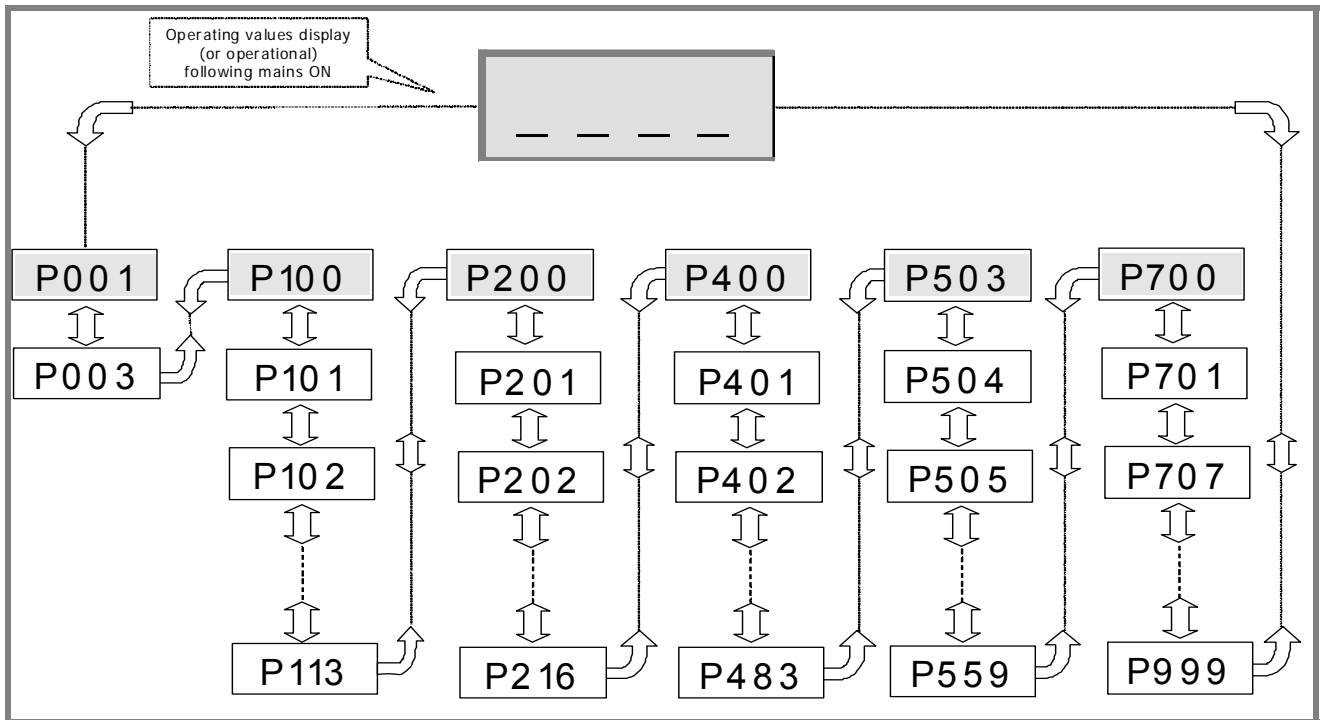
## Changing parameter values


To access the parameter section, one of the value keys  or  must be pressed. The display changes to the parameter display p 0 0 1 ... p 9 9 9. All parameters are arranged in order 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 Chapter 7 "Parameterisation"

When the required parameter has been selected, press the ENTER key  to display the parameter value and change the value with the value keys  or . A flashing display indicates that the value has been changed but not yet stored. Pressing the ENTER key  stores the changed value.

**Menu structure with the ControlBox**




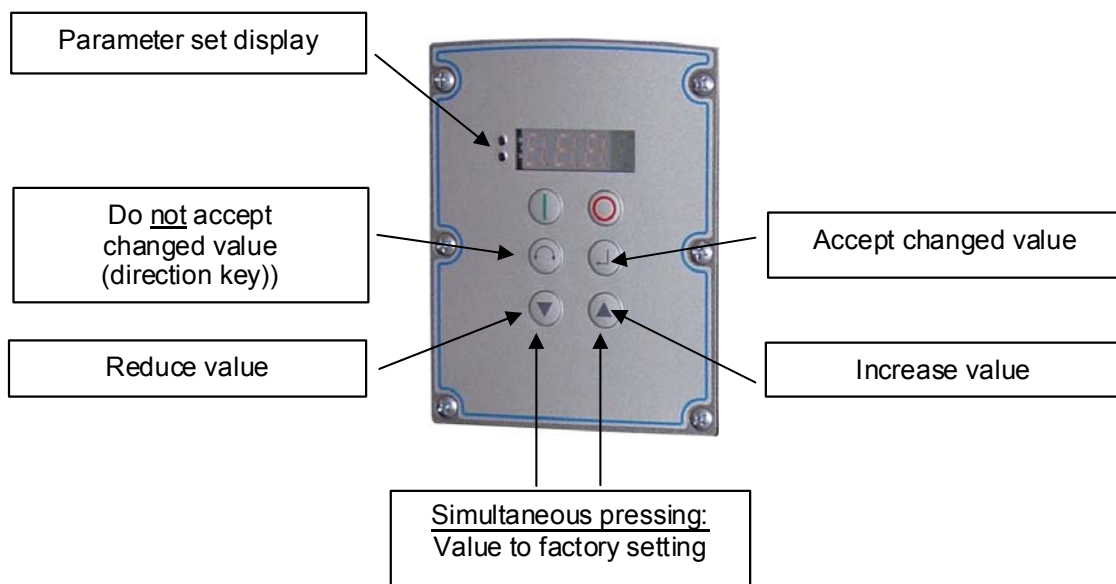
To **change a parameter value**, the ENTER key  must be pressed when the applicable parameter number is displayed.

Changes can then be made using the VALUE keys  or  and must be confirmed with  to save them and leave the parameter.

As long as a changed value has not been confirmed by pressing ENTER, the value display will blink; this value has not yet been stored in the frequency inverter.

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

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



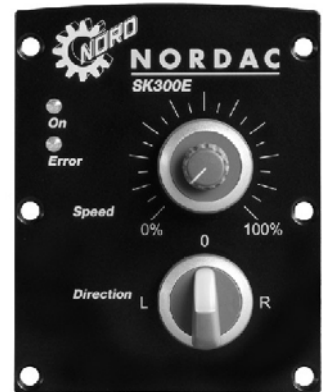


### 3.2.3 PotentiometerBox

(SK TU2-POT, Part. No. 275130060)  
(SK TU2-POT-C, Part. No. 275170060)

The PotentiometerBox can be used as a control unit for various functions. Selection can be carried out in parameter P549. An infinitely variable potentiometer and a three-position switch for selecting CW/CCW operation or Stop are integrated in the module for operation. This is a control switch that can generate an enable signal. The factory setting enables direct control of the output frequency in the minimum (P104) and maximum frequency (P105) ranges.

**Note:** The frequency inverter can then only be controlled via the PotentiometerBox, when the parameter (P509) >Interface< is programmed for "control terminals or keyboard" (P509 = 0).



LED	Description
● Green LED [ON]	Signals that mains voltage is present.
● Red LED [ERROR]	Signals actual error by flashing according to the number code of the error.

### 3.2.4 DeviceNet module

(SK TU2-DEV, Part. No. 275130090)  
(SK TU2-DEV-C, Part. No. 275170090)

DeviceNet is an open communications profile for distributed industrial automation systems. It is based on the CANbus system.

Up to 64 participants can be linked to one Bus system.

The transfer rate (125, 250, 500 kBit/s) and the Bus addresses are set using rotary coding switches or the applicable parameters.



DeviceNet status LEDs	MS (red/green)	Module status
	MS (red/green)	Mains (bus) status
Module status LEDs	DS (green)	Module status
	DE (red)	Module error

**NOTE:** Detailed information can be found in the operating instructions **BU 0080** or contact the supplier of the frequency inverter.

### 3.2.5 Profibus module

(SK TU2-PBR, Part. No. 275130070)  
 (SK TU2-PBR-24V, Part. No. 275130110)  
 (SK TU2-PBR-KL, Part. No. 275130065)

(SK TU2-PBR-C, Part. No. 275170070)  
 (SK TU2-PBR-24V-C, Part. No. 275170110)  
 (SK TU2-PBR-KL-C, Part. No. 275170065)

Profibus allows numerous different automation devices to exchange data. PLC's, PC's, operating and monitoring devices can all communicate via a uniform bus in serial bit mode.

PROFIBUS DP is primarily used for communication between sensor and actuator where system response needs to be very fast. PROFIBUS DP is a suitable alternative to expensive 24-volt parallel signal transmission and transmission of measured values. This type of PROFIBUS, which is optimised to speed, is used for instance for operating frequency inverters on automation devices.

Data exchange is specified in DIN 19245 Part 1 and 2 and application-specific upgrades in Part 3 of this standard. Within the European field bus standardisation process, PROFIBUS is integrated into the European field bus standard pr EN 50170.

The termination resistor for the last bus participant is located in the Profibus standard plug.



Profibus status LEDs	BR (green)	BUS ready
	BE (red)	BUS error

**NOTE:** Detailed information can be found in the operating instructions **BU 0020** or contact the supplier of the frequency inverter.

### 3.2.6 CANopen Bus module

(SK TU2-CAO, Part. No. 275130100)  
 (SK TU2-CAO-C, Part. No. 275170100)

The CANopen interface on the NORDAC frequency inverter enables the parameterisation and control of the devices in accordance with CANopen specifications. Up to 127 participants can be addressed on a single Bus. A termination resistor can be screwed onto the output of the last frequency inverter as an end plug. The transfer rate (10kBaud and 1MBaud) and the Bus addresses are set using rotary coding switches or the applicable parameters.



CANopen Status LEDs	CR (green)	CANopen RUN LED
	CE (red)	CANopen ERROR LED
Module status LEDs	DR (green)	Module status
	DE (red)	Module error

**NOTE:** Detailed information can be found in the operating instructions **BU 0060** or contact the supplier of the frequency inverter.

**3.2.7 InterBus module**

(SK TU2-IBS, Part. No. 275130080)  
 (SK TU2-IBS-C, Part. No. 275170080)

With InterBus, up to 256 subscribers with different automation devices can exchange data. PLC's, PC's, operating and monitoring devices can all communicate via a uniform bus in serial bit mode.

NORDAC frequency inverters are remote bus participants. The data width is variable (3 words; 5 words), at a baud rate of 500kBit/s (optional 2Mbit/s). An additional termination resistor is not necessary as it is already integrated. Addressing is carried out automatically by means of the physical arrangement of the participants.

An external 24V supply is required for uninterrupted Bus operation.



<b>Module status LEDs</b>	ST (red/green)	Module error/ready
<b>InterBus status LEDs</b>	UL (green)	Supply voltage applied.
	RC (green)	Remote Check, remote bus to previous InterBus device is OK.
	BA (green)	Bus Active, InterBus data are being exchanged (Bus running).
	RD (yellow)	Remote bus disabled, remote bus to next InterBus device is switched off.
	TR (green)	Transmit, data is being transferred from/to participants.

**NOTE:** Detailed information can be found in the operating instructions **BU 0070** or contact the supplier of the frequency inverter.

**3.2.8 AS interface**

(SK TU2-AS1, Part. No. 275130120)  
 (SK TU2-AS1-C, Part. No. 275170120)

The **Actuator-Sensor-interface** (AS interface) is a bus system for the simple field bus level. The transmission principle is a single master system with cyclical polling. A maximum of 31 slaves (or 62 A/B slaves) can be operated on an up to 100m long unshielded two-wire cable in any network structure (tree/line/star). The AS interface cable (yellow) transmits data and power while a second two-wire cable can be used for a small auxiliary voltage (24V). Addressing is implemented via the master, which can also provide other management functions, or via a separate addressing device. The 4 bit reference data (per direction) are cyclically transmitted with an effective error protection at a maximum cycle time of 5ms. Transmission of larger data volumes is also possible with some slave profiles (e.g. slave profile 7.4). The bus system is defined in the *AS Interface Complete Specification*.



<b>Status LEDs</b>	<b>Device S/E</b> (red/green)	Module status/error.
	<b>AS- Int. PWR/FLT</b> (red/green)	Standard status display for AS interface slaves.

**NOTE:** Detailed information can be found in the operating instructions **BU 0090** or contact the supplier of the frequency inverter.

### 3.2.9 Retrofit kit, SK TU2 cover

(SK TU2 cover for SK 300E S1/S2, Part. No. 275113050)

The retrofit kit for the NORDAC *trio* SK 300E is screwed on top of the SK 300E in the position of the technology unit. This module contains a blind plate with the same measurements as other technology units, a suitable seal and 6 screws for fastening.

This retrofit kit is used so that any technology units that are no longer required, e.g. the PotentiometerBox, can be removed from the SK 300E and the retrofit kit screwed on in its place. This ensures that the maximum protection class IP55/IP66 is maintained.

In addition, two LEDs are visible from outside the blind plate on the left side. These indicate the current status of the device.



LED	Description
● Green LED [ON]	Signals that mains voltage is present.
● Red LED [ERROR]	Signals actual error by flashing according to the number code of the error.

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#### NOTE



If a technology unit has not been ordered together with the SK 300E, it is always delivered with a blind cover. This means that an extra retrofit kit does not need to be ordered for this SK 300E.

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### 3.3 Customer unit overview

Customer units are optional modules, which offer a variety of control inputs and outputs in addition to the standard scope. The options for controlling the frequency inverter can be modified according to requirements.

A customer unit can be integrated in each frequency inverter. After the mains voltage is connected and switched on, it is automatically recognised by the inverter and the additional functions are made available. The cable connection is established using screw connectors. This makes the connection of devices very easy and convenient.



Customer unit	Protection type	Description	Data Available control connections are expanded by the following items.
Basic I/O <b>SK CU2-BSC</b> Part. No. 275130010	IP55	Simplest customer unit with suitable number of control signals for simple usage.	3 digital inputs 1 analogue input 0...10V 0/4...20mA
Basic I/O <b>SK CU2-BSC-C</b> Part. No. 275170010	IP66		
Standard I/O <b>SK CU2-STD</b> Part. No. 275130020	IP55	Expanded functionality for all types of special applications.	4 digital inputs 2 analogue inputs 0...10V 0/4...20mA 1 analogue / digital output
Standard I/O <b>SK CU2-STD-C</b> Part. No. 275170020	IP66		

#### ATTENTION



The customer units **SK CU2-...** are available for protection class IP55 and customer units **SK CU2-...-C** for IP66. It must be noted that the functionality and dimensions of the customer units are identical for the IP55 and IP66 versions. However, **special measures** (see Chap. 1.7) are implemented in the IP66 version to maintain this protection class.

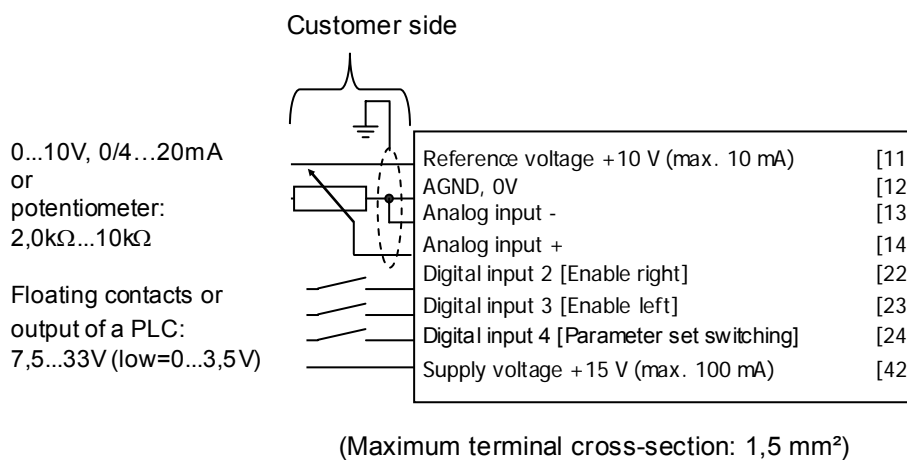
### 3.3.1 Customer unit Basic I/O

(SK CU2-BSC, Part. No. 275130010)  
 (SK CU2-BSC-C, Part. No. 275170010)

The Basic I/O customer unit (**Customer Unit**) provides an adequate number of control signals for simple control tasks, thereby offering a budget solution for many cases.

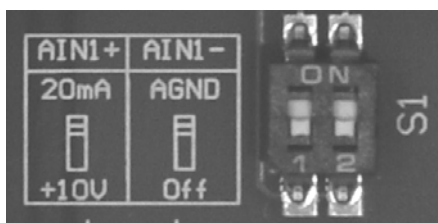
In addition to the controls available in the standard version, the Basic I/O has one analogue and 3 digital inputs. The analogue differential input can handle signals from 0...10V, 0...20mA or 4...20mA.

**Note:** AGND, 0V is the reference potential for the analogue and digital inputs.



#### DIP switches:

You can select whether current or voltage setpoints should be used for the analogue input. Set the DIP switches as follows.



- |  |   |                         |
|--|---|-------------------------|
| 1. Switching the load resistor for analog input 1        | ON = Current setpoint<br>OFF = Voltage setpoint | 0/4...20 mA<br>0...10 V |
| 2. Switching a bridge between terminals AGND/0V and AIN- | ON = Bridge closed<br>OFF = Bridge open         |                         |

**NOTE** With current setpoint setting:



Scaling must be taken into account when operating with a current setpoint of 0/4...20mA. If 20mA represents a setting of 100%, then parameter P403 "Analog input 1 adjustment 100%" must be set to 5V!

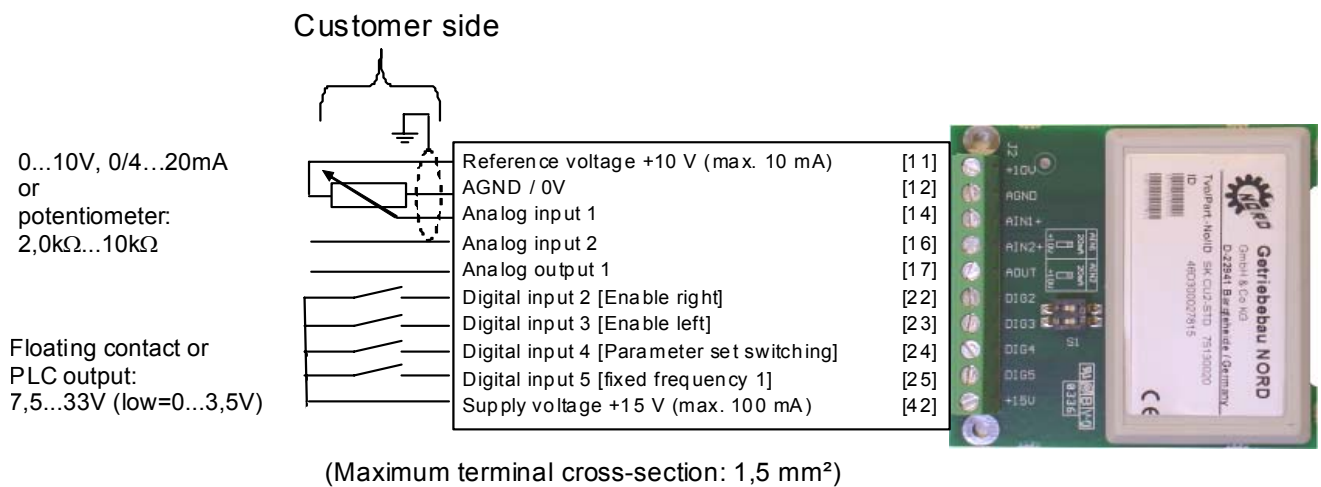
### 3.3.2 Customer unit Standard I/O

(SK CU2-STD, Part. No. 275130020)  
 (SK CU2-STD-C, Part. No. 275170020)

The Standard I/O Customer Unit provides the highest functionality of digital and analogue signal processing for the SK 300E. In addition to the standard equipment, 2 analogue inputs, 4 digital inputs and 1 analogue/digital output are available.

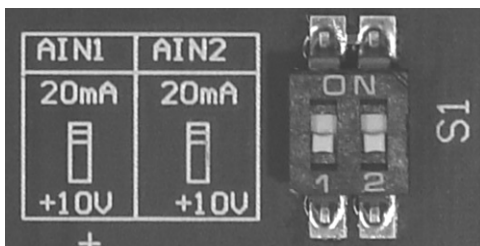
The 2 analogue inputs are not differential inputs. The analogue inputs can process signals from 0...10V, 0...20mA or 4...20mA with a burden resistance that can be switched via a DIP switch. Either analogue or digital evaluation is possible at the analogue output to transfer actual operating parameters, e.g. to a display device or process control system.

**Note:** AGND, 0V is the reference potential for the analogue and digital inputs.



#### DIP switches:

You can select, for the analogue input, whether current or voltage setpoints should be used. Set the DIP switches as follows.



1. Switching the load resistor for analog input 1	ON = Stromsollwert	0/4...20 mA
	OFF = Spannungssollwert	0...10 V

2. Switching the load resistor for analog input 2	ON = Current setpoint	0/4...20 mA
	OFF = Voltage setpoint	0...10 V

#### **NOTE**



With current setpoint setting:

Scaling must be taken into account when operating with a current setpoint of 0/4...20mA. If 20mA represents a setting of 100%, then parameter P403 "Analogue input 1 adjustment 100%" must be set to 5V!

Analogue inputs:

If both analogue inputs are parameterised to the same function, then analogue input 1 has priority and analogue input 2 has no function!

### 3.3.3 Mounting the customer unit

#### NOTE



Installation must be carried out by qualified personnel only, paying particular attention to safety and warning instructions.

#### Sequence:

- 1 = Switch off the mains voltage, observe the waiting period.
- 2 = Undo the fastening screws on the frequency inverter and remove it from the motor.

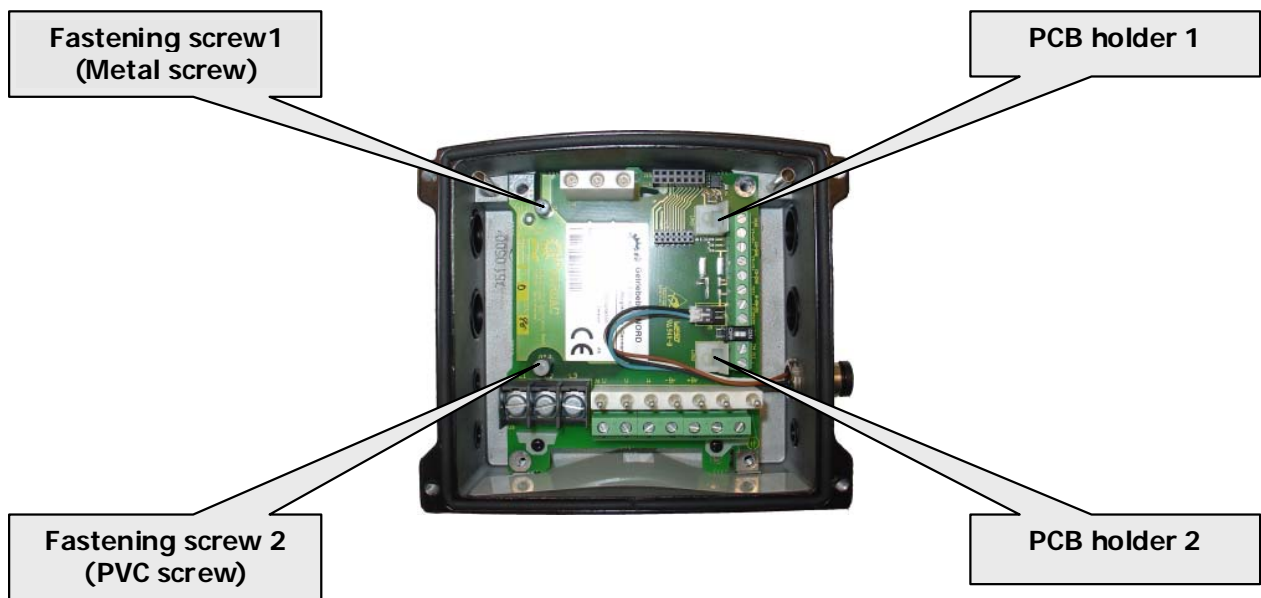
#### NOTE



When removing the frequency inverter, note that the capacitor discharge time of 90 seconds must be waited for and that no contact should be made with the underneath of the frequency inverter!

- 3 = Place the CU so that the drill holes approximately match. Press the PCB into place by putting pressure on to the plastic cover until it clicks into the PCB holders.  
(When removing, press the PCB holders back with one hand and lift the CU out with the connection terminal block.)
- 4 = Insert fastening screws  
(This creates a PE connection, no further connection is required).
- 5 = Make necessary connections.
- 6 = Replace frequency inverter and tighten screws.

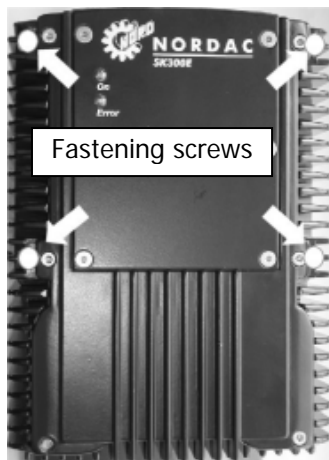
Sequence in detail → See following pages !





### Detailed description of mounting the customer unit

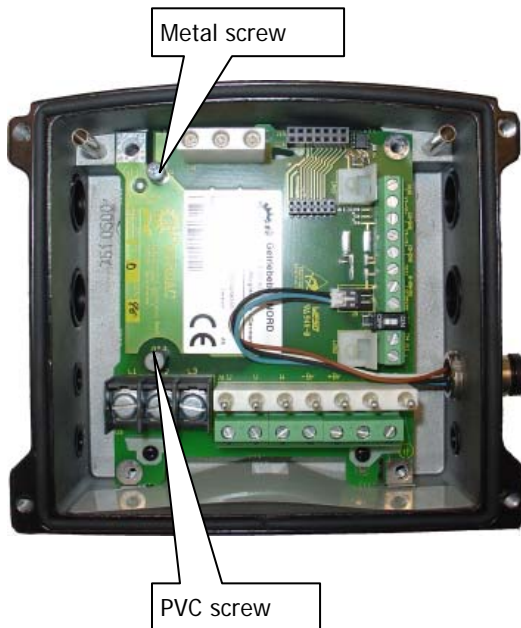
1.) Undo fastening screws



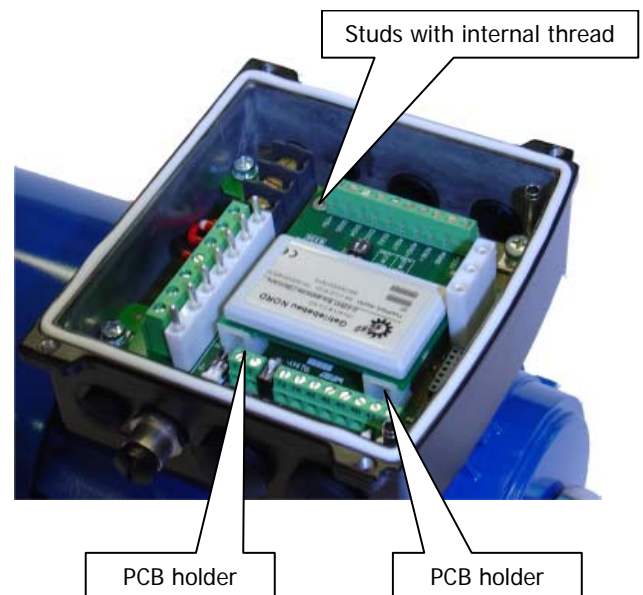
2.) Lift frequency inverter off upwards



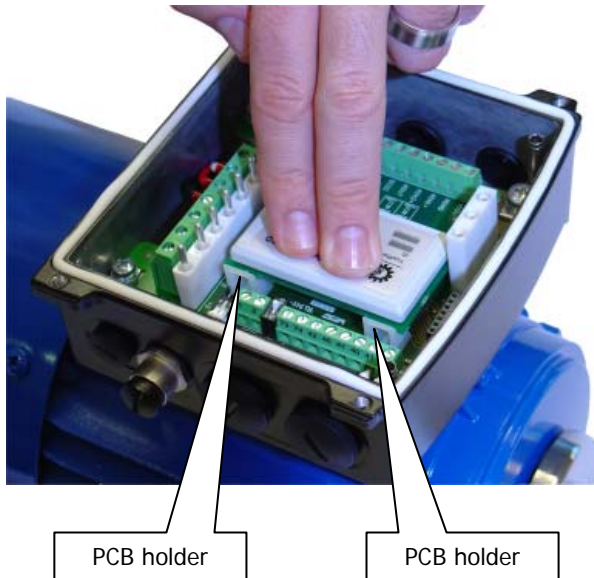
3.) Adapter unit without CU. The fastening screws for the customer unit must be removed.



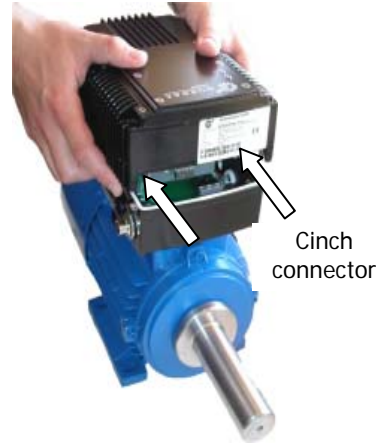
4.) Place the customer unit on the PCB holder and studs so that the internal threads for the fastening screws are visible.



5.) Press the customer unit down until it engages in the PCB holder.  
Then insert the fastening screws.



6.) When repositioning the frequency inverter, ensure that the cinch connectors on the front of the frequency inverter are inserted first.



**NOTE:** In order to achieve maximum protection class IP55, ensure that the seal is faultless and that all 4 fastening screws are secured correctly!!! The requirement for maximum protection class IP55 for the entire *trio* SK 300E unit is a protection class for the motor equivalent to that of the inverter.

### Detailed description of removing the customer unit

7.) Remove both fastening screws and release both PCB holders...



8.) ... and lift the CU out vertically.



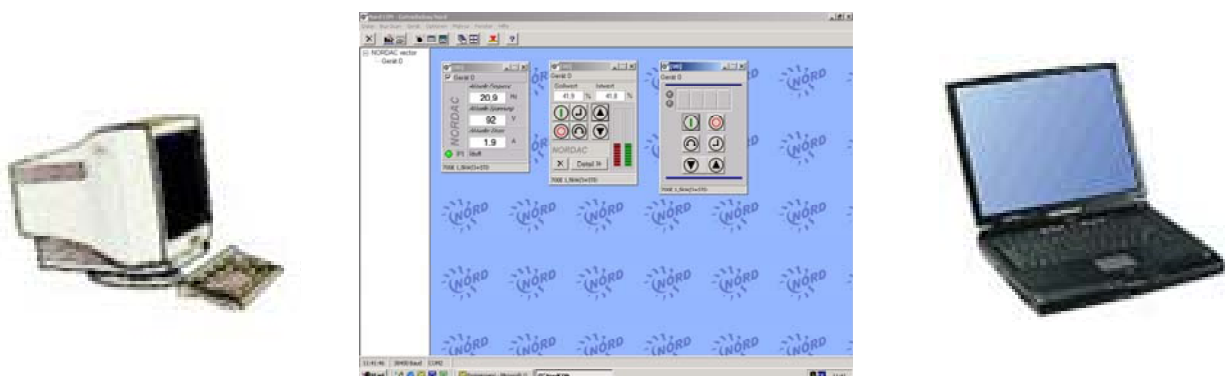
## 4 Operation and display

There are various solutions for operating the SK 300E, dependent upon application. When used on site at the device, the *Handheld Variant* of the **ParameterBox** can be connected directly via an M12 connector. As well as control and parameterisation of the frequency inverter, this also enables operating values to be displayed and datasets to be saved (see also Chap. 4.2, ParameterBox, Handheld variant).

For permanent fixed installation in a control panel, the **ParameterBox** is also available as an *Installation Variant*. The functionality is equivalent to that of the *handheld type* (see also Chap. 4.3 ParameterBox (Installation variant)).






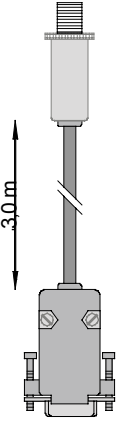




All NORDAC frequency inverters can be controlled and parameterised using the free **NORD CON** software. In conjunction with a laptop or PC, this provides diagnosis tools for simple drive optimisation. Parameter sets and oscillograms can be saved, edited and archived. Further information can be found in Chap. 5 "NORD CON software".



→ Website for downloading NORD CON: > [www.nord.com](http://www.nord.com) <

4.1 Control element connection variants

	Connection			NORDAC frequency inverter
	<p style="text-align: center;"><b>Direct to system connector</b></p>  <p>Screw terminals (pluggable)</p>		<p><b>ParameterBox</b> "Handheld" SK PAR-2H Part. No. 278910100</p>	 <p style="text-align: center;"><b>SK 300E</b></p>
	<p>Cable cross-section: 4 x 0.75 mm<sup>2</sup></p>  <p>Screw terminals Adapter unit SK 300E</p> <p>... Commercial 4-wire cables (not included in scope of delivery)</p>		<p><b>ParameterBox</b> "Installation" SK PAR-2E Part. No. 278910110</p>	 <p style="text-align: center;"><b>Connection cable 300E</b> Part. No. 278910060</p>
	 <p style="text-align: center;"><b>Interface converter</b> <b>SK IC1-232/485</b> Part. No. 276970020</p>		<p><b>NORD CON</b> Software (free) Part. No. 6099985 (NORD PAC) (... or download from <a href="http://www.nord.com">www.nord.com</a>)</p>	

## 4.2 ParameterBox (Handheld variant)

(SK PAR-2H, Part. No. 278910100)

The SK PAR-2H ParameterBox is a compact control device for direct connection to the SK 300E inverter. A suitable connection cable with an M12 plug contact is already included with the device. This means that the ParameterBox can be directly connected to the SK 300E without additional components.

Special connection cables are required for connection to other NORDAC inverters or a PC/laptop, which are listed in more detail in the ParameterBox instruction manual "**BU 0040**".

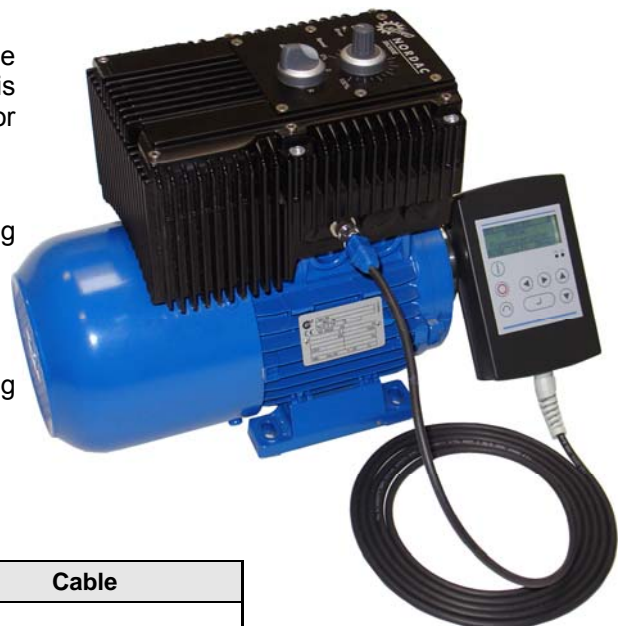


### Connection to SK 300E

Connection to the *trio* SK 300E can take place using the existing M12 socket. The maximum protection class IP55 is retained for the entire unit by using the special connector components.

After the mains voltage is switched on the corresponding device type is automatically recognised.

**Note:** Further information can be found in the operating instructions of the ParameterBox "**BU 0040**".



M12 connector, blue	Description	Cable
2 (wh)	+ 5V / 170mA	Length 3m 4 x 0.75mm <sup>2</sup>
1 (br)	GND	
4 (b/w)	P+ (A) (RS485 +)	
3 (bu)	P-(B) (RS485 -)	

### 4.3 ParameterBox (Installation variant)

(SK PAR-2E, Part. No. 278910110)

The SK PAR-2E ParameterBox is a compact control device for control panel installation. Up to 5 frequency inverters can be connected via the plug-in connection terminals. Protection class IP66 is complied with on the front side when installed.

A connection cable for the ParameterBox is not included in the scope of delivery. A commercial 4-wire cable with a recommended cable cross-section of 0.75mm<sup>2</sup> can be used in compliance with the general installation regulations.

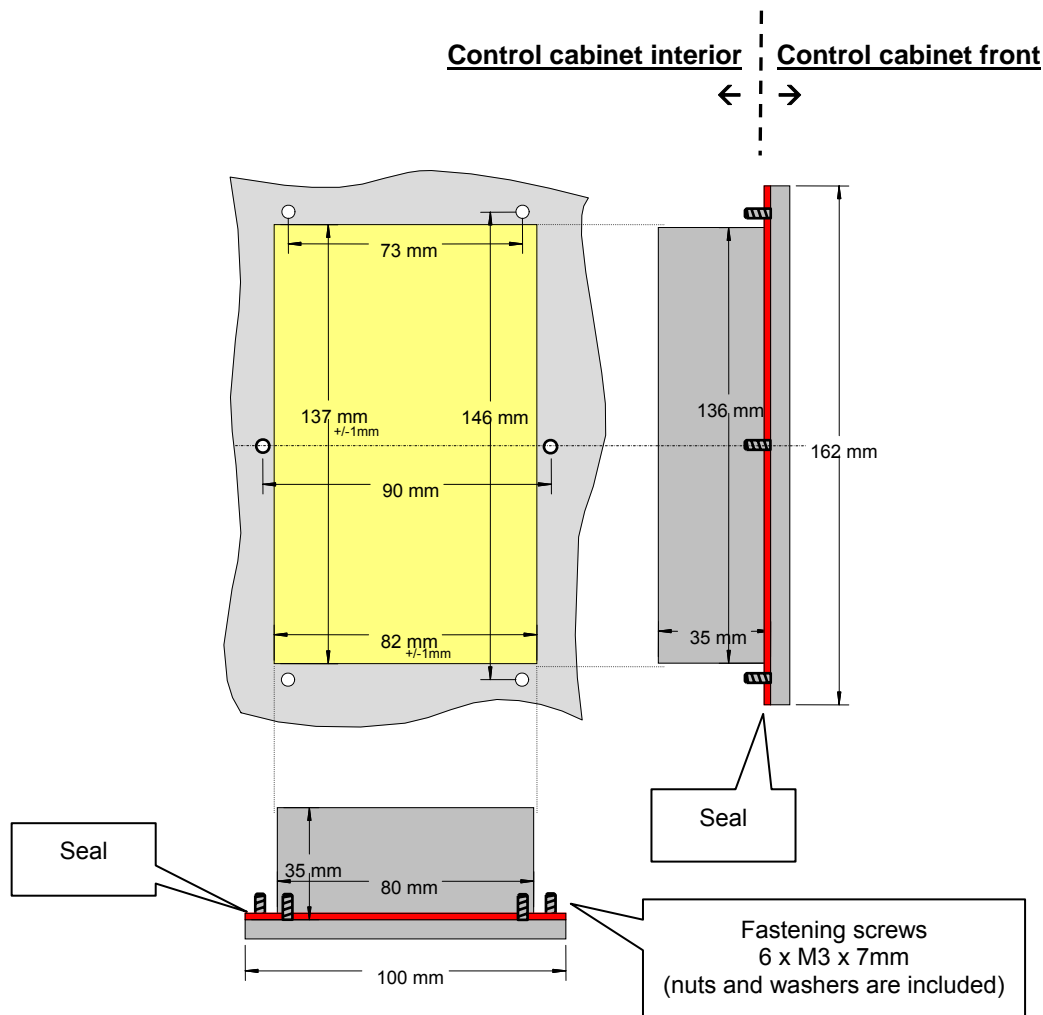
The 15V supply voltage for the ParameterBox is normally drawn from the frequency inverter.



#### Mechanical installation in a control panel

For installation in the control cabinet door or the control panel, a cut-out of 137mm x 82mm (tolerance +/- 1mm) must be made. The sealed unit must be inserted in the pre-processed cabinet panel. There are 6 screws (M3 x 7mm) for securing the unit to the interior of the control panel. The ParameterBox is now mounted securely on the switching cabinet door and has maximum protection class IP66 on the front side, if mounted correctly.

The electrical connection of the ParameterBox SK PAR-2E can take place in the installation variant via the internal screw terminals 1-4. Exact assignment of the terminals can be seen in the following section.



**SK PAR-2E electrical connection**

The ParameterBox SK PAR-2E is connected via the plug-in screw terminals, which are located inside the ParameterBox.

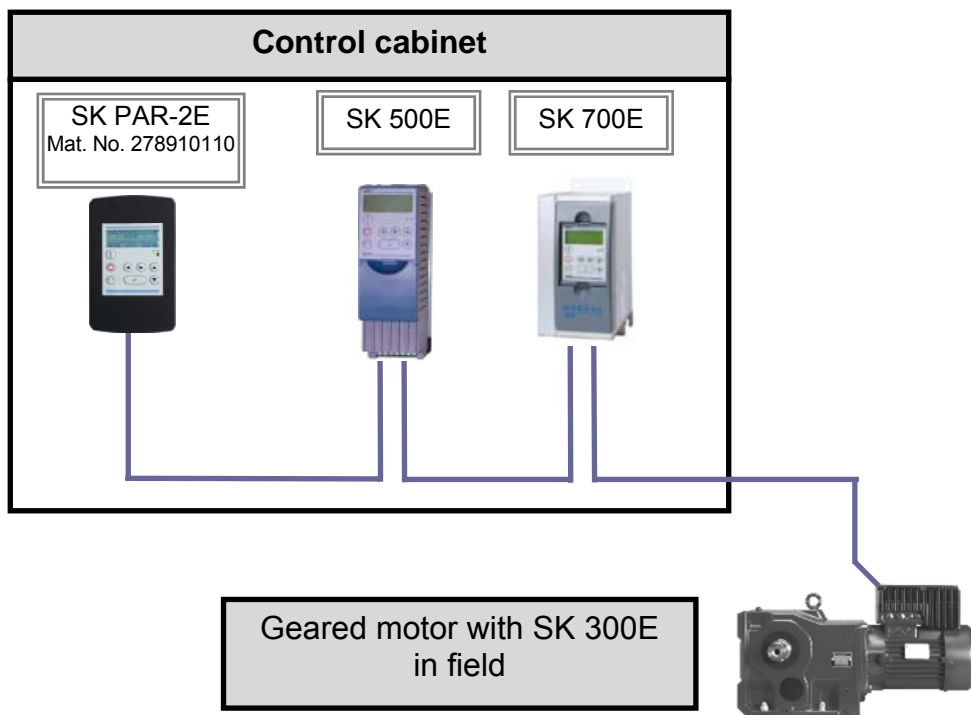
Number	Description	Terminals
42	+ 4.5 ... 30V with +15V / 60mA	0.14...1.5 mm <sup>2</sup>
40	GND	
73	P+ (A) RS485 +	
74	P-(B) RS485 -	

**Supply voltage**

The +15V supply voltage for the ParameterBox can normally be drawn from the connected frequency inverter. However, if several frequency inverters are linked together, ensure that only one frequency inverter is tapped for voltage and not several inverters! The frequency inverter with the shortest cable distance to the ParameterBox should be selected for this.

**Communication via RS485**

With connection of several frequency inverters in series (as diagram below), ensure that the ParameterBox is the first or last participant in the bus system. A termination resistor (approx. 120Ω) must be provided for the frequency inverter at the other end of the entire bus system. A termination resistor of this type is included as standard with the SK 300E.

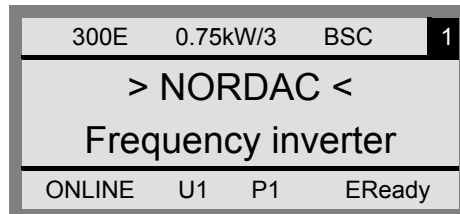








**NOTE:** For further information, see the ParameterBox instruction manual **BU 0040**.

## 4.4 Functions of the ParameterBox

### Language settings

In order to set the ParameterBox to the language of the respective operator, see the following explanation. A query as to whether German or English language is required is displayed during the first switch on. The following start data is then displayed:

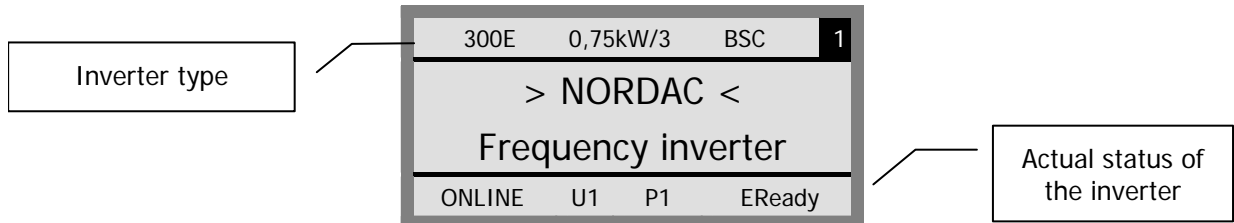


- 1.) Press the  key 4x → "Options" and  for Enter.
- 2.) Parameter P1301 is displayed with "Language : Deutsch"
- 3.) Press the  to select any of the languages in the following sequence:
- 4.) English, Francais, Espanol, Sverige, Nederlands
- 5.) Press  'Enter' to switch to the language displayed/selected.
- 6.) Press the   keys 2x together to return to the start.



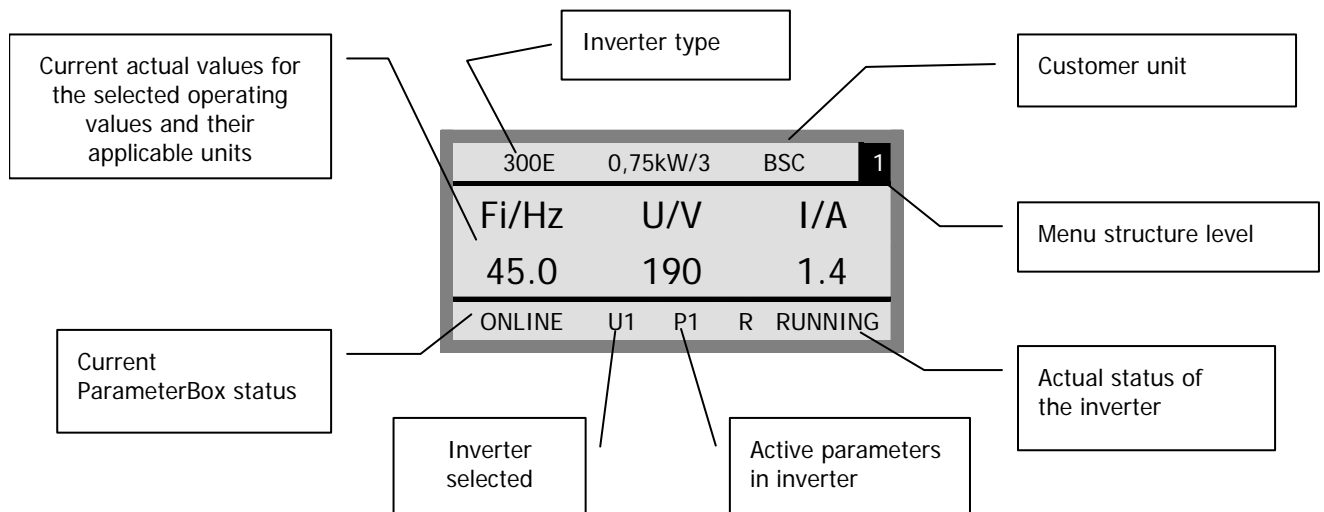
## Display

After the ParameterBox is connected and the mains voltage for the inverter is switched on, an automatic "**Bus scan**" takes place. The ParameterBox identifies the connected frequency inverter(s). The frequency inverter type and its actual operating status can be seen in the following display.




In the standard display mode, 3 operating values and the actual frequency inverter status can be displayed simultaneously.

The operating values displayed can be selected from a list of 8 possible values (in Menu>Display</>Values for display< P1004).

















### 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 menu level >Parameterise<, >Base parameters< and the respective parameter >Jog frequency< (P113). Settings must be carried out by qualified personnel only, paying particular attention to safety and warning instructions.

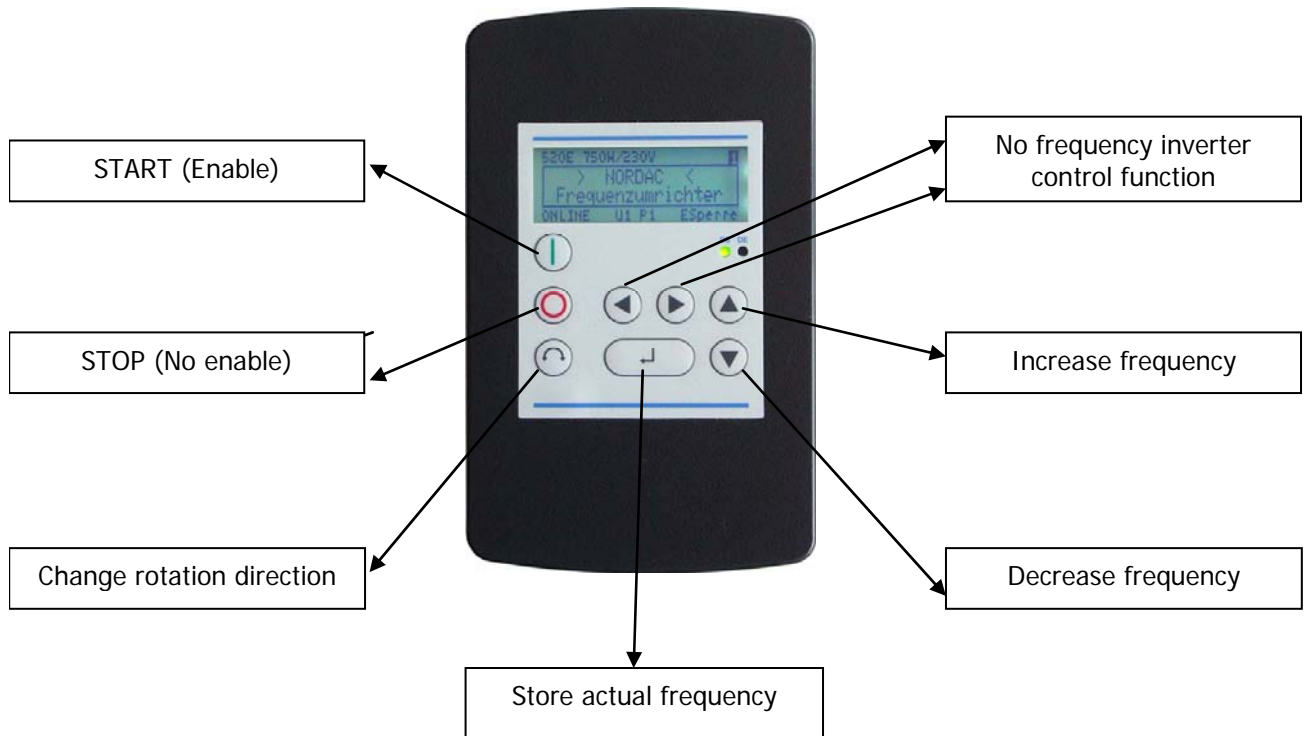
**ATTENTION** : The motor may start immediately after pressing the  START key!

**Operation**

<p><b>LCD Display</b></p>	<p>Graphic-capable, backlit LCD display for displaying operational values and parameters for the connected frequency inverter(s) and ParameterBox parameters.</p>	
	<p>Use the <b>Selection keys</b> to move through the menu levels and within the individual menu items.</p>	
	<p>Press the  and  keys together to go back one level.</p>	
	<p>The contents of individual parameters can be altered with the <b>VALUES keys</b>.</p>	
	<p>Press the  and  keys together to load the factory settings of the parameter selected.</p> <p>When controlling the frequency inverter using the keyboard, the frequency setpoint is set using the <b>VALUE keys</b>.</p>	
	<p>Press the <b>ENTER key</b> to select a menu group or accept the changed menu items or parameter values.</p> <p><b>Note:</b> If a parameter is exited without a new value being stored, then one of the <b>SELECTION keys</b> can be used for this purpose.</p> <p>If the inverter is to be controlled directly from the keyboard (not control terminals), then the actual setpoint frequency can be stored under the Jog Frequency parameter (P113).</p>	
	<p><b>START key</b> for switching on the frequency inverter.</p>	<p><b>Note:</b> Can only be used if this function has not been blocked in parameter P509 or P540.</p>
	<p><b>STOP key</b> for switching off the frequency inverter.</p>	
	<p>The rotational direction of the motor is switched by pressing the <b>Direction key</b>. Rotation direction left is indicated by a minus sign.</p> <p><b>Attention!</b> Take care when operating pumps, screw conveyors, ventilators, etc.</p>	
<p>  ON   ERROR         </p>	<p>The <b>LED's</b> signal the actual status of the ParameterBox.</p> <p><b>ON</b> (green) The ParameterBox is connected to the supply voltage and is operational.</p> <p><b>ERROR</b> (red) An error has occurred while processing data or in the connected frequency inverter.</p>	


### Controlling the frequency inverter

The frequency inverter can only be fully controlled with regards to speed and rotation direction by the ParameterBox if the parameter >Interface< (**P509 = 0/4**) is set to >Control terminals or keyboard< or >USS< and if it has not already been enabled via the control terminals.







#### NOTE



If the frequency inverter is enabled via the keyboard , then the parameter set selected for this frequency inverter in the Menu >Parameterisation< >Basic parameters< in the >Parameter set< parameter (P100) is used.

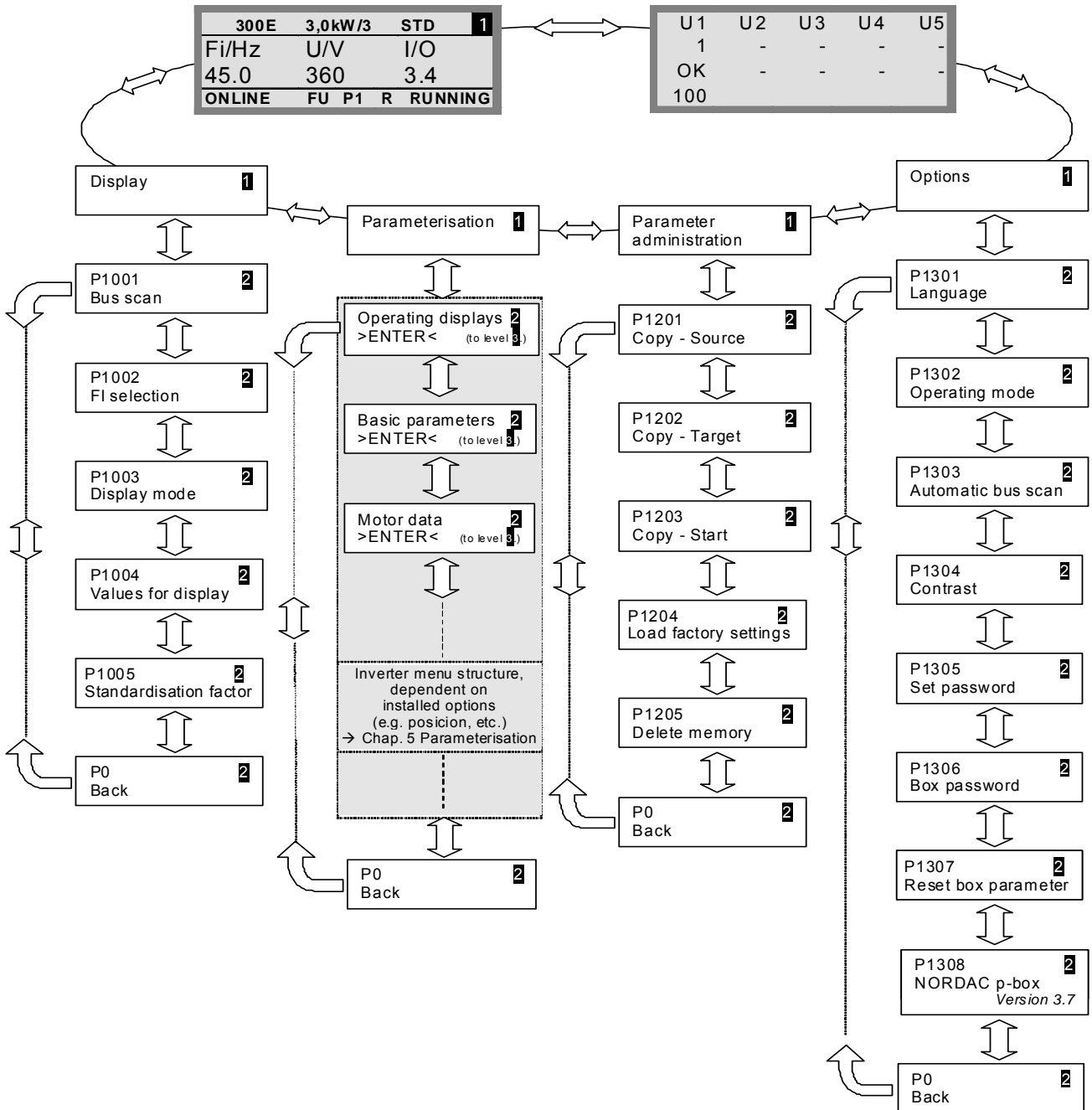
The parameter set cannot be changed during operation. A change in P100 is only accepted when the output frequency has passed once through zero.

The change in the parameter set must be confirmed with the  key and then activated by  and  or .

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

### Menu structure of the ParameterBox

The menu structure consists of various levels that are each arranged in a ring structure. Press the **ENTER** key (↵) to go to the next level. Simultaneous operation of the **SELECTION** keys moves the menu back one level (⏪ and ⏩).




**ATTENTION**

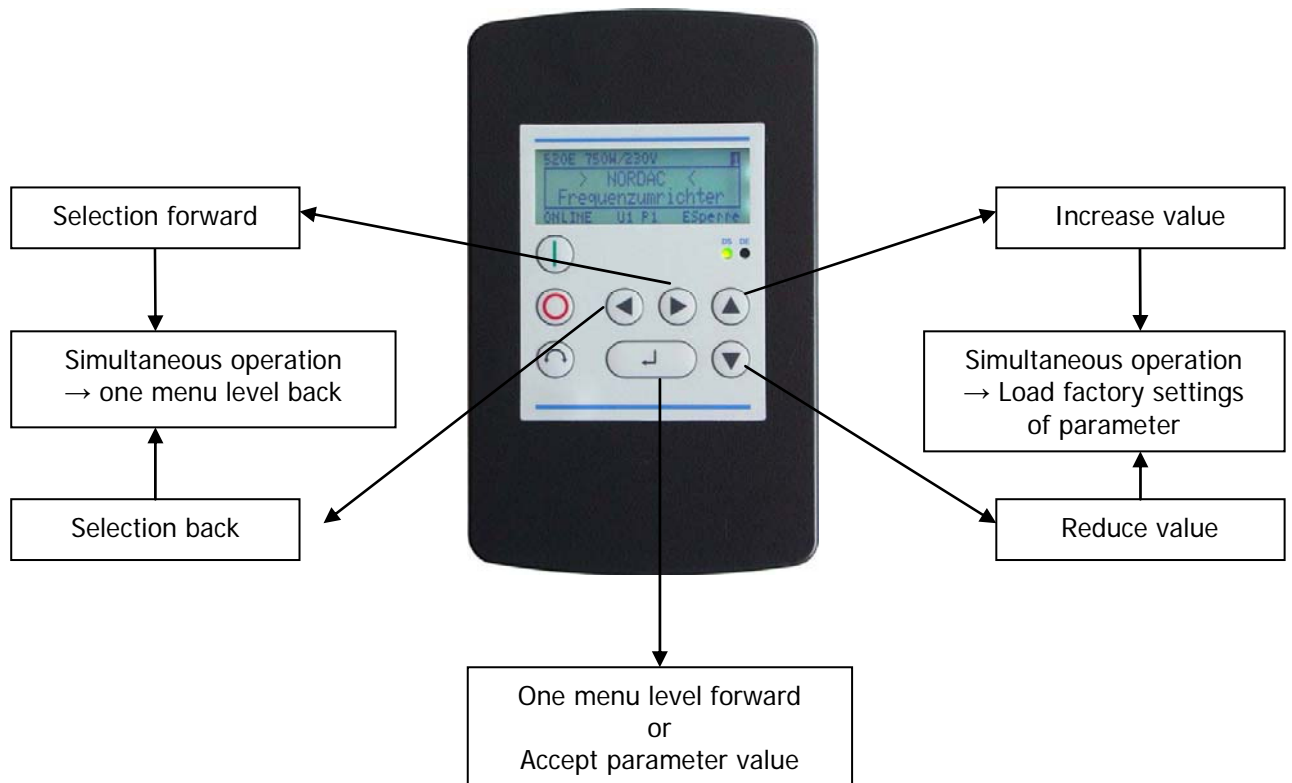


The parameters of the menu groups **>Display<** (P10xx), **>Parameter administration<** (P12xx) and **>Options<** (P13xx) in level 1 are exclusively ParameterBox parameters and do not have anything to do directly with the frequency inverter parameters.

Access to the frequency inverter menu structure is gained via the **>Parameterisation<** menu. The description regarding the parameterisation of the SK 300E starts in Chap. 7 General information.

### Parameterising with the ParameterBox

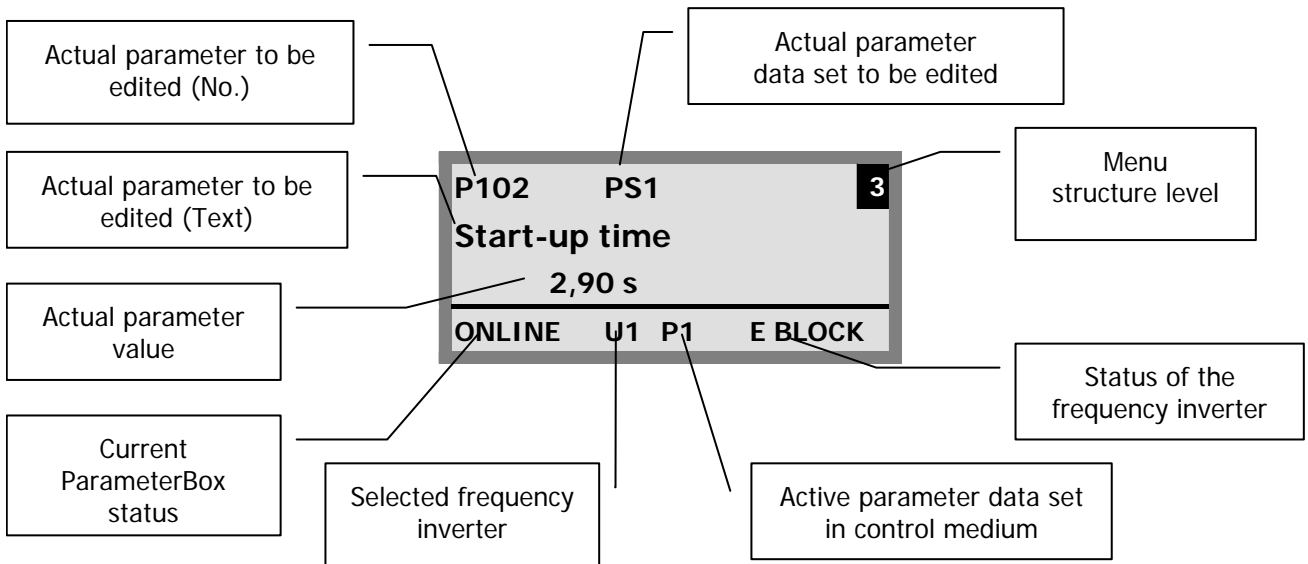
To enter the parameterisation mode, the menu group >Parameterisation< must be selected in the menu level 1. Pressing the **ENTER** key (  ) opens the parameter level of the connected frequency inverter. The following graphic shows how the control elements of the ParameterBox are used for the parameterisation of a frequency inverter.



**Screen layout during parameterisation**

If the setting of a parameter is changed, the value flashes until it is confirmed with the **ENTER key** (↵). To load the factory setting of the parameter to be edited, both **VALUE keys** (▲ and ▼) must be pressed together. To store this change, the setting must also be confirmed with the **ENTER key**.

If the change is not to be stored, then pressing one of the **SELECTION keys** (◀ or ▶) will call up the previously stored value and pressing a SELECTION key again will exit the parameter.



**Note:** The display in the lower line is used to display the actual status of the ParameterBox and the frequency inverter being controlled.

## 4.5 Parameters of the ParameterBox

The following main functions are assigned to the menu groups:

Menu group	No.	Main function
Display	(P10xx):	Selection of operating values and display layout
Parameterisation	(P11xx):	Parameterisation of the connected inverter and all storage objects
Parameter administration	(P12xx):	Copy and save complete parameter sets from storage objects and frequency inverters
Options	(P13xx):	Setting the ParameterBox functions and all automatic processes

### Menu group < Display > (P10xx)

Parameter	Setting value / Description / Note
<b>P1001</b> 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.
<b>P1002</b> FI selection	Selection of the actual object to be parameterised/controlled. The display and further operating actions refer to the item selected. In the frequency inverter selection list, only those devices detected during the bus scan are shown. The actual object appears in the status line. <b>Note:</b> If an error has occurred in a connected frequency inverter, it can be acknowledged by selecting the frequency inverter. <b>Value range:</b> U1 - U5
<b>P1003</b> Display mode	Selection of the operating values display for the ParameterBox <b>Standard</b> Any 3 values next to each other <b>Large size display</b> 1 value (any) with unit <b>List</b> Any 3 values listed with units
<b>P1004</b> Values for display	Selection of a display value for the actual value display of the ParameterBox. 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 Link voltage    Bus actual value1 non-stand.
<b>P1005</b> Standardisation factor	The first value on the display list is scaled with the standardisation factor. Should this standardisation factor deviate from 1.00, the unit of the scaled value is no longer displayed. Value range: -327.67 to +327.67; Resolution 0.01

**Menu group < Parameterisation> (P11xx)**

Parameter	Setting value / Description / Note
<b>P1101</b> Object selection	<p>Selection of the object to be parameterised.</p> <p>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.</p> <p><b>Note:</b> This <b>parameter is not shown</b> if only one device is recognised and there is no storage object in the ParameterBox.</p> <p>Value range: U1 - U5 and S1 - S5</p>

**Menu group < Parameter administration > (P12xx)**

Parameter	Setting value / Description / Note
<b>P1201</b> Copy - Source	<p>Selection of the actual source object to be copied.</p> <p>In the selection list, only the frequency inverters and storage objects detected during the bus scan are shown.</p> <p>Value range: U1 – U5 and S1 - S5</p>
<b>P1202</b> Copy - Target	<p>Selection of actual target object to copy.</p> <p>In the selection list, only the frequency inverters and storage objects detected during the bus scan are shown.</p> <p>Value range: U1 – U5 and S1 - S5</p>
<b>P1203</b> Copy - Start	<p>This parameter triggers a transfer process, whereby all the parameter data sets selected in <b>&gt;Copy – Source&lt;</b> are transferred to the object specified in the <b>&gt;Copy – Target&lt;</b> parameter.</p> <p>While data is being overwritten, an information window appears with acknowledgement. The transfer starts after acknowledgement.</p>
<b>P1204</b> Load settings factory	<p>With this parameter, the parameter data sets of the object selected are described with factory settings.</p> <p>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.</p> <p>Value range: U1 - U5 and S1 - S5</p>
<b>P1205</b> Delete memory	<p>In this parameter the data in the selected storage medium is deleted.</p> <p>Value range: S1 - S5</p>



**Menu group < Options> (P13xx)**

Parameter	Setting value / Description / Note
<b>P1301</b> Language	Selection of languages for operation of the ParameterBox <b>Available languages:</b> German              English              French Spanish              Swedish              Dutch
<b>P1302</b> Operating mode	Selection of the operating mode for the ParameterBox <ul style="list-style-type: none"> <li>• <b>Offline:</b> The ParameterBox is operated autonomously. No PC or frequency inverter is connected. The parameter data set of the frequency inverter is not accessed. The storage objects of the ParameterBox can be parameterised and administrated.</li> <li>• <b>Online:</b> A frequency inverter is located at the interface of the ParameterBox. The frequency inverter can be parameterised and controlled. When changing to the "<b>ONLINE</b>" operating mode, a bus scan is started automatically.</li> <li>• <b>PC slave:</b> A PC is located at the interface of the ParameterBox. The ParameterBox can be addressed as a slave by the <b>NORD CON</b> software. The storage objects log on as separate frequency inverters <ul style="list-style-type: none"> <li>S1 ⇒ USS address 1</li> <li>S2 ⇒ USS address 2</li> <li>S3 ⇒ USS address 3</li> <li>S4 ⇒ USS address 4</li> <li>S5 ⇒ USS address 5</li> </ul> </li> </ul>
<b>P1303</b> Automatic bus scan	Setting the switch-on characteristics. <ul style="list-style-type: none"> <li>• <b>Off</b> An automatic bus scan is not implemented. The frequency inverters connected before switching off must be looked for again after switch-on.</li> <li>• <b>On</b> A bus scan is automatically implemented when the ParameterBox is switched on.</li> </ul>
<b>P1304</b> Contrast	Contrast setting of the ParameterBox display Value range: 0% ... 100%; Resolution 1%
<b>P1305</b> Set password	The user can set up a password in this parameter. If a value other than 0 has been entered in this parameter, then the settings of the ParameterBox or the parameters of the connected frequency inverter cannot be altered.
<b>P1306</b> Box password	If the password function is to be reset, the password selected in the <b>&gt;Set Password&lt;</b> parameter must be entered here. If the correct password has been selected, than all functions of the ParameterBox can be used again.
<b>P1307</b> Reset parameter	In this parameter the ParameterBox can be reset to the factory setting. All ParameterBox settings and the data in the storage media will be deleted.
<b>P1308</b> Software version	Displays the software version of the ParameterBox. Please note for future use.

#### 4.6 Error messages of the ParameterBox

Display	Error	Cause
Communication error		
200	Parameter number not permissible	<p>These error messages are due to EMC interferences or differing software versions of the participants.</p> <ul style="list-style-type: none"> <li>• Check the software version of the ParameterBox and that of the connected frequency inverter.</li> <li>• Check the wiring of all components and for possible EMC interference</li> </ul>
201	Parameter value cannot be changed	
202	Parameter outside value range	
203	Incorrect Sub- Index	
204	No Array parameter	
205	Incorrect parameter type	
206	Incorrect response identifier USS interface	
207	Checksum error of USS interface	<p>Communication between frequency inverter and ParameterBox is faulty (EMC), safe operation cannot be guaranteed.</p> <ul style="list-style-type: none"> <li>• Check the connection to the frequency inverter. Use a shielded cable between the devices. Route the BUS leads separately from the motor cables.</li> </ul>
208	Incorrect status identifier USS interface	<p>Communication between frequency inverter and ParameterBox is faulty (EMC), safe operation cannot be guaranteed.</p> <ul style="list-style-type: none"> <li>• Check the connection to the frequency inverter. Use a shielded cable between the devices. Route the BUS leads separately from the motor cables.</li> </ul>
209_1	Inverter not responding	<p>The ParameterBox is waiting for a response from the connected frequency inverter. The waiting time has elapsed without a response being received.</p> <ul style="list-style-type: none"> <li>• Check the connection to the frequency inverter. The frequency inverter USS parameter settings were changed during operation.</li> </ul>
Identification error		
220	Unknown device	<p>Device ID not found.</p> <p>The connected inverter is not listed in the database of the ParameterBox; no communication can be established.</p> <ul style="list-style-type: none"> <li>• Please contact your Getriebekonstruktion Nord dealership.</li> </ul>
221	Software version not recognised	<p>Software version not found!</p> <p>The software of the connected frequency inverter is not listed in the ParameterBox database, no communication can be set up.</p> <ul style="list-style-type: none"> <li>• Please contact your Nord supply agency.</li> </ul>

Display	Error	Cause <ul style="list-style-type: none"> <li>Remedy</li> </ul>
222	Inverter extension level not recognised	An unknown component has been detected in the frequency inverter (Customer unit). <ul style="list-style-type: none"> <li>Please check the components installed in the frequency inverter</li> <li>If necessary, check the software version of the ParameterBox and the frequency inverter.</li> </ul>
223	Bus configuration has changed	A different device to that saved responds when the last bus configuration is restored. This error can only occur if the parameter >Auto. Bus Scan< is set to <b>OFF</b> and another device has been connected to the ParameterBox. <ul style="list-style-type: none"> <li>Activate the Automatic Bus Scan function.</li> </ul>
224	Device is not supported	The frequency inverter type connected to the ParameterBox is not supported! <ul style="list-style-type: none"> <li>The ParameterBox cannot be used with this frequency inverter.</li> </ul>
225	The connection to the inverter is blocked	Access to a device that is not <b>ONLINE</b> (previous Time Out error). <ul style="list-style-type: none"> <li>Carry out a bus scan via the parameter &gt;Bus Scan&lt; (P1001).</li> </ul>
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 carried out.
229	Object selected is empty	Parameterisation attempt of a deleted storage medium
230	Different software versions	<b>Warning</b> Copying objects with different software versions can lead to problems when transferring parameters.
231	Invalid password	Attempt to change a parameter without a valid Box password being entered in parameter >Box Password< P1306.
232	Bus scan only during operation: <b>ONLINE</b>	A bus scan (search for a connected frequency inverter) is only possible when in <b>ONLINE</b> mode.

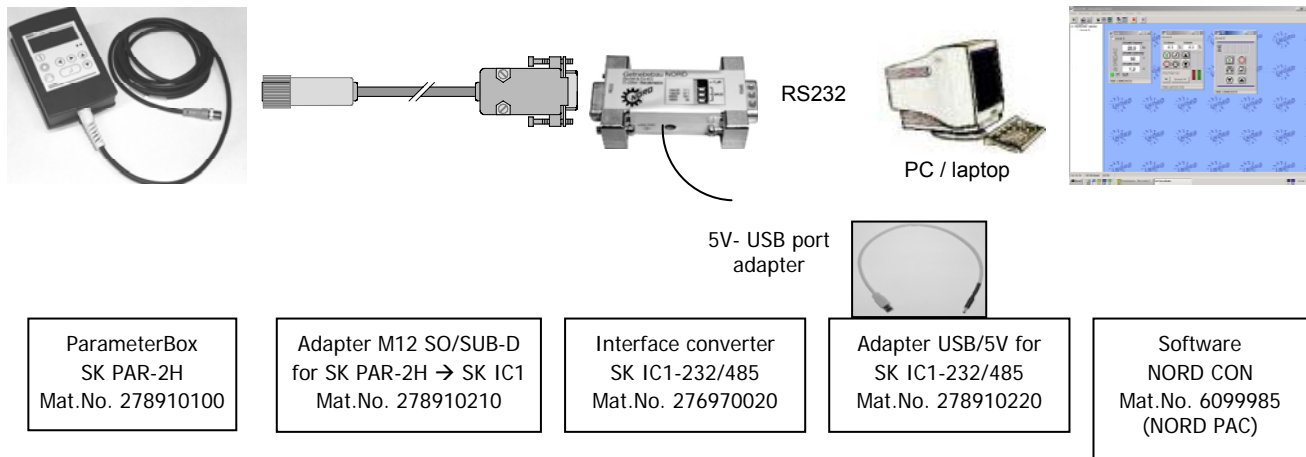
Display	Error	Cause • Remedy
Warnings		
240	Overwrite data? → YES                      NO	<p>These warnings indicate that there is a possibly significant change which needs additional confirmation.</p> <p>Once the next procedure has been selected, it must be confirmed with the "ENTER" key.</p>
241	Delete data? → YES                      NO	
242	Move SW version? → CONTINUE      CANCEL	
243	Move series? → CONTINUE      CANCEL	
244	Delete all data? → YES                      NO	
Inverter control error		
250	<b>This function is not enabled</b>	<p>The function requested is not enabled at the frequency inverter parameter interface.</p> <ul style="list-style-type: none"> <li>• Change the value of the parameter P509 &gt;Interface&lt; of the connected frequency inverter to the required function.</li> </ul>
251	<b>Control command was not successful</b>	<p>The control command cannot be implemented by the frequency inverter, as a higher priority function, e.g. Emergency Stop or an OFF signal to the control terminals of the frequency inverter, is present</p>
252	<b>Control is not possible OFFLINE</b>	<p>Call up of a control function in <b>Offline</b> mode.</p> <ul style="list-style-type: none"> <li>• Change the operating mode of the ParameterBox in the parameter &gt;Operating Mode&lt; P1302 to <b>Online</b> and repeat the action.</li> </ul>
253	<b>Error acknowledgement not successful</b>	<p>The acknowledgement of an error at the frequency inverter was not successful, the error message remains.</p>
Error message from inverter		
"Error No. from inverter"	Inverter error "Inverter error text"	<p>An error has occurred at the frequency inverter with the displayed number. The frequency inverter error No. and error text is displayed.</p>

## 4.7 Data transfer with NORD CON

The NORDAC ParameterBox S1 to S5 storage elements can be administrated and archived using the **NORD CON** control and parameter software.

To achieve transfer of data, the PC serial interface (RS232) must be connected to the ParameterBox via an interface converter (SK IC1-232/485, Part. No. 276970020) and suitable connection cable. (M12 Socket/SUB-D, Part. No. 278910210). In addition, the interface inverter must be connected to an external supply voltage. Use the USB/5V adapter for this, it is connected to the interface converter via a cinch connector and to the PC/laptop via a USB connector.

**The following components are required for the ParameterBox → PC/laptop connection:**



In this set-up, communication is controlled by the PC. For this, the ParameterBox must be set in the menu group **>Options<**, Parameter **>Operating mode< (P1302)** to the value **PC slave**. After a bus scan, the **NORD CON** program will then detect the filed storage objects S1 to S5 as separate frequency inverters with bus addresses 1 to 5 and display them onscreen.

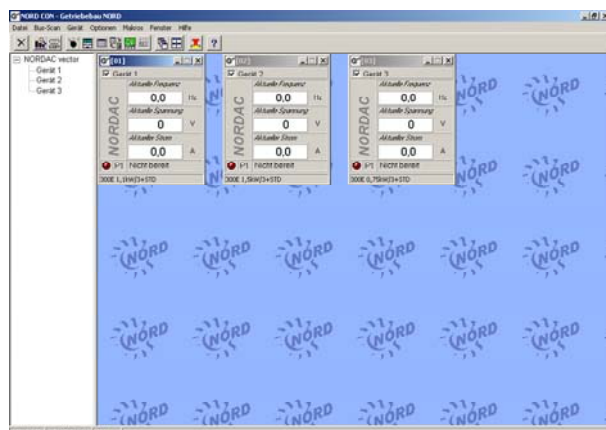
### NOTE



Only frequency inverter parameter data sets already saved in the storage objects can be detected and edited by the **NORD CON** parameterisation software.

To edit the data set of a new frequency inverter, the inverter type first has to be set via the **>Load factory settings (P1204)<** parameter. The NORD CON software then detects the new storage object in a new bus scan. The new parameter data set can then be edited with the usual tools.

All NORD CON parameterisation functions are now available.



## 5 NORD CON software

### 5.1 General information

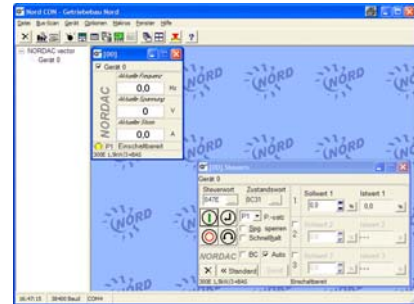
**NORD CON** is a PC program to control and parameterise frequency inverters manufactured by Getriebebau NORD. The software can be installed on all computers with the Windows 95, 98, NT, 2000, ME or XP operating systems.

There are two ways to implement the installation of the NORD CON software. The NORD CON software can either be installed from the NORD PAC CD (Part. No.: 6099985) or downloaded from the website >[www.nord.com](http://www.nord.com)<.

**NORD CON** can communicate with up to 31 frequency inverters simultaneously or via the device-specific RS485 interface.

The connection from PC to SK 300E is implemented via the interface converter **SK IC1-232/485** (Part. No. 276970020) and the **connection cable 300E** (Part. No. 278910060).

As well as control and parameterisation of the frequency inverter, operating values can also be displayed. The integrated oscilloscope function is a helpful tool for optimising drive systems. The resulting oscillograms – like the parameter data sets - can be saved, edited and archived.



**NOTE:** Internet site for downloading the PC software **NORD CON**

>>> [www.nord.com](http://www.nord.com) <<<

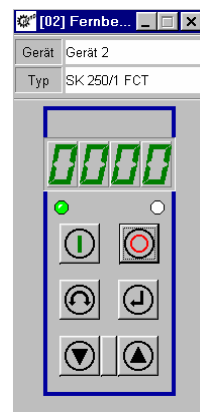
### Features

- Creation, documentation and storage of frequency inverter parameter settings
- Control of the connected frequency inverters
- Monitoring of connected frequency inverters
- Oscilloscope function
- Creation of macros for test process sequences
- Remote control of connected frequency inverters

### Remote control

For commissioning (parameterisation), the known device displays are simulated, enabling remote control of the frequency inverter in familiar surroundings.

All possible frequency inverter operating unit functions can be carried out.

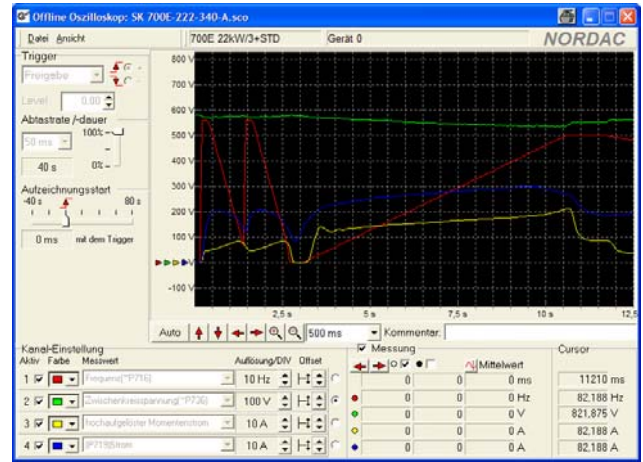


Simulation Controlbox

**Oscilloscope function**

The function to be recorded can be selected from various channel settings. A total of 4 channels are available and are scalable in both time and value range.

The curves can be saved and archived with the respective settings and called up at a later time.



**Parameterisation**

All the connected frequency inverter parameters can be read, edited, saved or printed for documentation with **NORD CON**.

All frequency inverter parameters can be easily accessed via the parameter name and the corresponding parameter number. This means that parameterisation with the PC software **NORD CON** is very transparent and therefore operation is much easier.

In addition, the parameter characteristics are available and it is possible to narrow down the displayed parameters.

Typ	SK 250V1 FCT	Gerät	Gerät 2																								
<table border="1"> <thead> <tr> <th>Steuerklemmen</th> <th>Zusatzparameter</th> <th>Informationen</th> </tr> <tr> <th>Alle</th> <th>Basis-Parameter</th> <th>Motordaten</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/> 1 Auswahl Anzeige</td> <td><input checked="" type="checkbox"/> 100 Parametersatz</td> <td></td> </tr> <tr> <td><input checked="" type="checkbox"/> 101 Param.-Satz kopieren</td> <td><input checked="" type="checkbox"/> 102 Hochlaufzeit</td> <td></td> </tr> <tr> <td><input checked="" type="checkbox"/> 103 Bremszeit</td> <td><input checked="" type="checkbox"/> 104 Minimale Frequenz</td> <td></td> </tr> <tr> <td><input checked="" type="checkbox"/> 105 Maximale Frequenz</td> <td><input checked="" type="checkbox"/> 106 Rampenverundungen</td> <td></td> </tr> <tr> <td><input checked="" type="checkbox"/> 107 Einfallzeit Bremse</td> <td><input checked="" type="checkbox"/> 108 Ausschaltmodus</td> <td></td> </tr> <tr> <td><input checked="" type="checkbox"/> 109 Strom DC-Bremse</td> <td><input checked="" type="checkbox"/> 112 Momentstromgrenze</td> <td></td> </tr> </tbody> </table>				Steuerklemmen	Zusatzparameter	Informationen	Alle	Basis-Parameter	Motordaten	<input checked="" type="checkbox"/> 1 Auswahl Anzeige	<input checked="" type="checkbox"/> 100 Parametersatz		<input checked="" type="checkbox"/> 101 Param.-Satz kopieren	<input checked="" type="checkbox"/> 102 Hochlaufzeit		<input checked="" type="checkbox"/> 103 Bremszeit	<input checked="" type="checkbox"/> 104 Minimale Frequenz		<input checked="" type="checkbox"/> 105 Maximale Frequenz	<input checked="" type="checkbox"/> 106 Rampenverundungen		<input checked="" type="checkbox"/> 107 Einfallzeit Bremse	<input checked="" type="checkbox"/> 108 Ausschaltmodus		<input checked="" type="checkbox"/> 109 Strom DC-Bremse	<input checked="" type="checkbox"/> 112 Momentstromgrenze	
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Aktuelle Einstellung: Istfrequenz		Neue Einstellung: Istfrequenz																									

**Macros**

Macros enable simple process flows to be created for test purposes. This can be very useful, for instance, for testing during commissioning of a frequency inverter.

Label	Ziel	Pause	Bemerkung
Label 1	keins	1000	Umrücker-Zustand bereit einstellen
Loop	keins	5000	Freigabe recht 50% für 5 sec
HLZ1	keins	0	Hochlaufzeit auf 2 Sekunden setzen
Label 4	keins	5000	Freigabe links 100% für 5 Sekunden
HLZ2	Loop	0	Hochlaufzeit auf 1 Sekunden setzen

## 6 Commissioning

### 6.1 Basic settings

The NORDAC *trio* SK 300E is already set up so that the assigned 4-pole standard motor can be operated without further presetting.

The frequency inverter is not equipped with a line main switch and is therefore always live when connected to the power supply. It waits with a blocked output until an enable signal occurs.

---

#### Attention



If a digital input is not programmed for enable and the parameter P428 is changed to 2 (= "Immediate with mains"), the motor will start immediately, as all enable conditions have been met.

---

The following options for an enable signal are available:

- 1) An enable signal is generated by pressing the start key when a ParameterBox is connected. See "Initial check with ParameterBox" on Page 73 .
- 2) When connected to a PC, an enable can be generated with the START key in the "NORD CON" control software (see Chapter 5 "NORD CON software", Page 70).
- 3) An "Enable right" is implemented with the factory setting if a control input is configured, e.g. digital input 2 on the CU Basic I/O or Standard I/O (terminal 22), with the internal 15V supply voltage (terminal 42).
- 4) By changing the "Automatic start up" parameter P428 to 2 (= "Immediate with mains"), this enable occurs as soon as the mains voltage is switched on. The requirement for this is that no digital input has been parameterised for Enable.

---

#### Note



In delivery condition, only the most important parameters are visible for eventual parameter changes. Should it be necessary to change other parameters as well, such as e.g. motor data when using a different motor, then parameter P003 "Supervisor Mode" must be set to 1, so that all parameters are visible (see also parameter P003 →, Page 78)!!!

---

#### **Visible parameters in delivery condition:**

**Supervisor mode** switched off (P003 = 0), i.e. only a limited number of parameters are visible, all other parameters are hidden:

#### **Parameterisation with the ParameterBox:**

##### **Operating displays**

P001 Selection of the operating display  
 P003 Supervisor mode

##### **Basic parameters**

P102 Start-up time  
 P103 Braking time  
 P104 Minimum frequency  
 P105 Maximum frequency  
 P107 Brake application time

##### **Control terminals**

P400 Analog input function 1  
 P420 Digital input function 1  
 P421 Digital input function 2  
 P422 Digital input function 3  
 P423 Digital input function 4  
 P424 Digital input function 5  
 P434 Function relay 1  
 P435 Standardisation relay 1  
 P460 Time watchdog

##### **Information**

P700 Actual error  
 P701 Old error  
 P743 Inverter type  
 P744 Upgrade level

#### **Parameterisation with the ControlBox:**

##### **Operating displays**

P001 Selection of the operating display  
 P003 Supervisor mode



## 6.2 Different motor

### Using a different motor to delivery condition:

#### Note



In order to make the motor parameters visible, first set parameter P003 "**Supervisor Mode**" to 1 (see also parameter P003 →, Page 78)!!!

A motor list for standard motors is stored in the device. Select the standard motor in parameter P200 "**Motor list**". The relevant data is loaded automatically in parameters P201 – P208 and must be compared again with the data on the motor rating plate.

When using other motors, the data from the rating plate of the motor must be input into parameters P201 to P208.


To determine the **stator resistance** automatically, parameter P208 must be set to "0" and confirmed with the ENTER key. A single automatic measurement of the stator resistance now takes place. The value adjusted to the line resistance will be stored. This is dependent on the motor circuit entered in parameter P207 (star/delta circuit).

## 6.3 Initial check with the ParameterBox


Check first of all whether all cables are connected correctly and whether all relevant safety precautions have been taken.

Only then can the mains voltage be applied to the frequency inverter. When the ParameterBox is connected, the following window appears in the ParameterBox display:


300E	1.5kW/3	BSC	1
> NORDAC <			
Frequency inverter			
ONLINE	I1	P1	EReady

Ensure that the motor can start-up without danger. Press the START  key on the ParameterBox. The display changes to:

300E	1.5kW/3	BSC	1
Fi/Hz	U/V	I/O	
0.0	27	1.2	
ONLINE	I1	P1	R RUNNING

Check that the motor is running in the direction required by pressing the - key, thereby increasing the set frequency.

The actual output frequency, voltage and current are displayed.

After pressing the STOP key , the motor stops according to the set braking time. After this time has expired, the display will revert to the previous one.

The following parameters can now be changed if necessary.

## 6.4 Minimum configuration of control connections

The following steps must be carried out to operate the **NORDAC *trio* SK 300E** in minimum configuration.

**ATTENTION!** The data are based on the parameter data factory settings.

### 1.) With CU "Basic I/O" or "Standard I/O":

- a. Connect electronic enable:  
Set control terminal [22] to a high signal, e.g. terminal [42].
- b. Set an analog voltage setpoint (0-10V) between the control terminals [12] and [14] after the frequency inverter is ready for operation (dependent on the setting in P428).

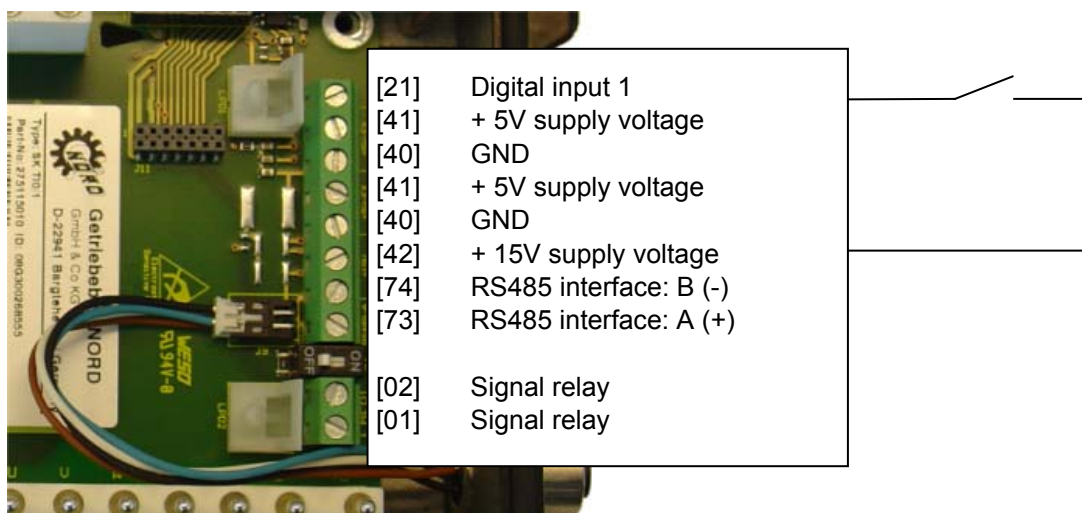
**Example:**



### 2.) Without CU

- a. Set jog frequency in P113 (e.g. 25 Hz). To be able to set the parameter, "Supervisor Mode" must first be switched on (to "1") in P003.
- b. Connect electronic enable:  
Set control terminal [21] to a high signal, e.g. terminal [42], +15V'. The requirement for this is that digital input 1 is programmed for function [1] "Enable right". In the factory setting, digital input 1 is programmed for function [13] to "PTC input". The reason is that each trio SK 300E must have PTC protection.
- c. The motor rotates at the jog frequency.

**Example:**



## 7 Parameterisation

Some parameters are only available in certain configurations when using various option modules (customer units/technology units).

### 7.1 Supervisor mode

The **Supervisor Mode** is used to simplify operation of the frequency inverter. This mode allows parameters that are normally only visible to a limited extent for simple operation to be viewed in full.

If **Supervisor Mode** (P003=0) is switched off, only the parameters required for simple operation are visible. All other parameters are present in the background, but are not displayed. The **Supervisor Mode** can be switched on by setting P003 = 1. When switched on, all parameters are visible.

The copying process is not dependent on the **Supervisor Mode**. All parameter data sets are generally copied.

#### Note



In the factory setting the supervisor mode is switched off, i.e. only a limited number of parameters are visible. In order to make all parameters visible, parameter P003 "**Supervisor Mode**" must be set to 1 (see also parameter P003 →, Chap. 7.5 )!!!

### 7.2 Electronic name plate

In addition to the storage capacity in the frequency inverter, the *trio* SK 300E also contains an additional storage component in the adapter unit. This means that, after the frequency inverter is parameterised, the respective data set is present both in the frequency inverter and the adapter unit.

Should a different (e.g. newer) frequency inverter be mounted on the motor, then the data in the adapter unit will be transferred to the inverter automatically. New data transfer is shown in the display. This message can be acknowledged via the display device or by switching on and off once. The new frequency inverter is then ready to switch on with the previous parameter data set.

This "**Electronic name plate**" means that a defective device can be replaced very rapidly. This prevents long downtimes with new parameterisation and optimisation.

### 7.3 Array parameter display

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

When using the ParameterBox, SK-PAR-..., (figure right), the array level selection options appear in the top right of the display.

#### Attention



When using the **ControlBox** in combination with an SK 300E, only the first array level is displayed for the array parameters. Further array levels are not displayed with the ControlBox.

It is **only** possible in combination with the ParameterBox to display all array levels of the individual array parameters!



ParameterBox - SK PAR-2H

ParameterBox, SK PAR-2H

## 7.4 Menu groups

There are two switchable parameter data sets available during operation. All parameters can be adjusted "ONLINE".

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

Menu group	No.	Main 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 / characteristic curve parameters	(P2--):	Setting of the motor-specific data, important for the ISD current control and choice of the characteristic curve during the setting of dynamic and static boost.
Control terminals	(P4--):	Analog input and output scaling, specification of digital input and relay output functions, as well as PID controller parameters.
Additional parameters	(P5--):	Functions dealing with e.g. the interface, pulse frequency or error acknowledgement.
Information	(P7--):	For display of e.g. actual operating modes, old error messages, device status reports or software version (read parameter).
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 actual parameter settings will be lost, if P523= 1 is set and confirmed with "ENTER".

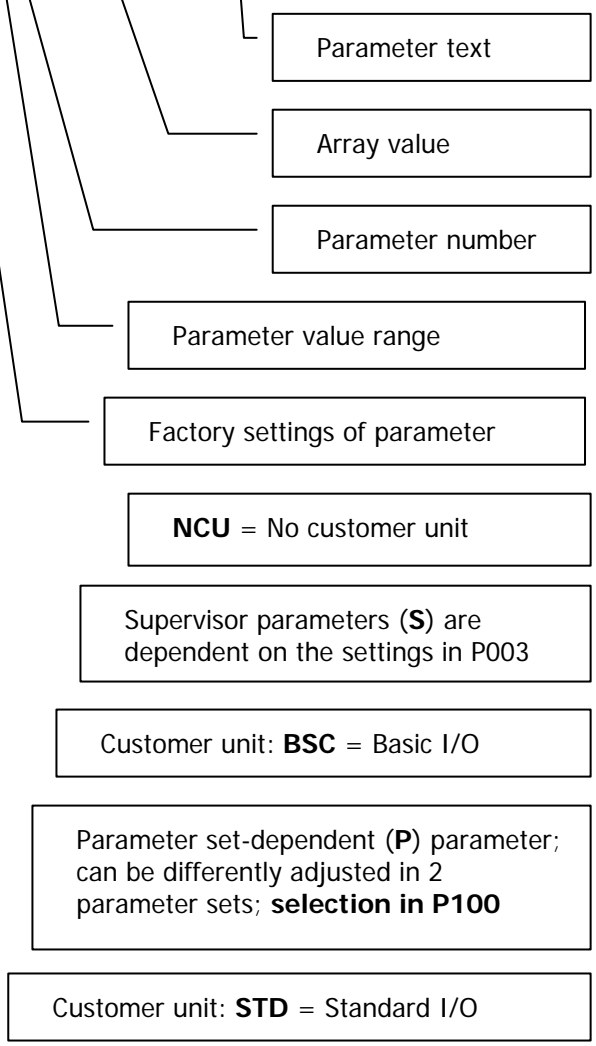
Actual parameter settings can be stored by being transferred to the **ParameterBox** memory or to a file using the **NORD CON** software.

---

**Example: Availability of the parameters / parameter description**

Parameter	Setting value / Description / Note	Supervisor		Parameter set
		Available with option		
<b>P000</b>	....-01 ....-02 ...	<b>S</b>		<b>P</b>
		<b>NCU</b>	<b>BSC</b>	<b>STD</b>
0.01...9999 [ 0 ]	Only with the Option ControlBox according to selection in P001. The operating parameter selected in P001 will be displayed here.			

Example depiction



## 7.5 Operating displays

The abbreviation **FI** will be used below for frequency inverter.

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P001</b>	<b>Selection display</b>		<b>Always available</b>
0 ... 6	<b>0</b> = Actual frequency [Hz], the frequency currently supplied by the FI.		
[ 0 ]	<b>1</b> = Speed [1/min], the actual speed calculated by the FI		
	<b>2</b> = Set frequency [Hz], the output frequency equivalent to the actual setpoint. This need not match the actual output frequency.		
	<b>3</b> = Current [A], the actual output current measured by the FI.		
	<b>4</b> = Torque current [A], the torque-developing output current of the FI.		
	<b>5</b> = Voltage [Vac], the actual alternating voltage being output by the FI.		
	<b>6</b> = Link voltage [Vdc], the FI-internal link voltage.		
<b>P003</b>	<b>Supervisor mode</b>		<b>Always available</b>
<b>0 ... 9999</b>	Supervisor mode can be switched on and off here. The number of visible parameters when the supervisor mode is switched off is dependent on the use of a <b>ParameterBox</b> or <b>ControlBox</b> .		
[ 0 ]	<b>0</b> = <b>Supervisor Mode switched off</b> (only limited number of parameters are visible)		
	<b>1</b> = <b>Supervisor mode switched on</b> (all parameters are visible (P001 – P746)		
	<b>2</b> = <b>Only the menu group 0</b> > Operating display< (P001 ... P003) is visible.		
	<b>3... 9999</b> , like setting value 2.		
<u>Visible parameters:</u>			
<b>Supervisor mode switched off → limited number</b>			
<b>ParameterBox (SK TU2-PAR-...)</b>		<b>ControlBox (SK TU2-CTR)</b>	
P001	Selection of the operating display	P001	Selection of the operating display
P003	Supervisor mode	P003	Supervisor mode
P102	Acceleration time		
P103	Deceleration time		
P104	Minimum frequency		
P105	Maximum frequency		
P107	Brake reaction time		
P400	Analog input function 1 (only with STD or STD)		
P405	Analog input function 2 (only with STD)		
P418	Analog output function (only with STD)		
P419	Analog output scalling (only with STD)		
P420	Digital input function 1		
P421	Digital input function 2 (only with BSC or STD)		
P422	Digital input function 3 (only with BSC or STD)		
P423	Digital input function 4 (only with BSC or STD)		
P424	Digital input function 5 (only with STD)		
P434	Function relay 1		
P435	Relay 1 scalling		
P460	Time watchdog		
P700	Actual error		
P701	Last fault		
P743	Inverter ID		
P744	Configuration		

## 7.6 Basic parameters

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P100</b>	<b>Parameter set</b>	<b>S</b>	
		<b>Always available</b>	
0 / 1 [ 0 ]	<p>Selection of the parameters sets to be parameterised. 2 parameter sets are available. All parameter set-dependent parameters are identified by <b>(P)</b>.</p> <p><b>Display: Parameter set 1 Parameter set 2</b></p> <p>Switching can take place during operation (online).</p> <p>If enabled via the <i>ControlBox</i>, the operating parameter set will match the settings in P100.</p> <p><u>Parameter set display at the ParameterBox:</u></p> <p>The active parameter set is shown on the display with the abbreviation 'P1' or 'P2'.</p>		
<b>P101</b>	<b>Copy parameter set</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 1 [ 0 ]	<p><b>0</b> = No copy process triggered.</p> <p><b>1</b> = Copies the active parameter set to the inactive parameter set. The parameter set P1 or P2 displayed in the ParameterBox is the active set. 2 parameter sets are available for switching.</p> <p>Copying of parameter sets to/from the ParameterBox → see Chap. 4.5 "Parameters of the ParameterBox", <b>P1201 – P1203</b>.</p>		
<b>P102</b>	<b>Acceleration time</b>		<b>P</b>
		<b>Always available</b>	
0 ... 99.99 s [ 2.0 ]	<p>Acceleration time is the time corresponding to the linear frequency rise from 0Hz to the set maximum frequency (P105). If an actual setpoint of &lt;100% is being used, the acceleration time is reduced linearly according to the setpoint set.</p> <p>The acceleration time can be extended by certain circumstances, e.g. FI overload, setpoint lag, ramp smoothing or if the current limit is reached.</p>		
<b>P103</b>	<b>Deceleration time</b>		<b>P</b>
		<b>Always available</b>	
0 ... 99.99 s [ 2.0 ]	<p>Deceleration time is the time corresponding to the linear frequency reduction from the set maximum frequency to 0Hz (P105). If an actual setpoint &lt;100% is being used, the deceleration time reduces accordingly.</p> <p>The deceleration time can be extended by certain circumstances, e.g. by the selected &gt;Switch-off mode&lt; (P108) or &gt; Ramp smoothing &lt; (P106).</p>		
<b>P104</b>	<b>Minimum frequency</b>		<b>P</b>
		<b>Always available</b>	
0 ... 400.0 Hz [ 0.0 ]	<p>The minimum frequency is the frequency supplied by the FI as soon as it is enabled and no additional setpoint is set.</p> <p>In combination with other setpoints (e.g. analog setpoint or fixed frequencies) these are added to the set minimum frequency.</p>		
<b>P105</b>	<b>Maximum frequency</b>		<b>P</b>
		<b>Always available</b>	
0,1 ... 400.0 Hz [ 50.0 ]	<p>The frequency supplied by the FI after being enabled and once the maximum setpoint is present, e.g. analog setpoint equivalent to P403, an appropriate fixed frequency or maximum via the <i>ParameterBox</i>.</p>		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P106</b>	<b>Ramp smoothing</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 100 % [ 0 ]	<p>This parameter enables a rounding of the acceleration and deceleration ramps. This is necessary for applications where soft, but dynamic speed change is important.</p> <p>A rounding is carried out for every setpoint change.</p> <p>The value to be set is based on the set acceleration and deceleration time, however values &lt;10% have no effect.</p>		
<b>P107</b>	<b>Brake reaction time</b>		<b>P</b>
		<b>Always available</b>	
0 ... 2.50 s [ 0.0 ]	<p>Electromagnetic brakes have a physically-dependent delayed reaction time when actuated. This can lead to load drops during lifting applications, as the brake delays in taking over the load.</p> <p>This reaction time can be taken into account under parameter P107 (Braking control).</p> <p>Within the adjustable reaction time, the inverter supplies the set absolute minimum frequency (P505) and so prevents movement against the brake and load drop when stopping.</p>		
<b>P108</b>	<b>Disconnection mode</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 9 [ 1 ]	<p>This parameter determines the manner in which the output frequency is reduced after "Blocking" (controller enable → low):</p> <ul style="list-style-type: none"> <li><b>0 = Voltage disable:</b> 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. Immediate switching on again of the FI can lead to error switch off.</li> <li><b>1 = Ramp:</b> The actual output frequency is reduced proportionally to the remaining braking time from P103.</li> <li><b>2 = Delayed ramping:</b> As in Ramp Down, however the braking ramp is extended for generational operation and the output frequency is increased for static operation. Under certain conditions, this function can prevent overvoltage switch off or reduce brake resistance power dissipation.</li> </ul> <p><b>Note:</b> This function must not be programmed if defined deceleration is required, e.g. with lifting mechanisms.</p> <ul style="list-style-type: none"> <li><b>3 = Immediate DC braking:</b> The FI switches immediately to the preselected DC current (P109). This direct current is supplied for &gt; Time DC brake on &lt; (P110).</li> <li><b>4 = Constant braking distance:</b> The deceleration ramp acts with a delay, if <u>not</u> moved with the maximum output frequency (P105). This leads to a similar braking distance from various frequencies. Note: This function cannot be used as a positioning function. This function should not be used with a ramp smoothing (P106).</li> <li><b>5 = Combined braking:</b> Dependent on the actual dc-link voltage, a high frequency voltage is switched to the basic mode (linear characteristic curves only, P211 = 0 and P212 = 0). The braking time is retained where possible (P103). → Additional heating in motor!</li> <li><b>6 = Quadratic ramp:</b> The deceleration ramp does not have a linear course, but is square.</li> <li><b>7 = Quadratic ramp with delay:</b> Combination of functions 2 and 6</li> <li><b>8 = Quadratic combined braking:</b> Combination of functions 5 and 6</li> <li><b>9 = Constant acceleration power:</b> Only valid for field weakening range! The drive is accelerated and braked using constant electrical power. The course of the ramps depends on the load.</li> </ul>		



Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P109</b>	<b>DC current brake</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 250 % [ 100 ]	<p>Current setting for direct current braking (P108= 3) and combined braking (P108= 5) functions.</p> <p>The correct setting value depends on the mechanical load and the required braking time. A higher setting brings large loads to a standstill more quickly.</p> <p>The 100% setting relates to a current value as stored in the &gt;Nominal current&lt; parameter P203.</p>		
<b>P110</b>	<b>DC braking time on</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 60.00 s [ 2.0 ]	<p>The time that the motor is applied, during the direct current braking (P108= 3) function, with the current selected in the &gt;DC braking current&lt; parameter (P109).</p> <p>Depending on the ratio of actual output frequency to max. frequency (P105), the &gt;DC braking time&lt; is reduced.</p> <p>The time starts with the removal of the enable and can be interrupted by fresh enabling.</p>		
<b>P112</b>	<b>Torque current limit</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
25 ... 400 % / 401 [ 401 ]	<p>With this parameter, a limit value can be set for the torque generating current. 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.</p> <p>The torque current limit can also be set over an infinite range of settings using an analog input. The maximum setpoint (compare adjustment 100%, P402, P408) then corresponds to the value set in P112.</p> <p>The limit value 20% of current torque cannot be undershot by a smaller analog setpoint (P400/405=2).</p> <p><b>401 = OFF</b> is for switching the torque current limit off! This is also the basic setting for the FI.</p>		
<b>P113</b>	<b>Jog frequency</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
-400.0...400.0 Hz [ 0.0 ]	<p>When using the <b>ControlBox</b> or <b>ParameterBox</b> to control the FI, the jog frequency is the starting value following successful enable if it is greater than the minimum frequency.</p> <p>When controlling via control terminals, the jog frequency can be switched on via one of the digital inputs (P420-424= jog frequency &gt;15&lt;). None of the digital inputs may be programmed for enable (function 1 or 2).</p> <p>The setting of the jog frequency can be done directly via this parameter or, if the FI is enabled via the keyboard, by pressing the ENTER key. In this case, the actual output frequency is set in parameter P113 and is then available for the next start.</p> <p><b>NOTE:</b> Specified setpoints via the control terminals, e.g. jog frequency, fixed frequencies or analog setpoints, are generally added with correct sign. The set maximum frequency (P105) cannot be exceeded in this case, and the minimum frequency (P104) cannot be undershot.</p>		

**7.7 Motor / characteristic curve parameters**

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
P200	Motor list	S	P
		Always available	

0 ... 41

**0 = No change to data**

[ 0 ]

**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<sub>S</sub> 0.01Ω / I<sub>EMPTY</sub> 6.5A

<b>2 =</b> 0.18kW 400V	<b>12 =</b> 5.5kW 400V	<b>22 =</b> 7.5Hp 400V	<b>32 =</b> 5.5kW 230V
<b>3 =</b> 0.25kW 400V	<b>13 =</b> 7.5kW 400V	<b>23 =</b> 0.25kW 230V	<b>33 =</b> 0.33Hp 230V
<b>4 =</b> 0.37kW 400V	<b>14 =</b> 11kW 400V	<b>24 =</b> 0.37kW 230V	<b>34 =</b> 0.5Hp 230V
<b>5 =</b> 0.55kW 400V	<b>15 =</b> 0.5Hp 400V	<b>25 =</b> 0.55kW 230V	<b>35 =</b> 0.75Hp 230V
<b>6 =</b> 0.75kW 400V	<b>16 =</b> 0.75Hp 400V	<b>26 =</b> 0.75kW 230V	<b>36 =</b> 1.0Hp 230V
<b>7 =</b> 1.1kW 400V	<b>17 =</b> 1.0Hp 400V	<b>27 =</b> 1.1kW 230V	<b>37 =</b> 1.5Hp 230V
<b>8 =</b> 1.5kW 400V	<b>18 =</b> 1.5Hp 400V	<b>28 =</b> 1.5kW 230V	<b>38 =</b> 2.0Hp 230V
<b>9 =</b> 2.2kW 400V	<b>19 =</b> 2.0Hp 400V	<b>29 =</b> 2.2kW 230V	<b>39 =</b> 3.0Hp 230V
<b>10 =</b> 3.0kW 400V	<b>20 =</b> 3.0Hp 400V	<b>30 =</b> 3.0kW 230V	<b>40 =</b> 4.0Hp 230V
<b>11 =</b> 4.0kW 400V	<b>21 =</b> 5.0Hp 400V	<b>31 =</b> 4.0kW 230V	<b>41 =</b> 7.5Hp 230V

With this parameter, the motor data presets can be changed. The factory setting in parameters P201 - P209 is a 4-pole DC standard motor with the nominal FI power.

Select one of the possible digits and press the ENTER key to set all of the following motor parameters (P201 to P209). The motor data is based on 4-pole DC standard motors.

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

Parameter	Setting value / Description / Note	S	P
		Always available	
<b>P201</b>	<b>Nominal frequency</b>		
20.0 ... 400.0 Hz [***]	The nominal frequency determines the v/f break point at which the FI supplies the nominal frequency (P204) at the output.		
Parameter	Setting value / Description / Note	S	P
		Always available	
<b>P202</b>	<b>Nominal speed</b>		
300..24000 rpm [***]	The nominal speed is important for the correct calculation and control of the motor slip and the speed display (P001 = 1).		

\*\*\* These settings are dependent on the selection in parameter 200.

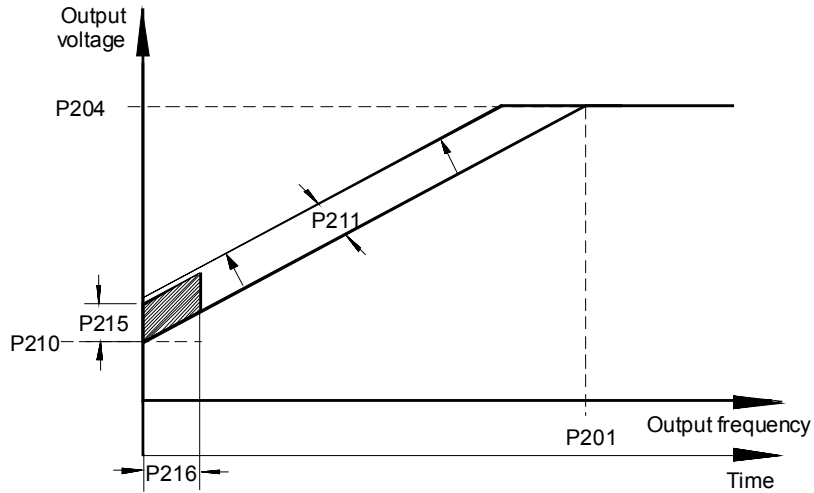
Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P203</b>	<b>Nominal current</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0.01 ... 20.00 A [***]	The nominal current is a decisive parameter for the current vector control.		
<b>P204</b>	<b>Nominal voltage</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
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.		
<b>P205</b>	<b>Nominal power</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 11 kW [***]	The motor nominal power controls the motor set via P200. The output is always shown in "kW" even if a motor with "HP" is selected in P200.		
<b>P206</b>	<b>Cos <math>\varphi</math></b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0.50 ... 0.90 [***]	The cos $\varphi$ is a decisive parameter for the current vector control.		
<b>P207</b>	<b>Star Delta Connection</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0...1 [***]	<b>0 = Star</b> <b>1 = Delta</b> The motor circuit is decisive for stator resistance measurement and therefore for current vector control.		
<b>P208</b>	<b>Stator resistance</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0.00 ... 300.00 $\Omega$ [***]	Motor stator resistance $\Rightarrow$ resistance of one <u>line</u> in the 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. For simple measurement, this parameter can be set to "Zero". Pressing the ENTER key initiates the automatic measurement between two motor phases. In the FI, the resistance on the line is measured on the basis of the delta or star circuit (P207) and the value saved. <b>Note:</b> For correct function of the current vector control, the stator resistance must be automatically measured by the FI.		
<b>P209</b>	<b>No load current</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0.01 ... 20.00 A [***]	This value is always calculated automatically from the motor data if there is a change in the parameter >cos $\varphi$ < P206 and the parameter >Nominal current< P203. <b>NOTE:</b> 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.		

\*\*\* These settings are dependent on the selection in parameter 200.

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P210</b>	<b>Static boost</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
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 <u>load-independent</u> . The no load current is calculated using the motor data. The factory setting of 100% is sufficient for normal applications.		
<b>P211</b>	<b>Dynamic boost</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
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 small a value leads to low torque.		
<b>P212</b>	<b>Slip compensation</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 150 % [ 100 ]	The slip compensation increases the output frequency, dependent on load, to keep the asynchronous motor speed approximately constant.  The factory setting of 100% is optimal when using DC asynchronous motors and correct motor data has been set.		
<b>P213</b>	<b>ISD control loop gain</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
5 ... 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.  This parameter can be adjusted to suit the type of application, e.g. to avoid unstable operation.		
<b>P214</b>	<b>Torque precontrol</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
-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.  <b>NOTE:</b> Motor torques (with rotation field right) are entered with a positive sign, generator torques are entered with a negative sign. The reverse applies for the rotation field left.		
<b>P215</b>	<b>Boost precontrol</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 200 % [ 0 ]	Only with linear characteristic curve (P211 = 0% and P212 = 0%).  For drives, which require a high starting torque, this parameter provides the option of switching on an additional current in the start phase. The application time is limited and can be selected at parameter >Lead boost time< P216.  All current and torque current limits that may have been set (P112 and P537) are deactivated during the time boost precontrol.		
<b>P216</b>	<b>Time Boost precontrol</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0.0 ... 10.0 s [ 0.0 ]	Only with linear characteristic curve (P211 = 0% and P212 = 0%).  Application time for increased starting current.		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	

**P2xx Control/characteristic curve parameters**



**NOTE:**

"typical"

Settings for the...

**Current vector control (factory setting)**

P201 to P209 = Motor data

P210 = 100%

**P211 = 100%**

**P212 = 100%**

P213 = 100%

P214 = 0%

P215 = no significance

P216 = no significance

**Linear v./f. characteristic curve**

P201 to P209 = Motor data

P210 = 100% (static boost)

**P211 = 0%**

**P212 = 0%**

P213 = no significance

P214 = no significance

P215 = 0% (dynamic boost)

P216 = 0s (time boost precontrol)

## 7.8 Control terminals

Parameter	Setting value / Description / Note	Supervisor		Parameter set
		Available with option		
<b>P400</b>	<b>Analog input function 1</b>		<b>BSC</b>	<b>STD</b>

0 ... 16  
[ 1 ]

The FI analog input can be used for various functions. It must be noted that only one of the functions given below is possible at any time.

If, for example, an actual PID frequency is selected, the frequency setpoint cannot be an analog signal. The setpoint can, e.g., be specified via a fixed frequency.

**Analog functions:**

- 0 = Off**, the analog input has no function.
- 1 = Set frequency**, the given analog range (P402/P403) varies the output frequency between the set minimum and maximum frequencies (P104/P105).
- 2 = Torque current limit**, based on the set torque current limit (P112), this can be changed via the analog input. 100% setpoint here corresponds to the set torque current limit.
- 3 = Actual frequency PID**, required to generate a control circuit. The analog input (actual value) is compared with the setpoint (e.g. fixed frequency). The output frequency is adjusted as far as possible until the actual value equals the setpoint. (see controller settings P413 – P415)
- 4 = Frequency addition**, applies in connection with an additional frequency specification about auxiliary setpoints (P410/411). In these cases, the setpoints are added.
- 5 = Frequency subtraction**, the frequency value provided is subtracted from the setpoint.
- 6 = Reserved**
- 7 = Reserved**
- 8 = Actual frequency PID limited**, like function 3 "Actual frequency PID", however the output frequency cannot fall below the programmed minimum frequency value in Parameter P104. (no rotation direction reversal)
- 9 = Actual frequency PID monitored**, like Function 3 "Actual frequency PID", however the FI switches the output frequency off when the minimum frequency P104 is reached.
- 10 = up to 13 = reserved**
- 14 = Actual value process controller \***, activates the process controller, analog input 1 is connected to the actual value sensor (compensator, air can, flow volume meter, etc.). The mode (0-10 V or 0/4-20 mA) is set in P401.
- 15 = Setpoint process controller \***, as function 14, however the setpoint is specified (e.g. by a potentiometer). The actual value must be specified using another input.
- 16 = Lead process controller \***, adds an adjustable additional setpoint after the process controller.

\*) further details regarding the process controller can be found in Chap. 12.3

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
P401	Analog input mode 1	S	
			BSC STD

0 ... 3  
[ 0 ]

0 = 0 – 10V limited:

An analog setpoint smaller than the programmed adjustment 0% (P402) does not lead to undershooting of the programmed minimum frequency (P104). Therefore does not lead to any rotation direction reversal.

1 = 0 - 10V:

If a setpoint smaller than the programmed adjustment 0% (P402) is present, this can cause a change in direction rotation. This allows rotation direction reversal using a simple voltage source and potentiometer.

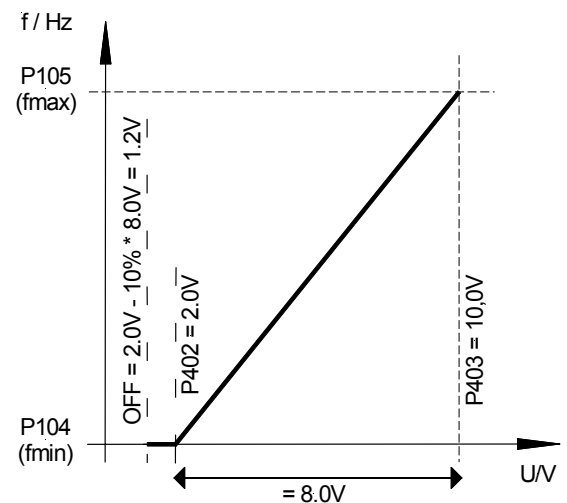
E.g. internal setpoint with rotation direction change: P402 = 5V, P104 = 0Hz, Potentiometer 0–10V ⇒ Rotation direction change at 5V in mid-range setting of the potentiometer.

During the reversing moment (hysteresis = ± P505), the drive stands still when the minimum frequency (P104) is smaller than the absolute minimum frequency (P505). A brake that is controlled by the FI will be closed in the hysteresis range.

If the minimum frequency (P104) is greater than the absolute minimum frequency (P505), the drive reverses when the minimum frequency is reached. In the hysteresis range ± P104, the FI supplies the minimum frequency (P104), the brake controlled by the FI does not close.

2 = 0 – 10V monitored:

If the minimum adjusted setpoint (P402) is undershot by 10% of the difference value from P403 and P402, the FI output switches off. Once the setpoint is greater than  $[P402 * (10% * (P403 - P402))]$ , it will deliver an output signal again.



E.g. setpoint 4-20 mA:

P402: Adjustment 0% = 1V; P403: Adjustment 100% = 5V; -10% corresponds to -0.4V; i.e. 1...5V (4...20mA) normal operating zone, 0.6...1V = minimum frequency setpoint, below 0.6V (2.4mA) output switches off.

3 = -10 - 10V: If a setpoint smaller than the programmed adjustment 0% (P402) is present, this can cause a change in direction rotation. This allows rotation direction reversal using a simple voltage source and potentiometer.

E.g. internal setpoint with rotation direction change: P402 = 5V, P104 = 0Hz, Potentiometer 0–10V ⇒ Rotation direction change at 5V in mid-range setting of the potentiometer.

During the reversing moment (hysteresis = ± P505), the drive stands still when the minimum frequency (P104) is smaller than the absolute minimum frequency (P505). A brake that is controlled by the FI will not be closed.

If the minimum frequency (P104) is greater than the absolute minimum frequency (P505), the drive reverses when the minimum frequency is reached. In the hysteresis range ± P104, the FI supplies the minimum frequency (P104), the brake controlled by the FI does not close.

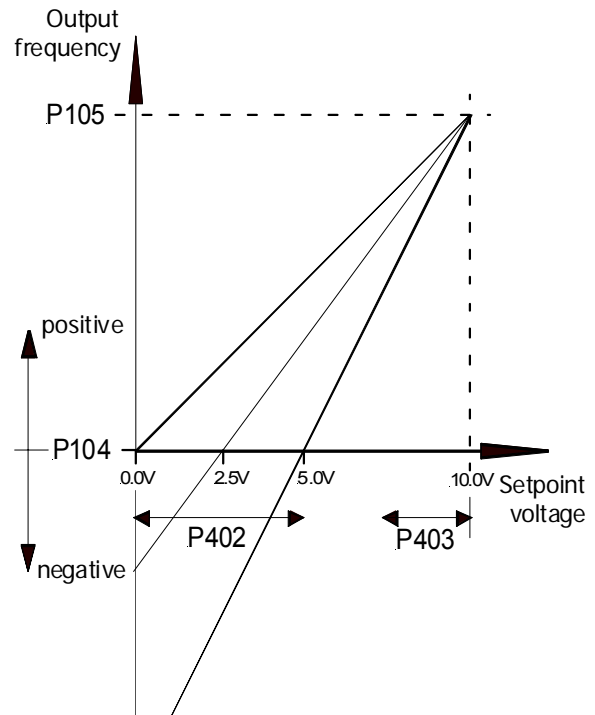
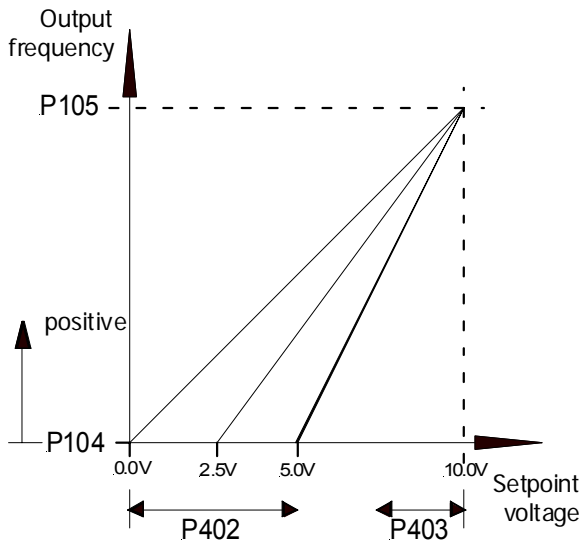
Parameter	Setting value / Description / Note	Supervisor	Parameter set	
		Available with option		
<b>P402</b>	<b>Analog input adjustment 1 0%</b>	S		
			BSC	STD
0.0 ... 10.0 V [ 0.0 ]	This parameter sets the voltage that should correspond with the minimum value of the selected function for the analog input 1. In the factory setting (setpoint) this value is equivalent to the setpoint set via P104 >Minimum frequency<. Typical setpoints and corresponding settings: 0 - 10V → 0.0 V 2 - 10 V → 2.0 V (monitored with the function 0-10V) 0 - 20 mA → 0.0 V (internal resistance approx. 250Ω) 4 - 20 mA → 1.0 V (internal resistance approx. 250Ω)			

Parameter	Setting value / Description / Note	Supervisor	Parameter set	
		Available with option		
<b>P403</b>	<b>Analog input adjustment 1 100%</b>	S		
			BSC	STD
0.0 ... 10.0 V [ 10.0 ]	This parameter sets the voltage that should correspond with the maximum value of the selected function for the analog input 1. In the factory setting (setpoint) this value is corresponds with the setpoint set via P105 >Maximum frequency<. Typical setpoints and corresponding settings: 0 - 10 V → 10.0 V 2 - 10 V → 10.0 V (monitored with the function 0-10V) 0 - 20 mA → 5.0 V (internal resistance approx. 250Ω) 4 - 20 mA → 5.0 V (internal resistance approx. 250Ω)			

**P400 ... P403**

P401 = 0 → 0 – 10V limited

P401 = 1 → 0 - 10V not limited



Parameter	Setting value / Description / Note	Supervisor	Parameter set	
		Available with option		
<b>P404</b>	<b>Filter analog input 1</b>	S		
			BSC	STD
10 ... 400 ms [ 100 ]	Adjustable digital low-pass filter for the analog signal. Interference peaks are hidden, the reaction time is extended.			



Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P405</b>	<b>Analog input function 2</b>		STD
0 ... 16 [ 0 ]	<i>This parameter is identical to P400.</i>		
<b>P406</b>	<b>Analog input mode 2</b>	S	STD
0 ... 3 [ 0 ]	<i>This parameter is identical to P401.</i>		
<b>P407</b>	<b>Analog input adjustment 2 0%</b>	S	STD
0,0 ... 10,0 V [ 0,0 ]	<i>This parameter is identical to P402.</i>		
<b>P408</b>	<b>Analog input adjustment 2 100%</b>	S	STD
0,0 ... 10,0 V [ 10,0 ]	<i>This parameter is identical to P403.</i>		
<b>P409</b>	<b>Filter analog input 2</b>	S	STD
10 ... 400 ms [ 100 ]	<i>This parameter is identical to P404.</i>		
<b>P410</b>	<b>Minimum frequency auxiliary setpoints</b>	S	P
0,0 ... 400,0 Hz [ 0,0 ]	The minimum frequency that can act on the setpoint via the auxiliary setpoints. Auxiliary setpoints are all frequencies that are additionally delivered for further functions in the FI: Actual frequency PID Frequency subtraction Minimum frequency above analog setpoint (potentiometer)	Always available Frequency addition Auxiliary setpoints via BUS Process controller	
<b>P411</b>	<b>Maximum frequency auxiliary setpoints</b>	S	P
0,0 ... 400,0 Hz [ 50,0 ]	This is the maximum frequency that can affect the setpoint through the auxiliary setpoints (e.g. analog input). Auxiliary setpoints are all frequencies that are additionally delivered for further functions in the FI: Actual frequency PID Frequency subtraction Maximum frequency above analog setpoint (potentiometer)	Always available Frequency addition Auxiliary setpoints via BUS Process controller	
	Further information can be found in the graphic for setpoint processing in Chap. 12.1 !!!		
<b>P412</b>	<b>Nominal value Process controller</b>	S	P
0,0 ... 10,0 V [ 5,0 ]	Fixed specification of a setpoint for the process controller that will only occasionally be altered. Only with P400 = 14 ... 16 (process controller). Further details can be found in Chap. 12.3	BSC	STD

Parameter	Setting value / Description / Note	Supervisor		Parameter set	
		Available with option			
<b>P413</b>	<b>PID control P-component</b>	<b>S</b>		<b>P</b>	
			<b>BSC</b>	<b>STD</b>	
0 ... 400.0 % [ 10.0 ]	<p>This parameter is only effective when the <b>function PID actual frequency</b> is selected in parameter P400.</p> <p>The P-component of the PID controller determines the frequency jump if there is a regulation deviation based on the rule difference.</p> <p>For example: At a setting of P413 = 10% and a regulation difference of 50%, 5% is added to the actual setpoint.</p> <p>Further information about the PID controller can be found in Chap. 12.2.</p>				
<b>P414</b>	<b>PID control P-component</b>	<b>S</b>		<b>P</b>	
			<b>BSC</b>	<b>STD</b>	
0 ... 400.0 %/ms [ 1.0 ]	<p>This parameter is only effective when the <b>function PID actual frequency</b> is selected in parameter P400.</p> <p>The I-component of the PID controller determines the frequency change, dependent on time.</p> <p>Further information about the PID controller can be found in Chap. 12.2.</p>				
<b>P415</b>	<b>D-component PID controller</b>	<b>S</b>		<b>P</b>	
			<b>BSC</b>	<b>STD</b>	
0 ... 400.0 %ms [ 1.0 ]	<p>This parameter is only effective when the <b>function PID actual frequency</b> is selected in parameter P400.</p> <p>If there is a rule deviation, the D-component of the PID controller determines the frequency change multiplied by time (%ms).</p> <p>If one of the analog inputs is set in the <b>function actual value process controller</b>, this parameter determines the controller limitation (%) after the PI controller.</p> <p>Further information about the PID controller can be found in Chap. 12.2.</p>				
<b>P416</b>	<b>Ramptime PI setpoint</b>	<b>S</b>		<b>P</b>	
			<b>BSC</b>	<b>STD</b>	
0.00 ... 99.99 s [ 2.0 ]	<p>This parameter is only effective when the <b>function PID actual frequency</b> is selected.</p> <p>Ramp time for the setpoint PID.</p> <p>Further information about the PID controller can be found in Chap. 12.2.</p>				

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P418</b>	<b>Function analog output</b>		<b>P</b>
			<b>STD</b>

0 ... 52

[ 0 ]

**Analog functions:**

An analog voltage (0 to + 10 V) can be taken from the control terminals (max. 5 mA). Various functions are available, the following generally applies:

0 Volt analog voltage always corresponds to 0% of the selected value.

10 V always corresponds to the motor nominal value (unless otherwise stated) multiplied by the P419 standardisation factor, e.g.

$$\Rightarrow 10\text{Volt} = \frac{\text{motor nominal value} \cdot \text{P419}}{100\%}$$

- 0 = No function**, no output signal at the terminals.
- 1 = Actual frequency**, the analog voltage is proportional to the FI output frequency.
- 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.
- 3 = Current**, the effective value of the output current supplied by the FI.
- 4 = Torque current**, displays the motor load torque calculated by the FI. (100% = P112)
- 5 = Voltage**, the output voltage supplied by the FI.
- 6 = DC Link voltage**, the DC voltage in the FI. This is not based on the motor rated data. 10 Volt, standardised at 100%, is equivalent to 850 Volt DC (400V devices) or 450 Volt DC (230V devices)!  
P419 can be used for modification of the required working range. The maximum analog output (10V) corresponds to the standardisation value of the appropriate selection.
- 7 = Value from P542 External control**, the analog output can be set using parameter P542 independently of the actual operating status of the FI to 0.0 ... 10.0V.
- 8 = ... 14 reserved**
- 30 = Actual set frequency before ramp**, shows the frequency produced by any upstream controllers (ISD, PID, etc.). This is then the set frequency for the power level adapted via the acceleration or deceleration ramp (P102, P103).
- 31 = Value via BUS**, the analog output is controlled via a bus system. The process data are directly transferred (P546, P547, P548).

... continued on the next page.

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	

**Digital functions:**

All relay functions described in Parameter >Function Relay 1< P434 can also be transferred via the analog output. If a condition has been fulfilled, then there will be 10V at the output terminals. Negation of the function can be set in parameter >Analog output standardisation< P419.

- |  |                              |
|--|------------------------------|
| 15 = External brake                    | 27 = ... 29 reserved         |
| 16 = Inverter working                  | 32 = ... 43 reserved         |
| 17 = Current limit                     | 44 = Bus I/O In Bit 0        |
| 18 = Torque current limit              | 45 = Bus I/O In Bit 1        |
| 19 = Frequency limit                   | 46 = Bus I/O In Bit 2        |
| 20 = Level with setpoint               | 47 = Bus I/O In Bit 3        |
| 21 = Fault                             | 48 = Bus I/O In Bit 4        |
| 22 = Warning                           | 49 = Bus I/O In Bit 5        |
| 23 = Overcurrent warning               | 50 = Bus I/O In Bit 6        |
| 24 = Overtemperature warning motor     | 51 = Bus I/O In Bit 7        |
| 25 = Torque current limit              | 52 = Value from Bus setpoint |
| 26 = Value from P541, external control |                              |

P419	Analog output standardisation	P	
			STD

-500 ... 500 %  
[ 100 ]

**Analog functions P418 (= 0 ... 14, 30, 31)**

Using this parameter an adjustment can be made to the analog output for the selected operating range. 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.

**Digital functions P418 (= 15 ... 28, 34...52)**

The switching threshold can be set using this parameter for the functions Current limit (= 17), Torque current limit (= 18) and Frequency limit (= 19). A value of 100% refers to the corresponding motor nominal value (see also P435).

With a negative value, the output function is output negated (0/1 → 1/0).

P420	Digital input function 1	Always available	
------	--------------------------	------------------	--

0 ... 21  
[ 13 ]

**PTC input** as factory setting, control terminal 21.

Various functions can be programmed. These can be seen in the following table.

**NOTE:** Only digital functions are possible with this input, therefore only the functions up to No. 21!

P421	Digital input function 2	BSC	STD
------	--------------------------	-----	-----

0 ... 48  
[ 1 ]

**Enable right** as factory setting, control terminal 22

Various functions can be programmed. These can be seen in the following table.

Parameter	Setting value / Description / Note	Supervisor		Parameter set
		Available with option		
<b>P422</b>	<b>Digital input function 3</b>			
			<b>BSC</b>	<b>STD</b>
0 ... 48 [ 2 ]	<b>Enable left</b> as factory setting, control terminal 23 Various functions can be programmed. These can be seen in the following table.			
<b>P423</b>	<b>Digital input function 4</b>			
			<b>BSC</b>	<b>STD</b>
0 ... 48 [ 8 ]	<b>Parameter set switching Bit 0</b> as factory setting, control terminal 24 Various functions can be programmed. These can be seen in the following table.			
<b>P424</b>	<b>Digital input function 5</b>			
				<b>STD</b>
0 ... 48 [ 4 ]	<b>Fixed frequency 1 (P429)</b> as factory setting, control terminal 25 Various functions can be programmed. These can be taken from the following table.			

... Function descriptions follow on the next pages

List of the possible functions of the digital inputs P420 ... P425, P470

Value	Function	Description	Signal
00	No function	Input switched off.	---
01	Enable right	The FI delivers an output signal with the rotation field right if a positive setpoint is present. 0 → 1 Flank (P428 = 0)	High
02	Enable left	The FI delivers an output signal with the rotation field left if a positive setpoint is present. 0 → 1 Flank (P428 = 0)	High
If automatic starting is active (P428 = 1), a high level is sufficient. If the functions "Enable right" and "Enable left" are actuated simultaneously, the FI is blocked.			
03	Change rotation direction	Causes the rotation field to change direction, combined with Enable right or left.	High
04	Fixed frequency 1 <sup>1</sup>	The frequency from P429 is added to the actual setpoint value.	High
05	Fixed frequency 2 <sup>1</sup>	The frequency from P430 is added to the actual setpoint value.	High
06	Fixed frequency 3 <sup>1</sup>	The frequency from P431 is added to the actual setpoint value.	High
07	Fixed frequency 4 <sup>1</sup>	The frequency from P432 is added to the actual setpoint value.	High
If several fixed frequencies are actuated at the same time, then they are added with the correct sign. In addition, the analog setpoint (P400) and possibly the minimum frequency (P104) are added.			
08	Parameter set switch Bit 0	Selection of the active parameter set. (Low level = Parameter set 1, high level = Parameter set 2)	High
09	Hold 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	Voltage disable <sup>2</sup>	The FI output voltage is switched off and the motor runs freely to a stop (low = blocked).	Low
11	Quick stop <sup>2</sup>	The FI reduces the frequency according to the programmed quick stop time (P426).	Low
12	Fault acknowledgement <sup>2</sup>	Fault acknowledgement with an external signal. If this function is not programmed, an fault can also be acknowledged by a low enable setting (P506).	0 → 1 flank
13	PTC resistor input <sup>2</sup>	Analog evaluation of signal present. Switching threshold at approx. 2.5 V Switch-off delay = 2sec, warning after 1sec.	Analog
14	Remote control <sup>2</sup>	With Bus system control, low level switches the control to control via control terminals.	High
15	Jog frequency <sup>1</sup>	The fixed frequency value can be adjusted using the HIGHER/LOWER and ENTER keys (P113), if control is via the ControlBox or ParameterBox.	High
16	Motor potentiometer	As in setting 09, however, the frequency is not maintained below the minimum frequency P104 and above the maximum frequency P105. The ramps can be set using start-up and braking time.	Low
17	Reserved		
18	Watchdog <sup>2</sup>	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	Setpoint 1 on/off	Analog input switch-on and switch-off 1/2 (high = ON) The low signal sets the analog input to 0% which does not lead to shutdown when the minimum frequency (P104) > than the absolute minimum frequency (P505).	High
20	Setpoint 2 on/off		High
21	Fixed frequency 5 <sup>1</sup>	The frequency from P433 is added to the actual setpoint value.	High

... continued on the next page

Value	Function	Description	Signal
22	... 25 reserved		
	<b>Analog functions for digital inputs</b> can be programmed for every input, they have a resolution of 7 bit and can be used for simple applications.		
26	Torque current limit	Adjustable load limit, the output frequency is reduced when it is reached. → P112	Analog
27	Actual frequency PID	Possible PID actual value feedback	Analog
28	Frequency addition	Addition to other frequency setpoint values	Analog
29	Frequency subtraction	Subtraction from other frequency setpoint values	Analog
30	Inhibit PID	Switching the PID controller / process controller function on and off (high = ON)	High
	<b>Analog functions for digital inputs</b> can be programmed for every input, they have a resolution of 7 bit and can be used for simple applications.		
40	Current value process controller *	Activates the process controller, analog input 1 is connected to the actual value sensor (compensator, air can, flow volume meter, etc.). The mode (0-10 V or 0/4-20 mA) is set in P401.	Analog
41	Nom. Value Process controller *	Like function 14, however the setpoint is specified (e.g. by a potentiometer). The actual value must be specified using another input.	Analog
42	Add. Process control *	Adds an adjustable additional setpoint after the process controller	Analog
43	... 46 reserved		
47	Motorpoti frequency +	When an enable is present, the frequency setpoint can be increased by pressing the key. The acceleration time P102 is relevant for increases using the key. Limitation is implemented with the maximum frequency P105.	High
48	Motorpoti frequency -	When an enable is present, the frequency setpoint can be decreased by pressing the key. The deceleration time P103 is relevant for decreases using the key. Limitation is implemented with the minimum frequency P104.  Reversing is not possible in this way.	High
71	Motorpoti frequency + with automatic saving	When an enable is present, the frequency setpoint can be increased by pressing the key. The acceleration time P102 is relevant for increases using the key. Limitation is implemented with the maximum frequency P105.  One second after the frequency change, the held frequency value is automatically saved in parameter P113 (jog frequency).	High
72	Motorpoti frequency - with automatic saving	When an enable is present, the frequency setpoint can be decreased by pressing the key. The deceleration time P103 is relevant for decreases using the key. Limitation is implemented with the minimum frequency P104.  Reversing is not possible in this way.  One second after the frequency change, the held frequency value is automatically saved in parameter P113 (jog frequency).	High
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)		
	*) For further details about the process controller, see Chap. 12.3		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P426</b>	<b>Quick stop time</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 10.00 s [ 0.1 ]	Deceleration time setting for the quick stop function, which can be triggered by digital input, bus control, keyboard or automatically in the case of an error.  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 emergency stop time is reduced correspondingly.		
<b>P427</b>	<b>Quick stop on error</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 3 [ 0 ]	<p><b>0 = Off</b>, automatic quick stop during error is deactivated</p> <p><b>1 = With mains failure</b>, automatic quick stop during mains failure</p> <p><b>2 = With errors</b>, automatic quick stop during error</p> <p><b>3 = Error or mains failure</b>, automatic quick stop during mains failure or error</p>		
<b>P428</b>	<b>Automatic starting</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 2 [ 0 ]	<p><b>0 = Off</b>, the FI needs a flank for enable (signal change from "low" to "high") at the respective digital input or PotentiometerBox switch.</p> <p><b>1 = On</b>, the FI reacts to a high level. This applies both for digital input signals and switched PotentiometerBox.</p> <p><b>2 = Immediate with mains voltage</b>, when the mains voltage is switched on, the drive starts immediately with the set minimum or jog frequency without a high level being present at a digital input or via the PotentiometerBox. <i>Requirement: No digital inputs should be programmed for enable!</i></p> <p><b>Setpoint specification:</b>  <u>Without analog input signal via customer unit or PotentiometerBox:</u>                      → Set minimum frequency (P104) or jog frequency (P113)                          P104 = Only positive value can be set for rotation right                          P113 = Right or left rotation depending on sign                      → If P104 and P113 are set with same sign, they are added.  <u>With analog input signal via customer unit or PotentiometerBox:</u>                      → P104 applies as minimum value for analog input signal (CU or potentiometer), is therefore not added. P105 (max. frequency) is the maximum value for the analog input signal.                      → When the jog frequency is set (P113), it is added to the analog input signal.                      → When the PotentiometerBox is used, the switch is inactive (only operating light).</p>		

**Attention**



If no digital input is programmed for "Enable" and the parameter P428 is changed to [2]= "Immediate with mains", the motor will start immediately because all enable conditions have been fulfilled.



Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P429</b>	<b>Fixed frequency 1</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
-400 ... 400 Hz [ 0.0 ]	Used to set the fixed frequencies. They are added for multiple selection. If <u>none</u> of the digital inputs are programmed for enable, the FI is enabled when a fixed frequency is actuated.		
<b>P430</b>	<b>Fixed frequency 2</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
-400 ... 400 Hz [ 0.0 ]	See (P429) Fixed frequency 1		
<b>P431</b>	<b>Fixed frequency 3</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
-400 ... 400 Hz [ 0.0 ]	See (P429) Fixed frequency 1		
<b>P432</b>	<b>Fixed frequency 4</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
-400 ... 400 Hz [ 0.0 ]	See (P429) Fixed frequency 1		
<b>P433</b>	<b>Fixed frequency 5</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
-400 ... 400 Hz [ 0 ]	See (P429) Fixed frequency 1		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
P434	Function relay 1		P
		Always available	

0 ... 38

**Control terminals 1/2:**

[7]

The settings 3 to 5 and 11 work with 10% hysteresis, i.e. the relay contact closes (function 11 opens) when the limit value is reached and opens (function 11 closes) when a 10% smaller value is undershot. This behaviour can be inverted with a negative value in P435.

Setting / Function	Relay contact ... for limit value or function
<b>0 = No function</b>	Open
<b>1 = External brake</b> , to control a brake on the motor. The relay switches at the set absolute minimum frequency (P505, default: 2 Hz). A setpoint delay should be programmed for typical brakes (see P107).  <b>NOTE:</b> In the SK 300E, a DC voltage is generated for a brake and supplied at the terminals -Br and +Br. The relay contact should generally be used with a special brake voltage.	Closes
<b>2 = Inverter is working</b> , the closed relay contact indicates voltage at the FI output (U - V - W).	Closes
<b>3 = Current limit*</b> , based on the setting of the motor nominal current in P203. This value can be adjusted with the standardisation (P435).	Closes
<b>4 = Torque current limit *</b> , based on motor data settings in P203 and P206. Signals a corresponding torque load. This value can be adjusted with the standardisation (P435).	Closes
<b>5 = Frequency limit *</b> , based on motor nominal frequency setting in P201. This value can be adjusted with the standardisation (P435).	Closes
<b>6 = Level with Setpoint</b> , indicates that the FI has completed the frequency increase or decrease. Setpoint frequency = actual frequency! After the contact is closed, the setpoint must change by at least 1 Hz. → <i>Setpoint not reached - contact opens</i>	Closes
<b>7 = Fault</b> , general Fault message. Fault is or not yet acknowledged. → <i>Operational - contact closes</i>	Opens
<b>8 = Warning</b> : general warning, a limit value was reached that could lead to a later shutdown of the FI.	Opens
<b>9 = Overcurrent warning</b> : At least 130% FI nominal current was delivered for 30 sec. ( $I^2t$ function)	Opens
<b>10 = Overtemperature motor (warning)</b> : The motor temperature is evaluated via a digital input. → Motor is too hot. Warning occurs after 1 second, overheating switch off after 2 seconds.	Opens
<b>11 = Torque current limit/ current limit active (warning)</b> , limit value in P112 is reached. P435 has no significance. Hysteresis = 10%.	Opens
<b>12 = Value of P541 - External control</b> : The relay can be controlled using parameter P541 (Bit 0), independently of the actual operating status of the FI.	Closes
<b>13 = ... 29 reserved</b>	---

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
	<b>30 = Bus IO In Bit 0</b> (In combination with option SK TU2-AS1, AS-Interface) *		Closes
	<b>31 = Bus IO In Bit 1</b> (In combination with option SK TU2-AS1, AS-Interface) *		Closes
	<b>32 = Bus IO In Bit 2</b> (In combination with option SK TU2-AS1, AS-Interface) *		Closes
	<b>33 = Bus IO In Bit 3</b> (In combination with option SK TU2-AS1, AS-Interface) *		Closes
	<b>34 = Bus IO In Bit 4</b> (In combination with option SK TU2-AS1, AS-Interface) *		Closes
	<b>35 = Bus IO In Bit 5</b> (In combination with option SK TU2-AS1, AS-Interface) *		Closes
	<b>36 = Bus IO In Bit 6</b> (In combination with option SK TU2-AS1, AS-Interface) *		Closes
	<b>37 = Bus IO In Bit 7</b> (In combination with option SK TU2-AS1, AS-Interface) *		Closes
	<b>38 = Value from Bus setpoint</b>		Closes

\* Further information on parameterisation with the AS-Interface → **BU 0090 DE**

P435	Relay 1 scalling		P
		Always available	
-400 ... 400%			
[ 100 ]	Adjustment of the limit values of the relay functions. For a negative value, the output function will be output negative. If the set values are positive the relay contact closes, if they are negative the relay contact opens when the limit value is reached.		

P460	Watchdog time		
		Always available	
0.0 /			
0.1 ... 999.9 s	<b>0.1 ... 999.9</b> = The time interval between the expected Watchdog signals (programmable function of the digital inputs P420 – P425). If this time interval passes without a pulse being registered, a switch off occurs with an E012 error message.		
[ 10.0 ]	<b>0.0 = customer fault:</b> As soon as a low-high flank is registered at the input, the FI switches off with fault message E012.		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P480</b>	... -01 <b>Function Bus In Bits</b>	<b>S</b>	
	... -08	<b>Always available</b>	

0 ... 48

[ 0 ]

The Bus I/O In Bits are perceived as digital inputs. They can be set to the same functions (P420...425).

- [01]** = Function Bus I/O In Bit 1
- [02]** = Function Bus I/O In Bit 2
- [03]** = Function Bus I/O In Bit 3
- [04]** = Function Bus I/O In Bit 4

- [05]** = Function Bus I/O In Bit 5
- [06]** = Function Bus I/O In Bit 6
- [07]** = Function Bus I/O In Bit 7
- [08]** = Function Bus I/O In Bit 8

**NOTE**



**Array parameter:**

These parameters can only be set with the **ParameterBox**, only the Array [01] can be set with the **ControlBox**.

The following functions can be set with the Array parameters listed on the previous pages.

Value	Function	Value	Function
<b>0</b>	No function	<b>14</b>	Remote control
<b>1</b>	Enable right	<b>15</b>	Jog frequency
<b>2</b>	Enable left	<b>16</b>	Motor potentiometer
<b>3</b>	Phase seq. reversal	<b>17</b>	Reserved
<b>4</b>	Fixed frequency 1	<b>18</b>	Watchdog
<b>5</b>	Fixed frequency 2	<b>19</b>	Analog setpoint 1 ON/OFF
<b>6</b>	Fixed frequency 3	<b>20</b>	Analog setpoint 2 ON/OFF
<b>7</b>	Fixed frequency 4	<b>21</b>	Fixed frequency 5
<b>8</b>	Parameter set switch Bit 0	<b>22 -29</b>	Reserved
<b>9</b>	Maintain frequency (active)	<b>30</b>	PID controller / process controller ON/OFF
<b>10</b>	Voltage disable	<b>31 -46</b>	Reserved
<b>11</b>	Quick stop	<b>47</b>	Reserved
<b>12</b>	Fault acknowledgement	<b>48</b>	Motorpoti frequency +
<b>13</b>	PTC resistor input		Motorpoti frequency -

Parameter	Setting value / Description / Note	Supervisor	Parameter set																																																				
		Available with option																																																					
<b>P481</b> ... -01 ... -08	<b>Function Bus OUT Bits</b>	<b>S</b>																																																					
		<b>Always available</b>																																																					
0 ... 38 [ 0 ]	<p>The Bus I/O Out Bits are perceived as multi-function relay outputs. They can be set to the same functions (P434...443 / P624...629).</p> <p>[01] = Function Bus I/O Out Bit 1                      [05] = Function Bus I/O Out Bit 5  [02] = Function Bus I/O Out Bit 2                      [06] = Function Bus I/O Out Bit 6  [03] = Function Bus I/O Out Bit 3                      [07] = Function Bus I/O Out Bit 7  [04] = Function Bus I/O Out Bit 4                      [08] = Function Bus I/O Out Bit 8</p>																																																						
	<table border="1"> <thead> <tr> <th>Value</th> <th>Function</th> <th>Value</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>No function</td> <td>12</td> <td>Value of P541</td> </tr> <tr> <td>1</td> <td>External brake</td> <td>13 – 29</td> <td>Reserved</td> </tr> <tr> <td>2</td> <td>Inverter working</td> <td>30</td> <td>Bus IO IN Bit 0</td> </tr> <tr> <td>3</td> <td>Current limit</td> <td>31</td> <td>Bus IO IN Bit 1</td> </tr> <tr> <td>4</td> <td>Torque current limit</td> <td>32</td> <td>Bus IO IN Bit 2</td> </tr> <tr> <td>5</td> <td>Frequency limit</td> <td>33</td> <td>Bus IO IN Bit 3</td> </tr> <tr> <td>6</td> <td>Level with setpoint</td> <td>34</td> <td>Bus IO IN Bit 4</td> </tr> <tr> <td>7</td> <td>Fault</td> <td>35</td> <td>Bus IO IN Bit 5</td> </tr> <tr> <td>8</td> <td>Warning</td> <td>36</td> <td>Bus IO IN Bit 6</td> </tr> <tr> <td>9</td> <td>Overcurrent warning</td> <td>37</td> <td>Output via Bus setpoint</td> </tr> <tr> <td>10</td> <td>Motor over-temperature warning</td> <td></td> <td></td> </tr> <tr> <td>11</td> <td>Motor current limit active warning</td> <td></td> <td></td> </tr> </tbody> </table>	Value	Function	Value	Function	0	No function	12	Value of P541	1	External brake	13 – 29	Reserved	2	Inverter working	30	Bus IO IN Bit 0	3	Current limit	31	Bus IO IN Bit 1	4	Torque current limit	32	Bus IO IN Bit 2	5	Frequency limit	33	Bus IO IN Bit 3	6	Level with setpoint	34	Bus IO IN Bit 4	7	Fault	35	Bus IO IN Bit 5	8	Warning	36	Bus IO IN Bit 6	9	Overcurrent warning	37	Output via Bus setpoint	10	Motor over-temperature warning			11	Motor current limit active warning				
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10	Motor over-temperature warning																																																						
11	Motor current limit active warning																																																						
<b>P482</b> ... -01 ... -08	<b>Norm. Bus IO Out Bits</b>	<b>S</b>																																																					
		<b>Always available</b>																																																					
-400 ... 400 % [ 100 ]	<p>Adjustment of the limit values of the relay functions/Bus Out Bits. For a negative value, the output function will be output negative.</p> <p>When the limit value is reached and the setting values are positive, the relay contact closes, with negative setting values the relay contact opens.</p>																																																						
<b>P483</b> ... -01 ... -08	<b>Hysteresis Bus IO Out Bits</b>	<b>S</b>																																																					
		<b>Always available</b>																																																					
1 ... 100 % [ 10 ]	Difference between switch-on and switch-off point to prevent oscillation of the output signal.																																																						

### 7.9 Additional parameters

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P503</b>	<b>Leading function output</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 4 [ 0 ]	<p>To use the master function output, the inverter controller source must be selected in P509. Only the master frequency (setpoint 1) is transferred with Mode 1, while the actual values selected in P543, P544 and P545 are transferred in Mode 2.</p> <p><b>When using the USS mode:</b></p> <p>If the SK 300E is operated with a connected ParameterBox, the external USS channel for bus control is blocked. The external USS communication is automatically initiated when the ParameterBox connection is interrupted. If the FI has to be re-parameterised, the bus communication will be interrupted when the ParameterBox is connected.</p> <p><b>0 = Off</b>  <b>1 = USS mode 1</b>  <b>2 = CAN mode 1</b>  <b>3 = USS mode 2</b>  <b>4 = CAN mode 2</b></p>		
<b>P504</b>	<b>Pulse frequency</b>	<b>S</b>	
		<b>Always available</b>	
3.0 ... 10.0 kHz [ 6.0 ]	<p>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.</p> <p><b><math>I^2t</math>-characteristic curve FI</b>, raising the pulse frequency leads to a reduction of the output current dependent on time.</p> <p><b>Note</b> → The noise suppression grade limit curve B (for FI attached to motor) is reached with the setting 6kHz</p>		
<b>P505</b>	<b>Absolute minimum frequency</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0.1 ... 10.0 Hz [ 2.0 ]	<p>Gives the frequency value that cannot be undershot by the FI. If the setpoint becomes smaller than the absolute minimum frequency, the FI switches off or changes to 0.0Hz.</p> <p>At the absolute minimum frequency, braking control (P434 or P441) and the setpoint delay (P107) are actuated. If a setting value of "Zero" is selected, the brake relay does not switch during reversing.</p> <p>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.</p> <p><b>NOTE:</b> Output frequencies &lt; 2Hz lead to current limitation.</p>		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P506</b>	<b>Automatic fault acknowledgement</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 7 [ 0 ]	In addition to the manual error acknowledgement, an automatic one can also be selected. <b>0= No automatic</b> error acknowledgement <b>1...5 = Number</b> of permissible automatic error acknowledgments within one mains-on cycle. If the mains are switched off and then on, the full number will be available again. <b>6= Always</b> , an error message will always be automatically acknowledged when the cause is no longer present. <b>7= ENTER key</b> , acknowledgement is only possible using the ENTER key or by mains switch-off. No acknowledgement is implemented by removing the enable!		
<b>P507</b>	<b>PPO type</b>	<b>S</b>	
		<b>Always available</b>	
1 ... 4 [ 1 ]	This parameter can only be used with the technology units Profibus, DeviceNet or InterBus <b>See also additional descriptions BU 0020, BU 0080, BU 0070</b>		
<b>P508</b>	<b>Profibus address</b>	<b>S</b>	
		<b>Always available</b>	
1 ... 126 [ 1 ]	Profibus address, only with the technology unit Profibus <b>See also the additional description for the Profibus control BU 0020</b>		
<b>P509</b>	<b>Interface</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 20 [ 0 ]	Selection of the interface via which the FI is controlled. (P503 Master function output) <b>0= Control terminals or keyboard control **</b> with the ParameterBox, ControlBox, Potentiometer option or the Bus I/O Bits. <b>1= Only control terminals *</b> , the FI can only be controlled via the digital and analog input signals or via the Bus I/O Bits. <b>2= USS setpoint *</b> , the frequency setpoint is transferred via the RS485 interface. Control via the digital inputs is still active. <b>3= USS control word *</b> , the control signals (enable, rotation direction, etc.) are transferred via the RS485 interface, the setpoint via the analog input or the fixed frequencies. <b>4= USS *</b> , all control data is transferred via the RS485 interface. The analog and digital inputs have no function. <b>5= CAN setpoint *</b> <b>6= CAN control word *</b> <b>7= CAN *</b> <b>8= Profibus setpoint *</b> <b>9= Profibus control word *</b> <b>10= Profibus *</b> <b>11= CAN Broadcast *</b> <b>12= Interbus setpoint *</b> <b>13= InterBus control word *</b> <b>14= Interbus *</b> <b>15= CAN Open setpoint *</b> <b>16= CAN Open control word *</b> <b>17= CAN Open *</b> <b>18= DeviceNet setpoint *</b> <b>19= DeviceNet control word *</b> <b>20= DeviceNet *</b>		

**NOTE:**

For details about the respective Bus systems: please refer to the respective Options descriptions.

BU 0020 = Profibus      BU 0050 = USS

BU 0060 = CANopen      BU 0070 = InterBus

BU 0080 = DeviceNet      BU 0090 = AS-Interface

\*) The keyboard control (ParameterBox, ControlBox, Potentiometer option) is blocked, parameterisation is still possible.

\*\*) If the communication during keyboard control is interrupted (time out 0.5 sec), the FI will block without error message.

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P511</b>	<b>USS baud rate</b>	<b>S</b>	
		<b>Always available</b>	
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		
<b>P512</b>	<b>USS address</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 30 [ 0 ]	Setting the FI Bus address.		
<b>P513</b>	<b>Telegram timeout</b>	<b>S</b>	
		<b>Always available</b>	
-0.1 ... 100.0 s [ 0.0 ]	Monitoring function of the active bus interface. Following receipt of a valid telegram, the next one must arrive within the set period. Otherwise the FI reports an fault and switches off with the fault message E010 >Bus Time Out<.  -0.1 = 10.8 / 10.2 inactive, monitoring switched off, no error generated 0.0 ... 100.0 s = Response time for telegram failure		
<b>P514</b>	<b>CAN baud rate</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 7 [ 4 ]	Used to set the transfer rate (transfer speed) via the CANbus interface. All bus participants must have the same baud rate setting.  Further information can be obtained from the manual <b>BU 0060 CANbus</b> .  0 = 10kBaud      3 = 100kBaud      6 = 500kBaud 1 = 20kBaud      4 = 125kbaud      7 = 1Mbaud * 2 = 50kBaud      5 = 250kBaud      (test purposes only)		
*) Safe operation cannot be guaranteed			
<b>P515</b>	<b>CANbus address</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 255 [ 50 ]	Setting the CANbus address		
<b>P516</b>	<b>Skip frequency 1</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0.0 ... 400.0 Hz [ 0.0 ]	The output frequency is masked off in a range of ± 2Hz around the frequency value set here.  This range is transmitted with the set deceleration and acceleration ramp; it cannot be continuously supplied to the output. Frequencies below the absolute minimum frequency should not be set.  0= Masking frequency inactive		
<b>P518</b>	<b>Skip frequency 2</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0.0 ... 400.0 Hz [ 0.0 ]	See P516 Masking frequency 1		



Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P520</b>	<b>Flying start</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 4 [ 0 ]	This function is used to connect the FI to already rotating motors, e.g. in ventilation drives.  <b>0 = Switched off</b> , no flying start. <b>1 = Both directions</b> , the FI looks for a speed in both directions. <b>2 = Setpoint value direction</b> , searches only in the direction of the setpoint value present. <b>3 = Both directions</b> , only <u>after</u> mains supply failure and fault <b>4 = In setpoint direction</b> , only <u>after</u> mains supply failure and fault		
<b>P521</b>	<b>Flying start resolution</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
<b>0.02 ... 2.50</b> [ 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.		
<b>P522</b>	<b>Flying start offset</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
<b>-10.0 ... 10.0 Hz</b> [ 0.0 ]	A frequency value that can be added to the frequency value found, e.g. to remain in the motor range and so avoid the generator range and therefore the chopper range.		
<b>P523</b>	<b>Factory setting</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 2 [ 0 ]	By selecting the appropriate value and confirming it with the ENTER key, the selected parameter range is entered in the factory setting. Once this setting is made, the parameter value automatically changes back to 0.  <b>0 = No change:</b> Does not change the parameterisation <b>1 = Load factory settings:</b> The complete parameterisation of the FI reverts to the factory setting. All originally parameterised data are lost. <b>2 = Factory settings without bus:</b> All parameters of the FI, with the <u>exception</u> of the Bus parameter, are reset to the factory setting.		
<b>P535</b>	<b>I<sup>2</sup>t motor</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 1 [ 0 ]	<b>0 = Switched off</b> <b>1 = Switched on</b>  When calculating the motor temperature, the output current, time and the output frequency (cooling) are taken into account. When the temperature limit value is reached, this causes a switch off and an fault message E002/2.1 (motor over-temperature). Possible positive or negative effects of ambient conditions cannot be taken into account here.  <b>NOTE:</b> If an external fan is used, this parameter should be switched off (0).		
<b>P537</b>	<b>Current limit, via pulse switch off</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 1 [ 1 ]	This function prevents rapid shutdown of the FI according to the load. With the current limit switched on the output current is limited to approximately 150% of the FI nominal current. This limitation is implemented by brief switching off of individual output stage transistors, the actual output frequency remains unchanged.  <b>0 = Off</b> <b>1 = On</b>		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P538</b>	<b>Mains voltage monitoring</b>	<b>S</b>	
		<b>Always available</b>	
<b>0 ... 3</b> <b>[ 3 ]</b>	<p>For safe operation of the FI, the voltage supply must meet a specific quality. If there is a brief interruption of a phase or the voltage supply sinks below a particular limit value, the FI will output an error.</p> <p>Under certain operating conditions, it may be necessary to suppress this fault message. In this case, the input monitoring can be modified.</p> <p>The mains voltage monitoring must be switched off to operate the inverter on a single-phase mains (P538 = 0).</p> <p><b>0 = Switched off</b></p> <p><b>1 = Phase failure:</b> Only phase errors will produce an error message.</p> <p><b>2 = Low voltage:</b> Only low voltage will produce an error message.</p> <p><b>3 = Phase failure and low voltage:</b> Phase errors and undervoltage will produce an error message.</p> <p><b>Note:</b> Operation with an impermissible mains voltage can destroy the frequency inverter!</p>		
<b>P540</b>	<b>Rotation direction mode</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
<b>0 ... 7</b> <b>[ 0 ]</b>	<p>For safety reasons this parameter can be used to prevent a rotation direction reversal and therefore the incorrect rotation direction.</p> <p><b>0 = No rotation direction limitation</b></p> <p><b>1 = Disable phase sequency key</b>, the direction key on the ControlBox (SK TU2-CTR) is blocked. With this parameter, the direction key in the ParameterBox is <u>not</u> blocked.</p> <p><b>2 = To the right only*</b>, only rotation right is possible. The selection of the "incorrect" rotation leads to an enable with the minimum frequency (P104) in the "correct" direction.</p> <p><b>Note:</b> When using a PotentiometerBox (SK TU2-POT), function 5 is active here!</p> <p><b>3 = To the left only*</b>, only rotation left is possible. The selection of the "incorrect" rotation leads to an enable with the minimum frequency (P104) in the "correct" direction.</p> <p><b>Note:</b> When using a PotentiometerBox (SK TU2-POT), function 6 is active here!</p> <p><b>4 = Enable direction only</b>, rotation direction is only possible according to the enable signal, otherwise 0Hz. With "Enable right" only positive speeds are possible, with "Enable left" only negative speeds are possible.</p> <p><b>Note:</b> When using a PotentiometerBox (SK TU2-POT), function 7 is active here!</p> <p><b>5 = Right orientation controlled *</b>, only rotation right is possible. The selection of the "incorrect" rotation direction leads to the FI switching off.</p> <p><b>6 = Left orientation control *</b>, only rotation left is possible. The selection of the "incorrect" rotation direction leads to the FI switching off.</p> <p><b>7 = Enable direction controlled</b>, rotation direction is only possible according to the enable signal, otherwise the FI is switched off.</p> <p><small>*) Applies to keyboard (SK TU2-) and control terminal actuation, in addition, the direction key on the ControlBox is blocked.</small></p>		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P541</b>	<b>External control relay / Bus outputs</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 14 [ 0 ]	<p>This function provides the opportunity to control the relay and the digital outputs independently of the FI status. To do this, the relevant output must be set to the function External control (P418=7 or P434=12).</p> <p>This function is binary coded: Setting range [ 0000000000000-111111111111 ]. This function can either be used manually or in combination with a Bus control with this parameter (Function test).</p> <p><b>ParameterBox:</b> When setting with the ParameterBox each Bit can be switched ON/OFF individually.</p> <p><b>ControlBox:</b> With the ControlBox these values are displayed decimally, the respective values of the individual Bits can be seen in the following table. If there are several switched Bits, the values are correspondingly added.</p> <p><b>BUS:</b> The corresponding value is written into the parameter, thereby setting the relay and digital outputs.</p>		
Entry	Bit...	ParameterBox (text display)	ControlBox (value display)
1	Bit 0	Relay 1      On / Off	On = 1
2	Bit 1	Analog output 1 (digital function) On/Off	On = 2
3	Bit 2	Reserved	---
4	Bit 3	Reserved	---
5	Bit 4	Reserved	---
6	Bit 5	Reserved	---
7	Bit 6	Reserved	---
8	Bit 7	Reserved	---
9	Bit 8	Bus IO Out Bit 0      On / Off	On = 256
10	Bit 9	Bus IO Out Bit 1      On / Off	On = 512
11	Bit 10	Bus IO Out Bit 2      On / Off	On = 1024
12	Bit 11	Bus IO Out Bit 3      On / Off	On = 2048
13	Bit 12	Bus IO Out Bit 4      On / Off	On = 4096
14	Bit 13	Bus IO Out Bit 5      On / Off	On = 8192
<b>P542</b>	<b>Set analog output</b>	<b>S</b>	
			<b>STD</b>
0.0 ... 10.0 V [ 0 ]	<p>This function provides the opportunity of controlling the analog outputs of the FI (depending on the option) independently of its actual operating status. To do this, the relevant analog output must be set to the function External control (P418 = 7).</p>		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P543</b>	<b>Actual bus value 1</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 12	The return value 1 can be selected for bus actuation in this parameter.		
[ 1 ]	<b>NOTE:</b> Further details can be found in the respective BUS instruction manuals.		
	0 = Off	7 = Reserved	
	1 = Actual frequency	8 = Nominal frequency	
	2 = Actual speed	9 = Fault number	
	3 = Current	10 = Reserved	
	4 = Torque current	11 = Reserved	
	5 = Status of digital IO & relays	12 = Bus IO Out Bits 0-7	
	6 = Reserved		
<b>P544</b>	<b>Actual bus value 2</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 12	The return value 2 can be selected for bus actuation in this parameter.		
[ 0 ]	<b>NOTE:</b> Further details can be found in the respective BUS instruction manuals.		
	0 = Off	7 = Reserved	
	1 = Actual frequency	8 = Nominal frequency	
	2 = Actual speed	9 = Fault number	
	3 = Current	10 = Reserved	
	4 = Torque current	11 = Reserved	
	5 = Status of digital IO & relays	12 = Bus IO Out Bits 0-7	
	6 = Reserved		
<b>P545</b>	<b>Actual bus value 3</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 12	The return value 3 can be selected for bus actuation in this parameter. This is only available if <b>P546</b> is ≠ 3.		
[ 0 ]	<b>NOTE:</b> Further details can be found in the respective BUS instruction manuals.		
	0 = Off	7 = Reserved	
	1 = Actual frequency	8 = Nominal frequency	
	2 = Actual speed	9 = Fault number	
	3 = Current	10 = Reserved	
	4 = Torque current	11 = Reserved	
	5 = Status of digital IO & relays	12 = Bus IO Out Bits 0-7	
	6 = Reserved		
<b>P546</b>	<b>Function Bus setpoint 1</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 7	In this parameter, a function is allocated to the supplied setpoint 1 during bus actuation.		
[ 1 ]	<b>NOTE:</b> Further details can be found in the respective BUS instruction manuals.		
	0 = Off		
	1 = Setpoint frequency (16 Bit)		
	2-6 = Reserved		
	7 = Bus IO In Bits 0-7		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P547</b>	<b>Function Bus setpoint 2</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 20 [ 0 ]	In this parameter, a function is allocated to the output setpoint 2 during bus actuation. <b>NOTE:</b> Further details can be found in the respective BUS instruction manuals. <b>0</b> = Off <b>1</b> = Setpoint frequency <b>2</b> = Torque current limit <b>3</b> = Actual frequency PID <b>4</b> = Frequency addition <b>5</b> = Frequency subtraction <b>6</b> = Reserved <b>7</b> = Reserved <b>8</b> = Actual PID frequency limited <b>9</b> = Actual PID frequency monitored <b>10-13</b> = Reserved <b>14</b> = Process controller actual value <b>15</b> = Process controller setpoint <b>16</b> = Process controller lead <b>17</b> = Bus IO In Bits 0-7 <b>18</b> = Reserved <b>19</b> = Set relays <b>20</b> = Set analog output		
<b>P548</b>	<b>Function Bus setpoint 3</b>	<b>S</b>	<b>P</b>
		<b>Always available</b>	
0 ... 20 [ 0 ]	In this parameter, a function is allocated to the output setpoint 3 during bus actuation. It is only present when <b>P546</b> ≠ <b>3</b> . <b>NOTE:</b> Further details can be found in the respective BUS instruction manuals. <b>0</b> = Off <b>1</b> = Setpoint frequency <b>2</b> = Torque current limit <b>3</b> = Actual frequency PID <b>4</b> = Frequency addition <b>5</b> = Frequency subtraction <b>6</b> = Reserved <b>7</b> = Reserved <b>8</b> = Actual PID frequency limited <b>9</b> = Actual PID frequency monitored <b>10-13</b> = Reserved <b>14</b> = Process controller actual value <b>15</b> = Process controller setpoint <b>16</b> = Process controller lead <b>17</b> = Bus IO In Bits 0-7 <b>18</b> = Reserved <b>19</b> = Set relays <b>20</b> = Set analog output		
<b>P549</b>	<b>Function PotiBox (Option)</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 16 [ 1 ]	In this parameter, the setpoint of the PotentiometerBox (SK TU2-POT) is assigned a function. (An explanation can be found in the description of P400) The FI is only enabled with the PotentiometerBox when this parameter is set to the <b>setpoint frequency</b> (P400=1). <b>0</b> = Off <b>1</b> = Setpoint frequency <b>2</b> = Torque current limit <b>3</b> = Actual frequency PID <b>4</b> = Frequency addition <b>5</b> = Frequency subtraction <b>6</b> = Reserved <b>7</b> = Reserved <b>8</b> = Actual PID frequency limited <b>9</b> = Actual PID frequency monitored <b>10-13</b> = Reserved <b>14</b> = Process controller actual value <b>15</b> = Process controller setpoint <b>16</b> = Process controller lead		

Parameter	Setting value / Description / Note	Supervisor	Parameter set																				
		Available with option																					
<b>P551</b>	<b>Drive profile</b>	<b>S</b>																					
		Always available																					
0 ... 1	According to the option the relevant process data profiles can be activated with this parameter.																						
[ 0 ]	This parameter is only effective for pluggable technology units (SK TU2-...).																						
	<table border="1"> <thead> <tr> <th>System</th> <th>CANopen*</th> <th>DeviceNet</th> <th>InterBus</th> </tr> </thead> <tbody> <tr> <td>Technology unit</td> <td>SK TU2-CAO</td> <td>SK TU2-DEV</td> <td>SK TU2-IBS</td> </tr> <tr> <td>Setting</td> <td></td> <td></td> <td></td> </tr> <tr> <td><b>0 =</b></td> <td colspan="3">USS protocol (Profile "Nord")</td> </tr> <tr> <td><b>1 =</b></td> <td>DS402 profile</td> <td>AC Drives profile</td> <td>Drivecom profile</td> </tr> </tbody> </table>	System	CANopen*	DeviceNet	InterBus	Technology unit	SK TU2-CAO	SK TU2-DEV	SK TU2-IBS	Setting				<b>0 =</b>	USS protocol (Profile "Nord")			<b>1 =</b>	DS402 profile	AC Drives profile	Drivecom profile		
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<b>P552</b>	<b>Function PotentiometerBox right</b>	<b>S</b>																					
		Always available																					
0 ... 2	In this parameter the function can be set, in combination with the option <b>PotentiometerBox</b> (SK TU2-POT), for the switch in the <b>Right-hand position</b> (R).																						
[ 1 ]	<b>0 =</b> No function <b>1 =</b> Enabled right <b>2 =</b> Enabled left																						
<b>P553</b>	<b>Function PotentiometerBox left</b>	<b>S</b>																					
		Always available																					
0 ... 2	In this parameter the function can be set, in combination with the option <b>PotentiometerBox</b> (SK TU2-POT), for the switch in the <b>Left-hand position</b> (L).																						
[ 2 ]	<b>0 =</b> No function <b>1 =</b> Enabled right <b>2 =</b> Enabled left																						
<b>P558</b>	<b>Magnetisation time</b>	<b>S</b>	<b>P</b>																				
		Always available																					
0/1/2...500 ms	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.																						
[ 1 ]	For time critical applications, the excitation time can be set or deactivated. <b>0 =</b> No magnetisation time <b>1 =</b> Automatically determined magnetisation time <b>2 ... 500 =</b> According to magnetisation time set  <b>NOTE:</b> Setting values that are too low can reduce the dynamics and starting torque.																						
<b>P559</b>	<b>DC run-on time</b>	<b>S</b>	<b>P</b>																				
		Always available																					
0.00 ... 5.00 s	Following a stop signal and the deceleration 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.																						
[ 0.50 ]	The current level depends on the previous braking procedure (current vector control) or the static boost (linear characteristic).																						
<b>P560</b>	<b>Safe on EEPROM</b>	<b>S</b>	<b>P</b>																				
0...1	Setting 0 prevents cyclical writing to the EEPROM.																						
[1]	This is particularly important where, e.g. constant overwriting of parameters via bus connection would greatly overload the memory.																						



Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P710</b>	<b>Voltage analog output 1</b>	<b>S</b>	
			<b>STD</b>
0.0 ... 10.0 V	Displays the output value of the analog output 1.		
<b>P711</b>	<b>State of Relays</b>	<b>S</b>	
		<b>Always available</b>	
00 ... 11 (binary)	Displays the actual status of the signal relay. 00 ... 11 (binary); Bit 0 = Relay 1 (P434)		
<b>P712</b>	<b>Voltage analog input 2</b>	<b>S</b>	
			<b>STD</b>
0.0 ... 10.0 V	Displays the measured analog input value 2.		
<b>P716</b>	<b>Current frequency</b>	<b>S</b>	
		<b>Always available</b>	
-400.0...400.0 Hz	Displays the current output frequency.		
<b>P717</b>	<b>Current speed</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 9999 rpm	Displays the current motor speed calculated by the FI. <b>NOTE:</b> Positive values are displayed for both rotation directions.		
... -01 <b>P718</b> ... -02 ... -03	<b>Current setpoint frequency</b>	<b>S</b>	
		<b>Always available</b>	
-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 frequency ramp		
<b>P719</b>	<b>Actual current</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 50.0 A	Displays the actual output current.		
<b>P720</b>	<b>Actual torque current</b>	<b>S</b>	
		<b>Always available</b>	
-50.0 ... 50.0 A	Displays the actual calculated torque developing output current (active current). Basis for calculation are the motor data P201 ... P209. (Positive value = motor operation; Negative value – generator operation)		
<b>P722</b>	<b>Actual voltage</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 1000 V	Displays the actual voltage supplied by the FI output.		
<b>P728</b>	<b>Input voltage</b>	<b>S</b>	
		<b>Always available</b>	
0 ... 1000 V	Displays the current mains voltage at the FI input.		



Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P736</b>	<b>DC Link voltage</b>	<b>S</b>	
		Always available	
0 ... 1000 V DC	Displays the actual link voltage.		
<b>P739</b>	<b>Temperature heat sink</b>	<b>S</b>	
		Always available	
0 ... XX°C	Displays the actual FI heat sink temperature. 0 = Low range 9999 = High range (20 ... 100°C)		
<b>P740</b>	<b>Process data Bus In</b>	<b>S</b>	
		Always available	
0000 ... FFFF (hex)	This parameter informs about the actual control word and the setpoints that are transferred via the bus systems.		
... -01	... -01 = Control word (source from P509)		
... -02	... -02 = Setpoint 1 (P546)		
... -03	... -03 = Setpoint 2 (P547)		
... -04	... -04 = Setpoint 3 (P548)		
... -05	... -05 = Bus IO In Bits (P480)		
<b>P741</b>	<b>Process data Bus Out</b>	<b>S</b>	
		Always available	
0000...FFFF (hex)	This parameter informs about the actual status word and the actual values that are transferred via the bus systems.		
... -01	... -01 = Status word		
... -02	... -02 = Istwert 1 (P543)		
... -03	... -03 = Actual value 2 (P544)		
... -04	... -04 = Actual value 3 (P545)		
... -05	... -05 = Bus IO Out Bits (P481)		
<b>P742</b>	<b>Database version</b>	<b>S</b>	
		Always available	
0 ... 9999	Displays the internal database version of the FI.		
<b>P743</b>	<b>Inverter ID</b>		
		Always available	
0.00 ... 250.00 kW	Displays the inverter power in kW, e.g. "1.50" ⇒ FI with 1.5 kW nominal power.		
<b>P744</b>	<b>Configuration</b>		
		Always available	
0 ... 2	This parameter displays the option modules integrated by the FI. 0 = No customer unit 1 = Basic I/O 2 = Standard I/O		
<b>P745</b>	<b>Option version</b>	<b>S</b>	
		Always available	
0 ... 32767	Design status of the integrated options (only when own processor is present).		

Parameter	Setting value / Description / Note	Supervisor	Parameter set
		Available with option	
<b>P746</b>	<b>Option status</b>	<b>S</b>	
		<b>Always available</b>	

0000 ... FFFF hex Status of integrated options (when active), particularly the technology units with integrated bus modules in the SK 300E.  
 → Status values of respective bus modules can be found in the relevant bus instruction manuals.

**SK TU2-POT:**

		Switch position		
		0	Links	Right
Potentiometer position	0V	0000	1000	2000
	5V	01FF	11FF	21FF
	10V	03FF	13FF	23FF

<b>P747</b>	<b>Inverter voltage range</b>	<b>S</b>	
		<b>Always available</b>	

1 ... 2 Indicates the mains voltage range for which this device is specified.  
 1 = 200V ... 240V  
 2 = 380V ... 480V

<b>P999</b>	<b>Inverter type</b>		
		<b>Always available</b>	

0 ... 32767 (hex) Display of FI type coded as hexadecimal, e.g. 9023 hex

## 7.11 Parameter overview, User settings

(P) ⇒ Parameter set dependent, these parameters can be differently adjusted in 4 parameter sets.

S ⇒ Supervisor parameter, visibility depends on P003.

Parameter No.	Name	Factory setting	Super-visor	Setting after commissioning	
				P 1	P 2
<b>OPERATING DISPLAYS (6.4)</b>					
P001	Selection display	0			
P003	Supervisor code	0		0= S parameters are hidden 1= all parameters are visible	
<b>BASIC PARAMETERS (6.5)</b>					
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			
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) DC braking time on [s]	2.0	S		
P112	(P) Torque current limit [%]	401 (off)	S		
P113	(P) Jog frequency [Hz]	0.0	S		
<b>MOTOR DATA / CHARACTERISTIC CURVE PARAMETERS (6.6)</b>					
P200	(P) Motor list	0	S		
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 *	S		
P206	(P) Cos phi	0.78 *	S		
P207	(P) Motor circuit [star=0/delta=1]	1 *	S		
P208	(P) Stator resistance [ $\Omega$ ]	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		
*) dependent on FI power or P200/P220					

Parameter No.	Name	Factory setting	Super-visor	Setting after commissioning	
				P 1	P 2
<b>CONTROL TERMINALS (6.7)</b>					
P400	Function analog input 1	1			
P401	Analog on mode 1	0	S		
P402	Adjustment 1: 0% [V]	0.0	S		
P403	Adjustment 1: 100% [V]	10.0	S		
P404	Filter analog on. 1 [ms]	100	S		
P405	Function analog input 2	0			
P406	Analog on mode 2	0	S		
P407	Adjustment 2: 0% [V]	0.0	S		
P408	Adjustment 2: 100% [V]	10.0	S		
P409	Filter analog on. 2 [ms]	100	S		
P410	(P) Min. freq. an. on. 1/2 [Hz]	0.0	S		
P411	(P) Max. freq. an. on. 1/2 [Hz]	50.0	S		
P412	(P) Setpoint process controller [V]	5.0	S		
P413	(P) P-component PID controller [%]	10.0	S		
P414	(P) I-component PID controller [%/ms]	1.0	S		
P415	(P) D-component PID controller [%ms]	1.0	S		
P416	(P) Ramp PID controller [s]	2.0	S		
P418	(P) Function analog output	0			
P419	(P) Analog output scalling [%]	100			
P420	Digital input 1	13			
P421	Digital input 2	1			
P422	Digital input 3	2			
P423	Digital input 4	8			
P424	Digital input 5	4			
P426	(P) Quick stop time [s]	0.10	S		
P427	Quick stop on fault	0	S		
P428	Automatic start-up	0	S		
P429	(P) Fixed frequency 1 [Hz]	0.0	S		
P430	(P) Fixed frequency 2 [Hz]	0.0	S		
P431	(P) Fixed frequency 3 [Hz]	0.0	S		
P432	(P) Fixed frequency 4 [Hz]	0.0	S		
P433	(P) Fixed frequency 5 [Hz]	0.0	S		
P434	(P) Relay output 1	7			
P435	(P) Relay 1 scalling [%]	100			
P460	Watchdog time [s]	10.0			
P480	Function Bus I/O In Bits	0	S		
P481	Function Bus I/O Out Bits	0	S		
P482	Norm. Bus I/O Out Bits [%]	100	S		
P483	Hyst. Bus I/O Out Bits [%]	10	S		

Parameter No.	Name	Factory setting	Super-visor	Setting after commissioning	
				P 1	P 2
<b>ADDITIONAL PARAMETERS (6.8)</b>					
P503	Leading function output	0	S		
P504	Pulse frequency [kHz]	6.0	S		
P505	(P) Abs. minimum frequency [Hz]	2.0	S		
P506	Auto. fault acknowledgement	0	S		
P507	PPO type	1	S		
P508	Profibus address	1	S		
P509	Interface	0	S		
P511	USS baud rate	3	S		
P512	USS address	0	S		
P513	Telegram time out [s]	0.0	S		
P514	CAN Baud rate	4	S		
P515	CAN address	50	S		
P516	(P) Skip frequency 1 [Hz]	0.0	S		
P518	(P) Skip frequency 2 [Hz]	0.0	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	S		
P535	I <sup>2</sup> t motor	0	S		
P537	Current limit	1	S		
P538	Check input voltage	3	S		
P540	Mode phase sequency	0	S		
P541	Set relays	0	S		
P542	Set analog output [V]	0.0	S		
P543	(P) Actual Bus value 1	1	S		
P544	(P) Actual Bus value 2	0	S		
P545	(P) Actual Bus value 3	0	S		
P546	(P) Function Bus setpoint 1	1	S		
P547	(P) Function Bus setpoint 2	0	S		
P548	(P) Function Bus setpoint 3	0	S		
P549	PotentiometerBox function	1	S		
P551	Drive profile	0	S		
P552	Function PotiBox right	1	S		
P553	Function PotiBox left	2	S		
P558	(P) Magnetisation time [ms]	1	S		
P559	(P) DC run-on time [s]	0.50	S		
P560	Cyclical writing	1	S		

Parameter No.	Name	Actual status and displayed values
<b>INFORMATION (6.9), read only</b>		
P700	Actual Fault	
P701	Last fault	
P707	Software version (/revision)	
P708	Status digital input (bin/hex)	
P709	Voltage analog input 1 [V]	
P710	Voltage analog output 1 [V]	
P711	Status output relay	
P712	Voltage analog input 2 [V]	
P716	Current frequency [Hz]	
P717	Current speed [rpm]	
P718	Current setpoint frequency 1..3 [Hz]	
P719	Actual current [A]	
P720	Actual torque current [A]	
P722	Actual voltage [V]	
P728	Input voltage [V]	
P736	DC-Link voltage [V]	
P739	Heat sink temperature [°C]	
P740	Process data Bus In [hex]	
P741	Process data Bus Out [hex]	
P742	Database version	
P743	Inverter type [kW]	
P744	Upgrade level	
P745	Option version	
P746	Option status	
P747	Inverter voltage range 230/400V	
P999	Inverter type [hex]	

## 8 Fault messages

Faults cause the frequency inverter to switch off. This prevents device defects.

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

1. By switching the mains off and on again,
2. By an appropriately programmed digital input (P420 ... P424 = function 12),
3. By removing the "enable" from the FI (if no digital input acknowledge has been programmed),
4. By Bus acknowledgement or
5. by P506, the automatic fault acknowledgement.

**Device LEDs:** In the delivery condition (without technology unit), 2 LEDs (green/red) are visible externally (see illustration). These indicate the actual status of the device.

The **green LED** indicates that the mains voltage is present and operational, while a flashing code that increases in speed shows the degree of overload at the frequency inverter output.

The **red LED** signals actual error by flashing with a frequency which corresponds to the number code of the fault (Section. 6.2).



### 8.1 ControlBox display

The **ControlBox** displays an error with its number and the prefix "E". In addition, the actual error is displayed in parameter P700. The last error messages are stored in parameter P701.

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

### 8.2 Table of possible error messages

Display in the ControlBox		Error text in the Parameter Box	Cause • Remedy
Group	Detail in P700 / P701		
<b>E001</b>	<b>1.0</b>	<b>Inverter overtemperature</b>	Error signal from output stage module (static) <ul style="list-style-type: none"> <li>• Reduce ambient temperature (&lt;50°C or &lt;40°C , see also Chap. 9 Technical data)</li> </ul>
<b>E002</b>	<b>2.0</b>	<b>Overtemperature motor (PTC)</b> Only if a digital input is programmed (Function 13).	Motor temperature sensor has triggered <ul style="list-style-type: none"> <li>• Reduce motor load</li> <li>• Increase motor speed</li> <li>• Use motor external fan</li> </ul>
	<b>2.1</b>	<b>Motor overtemperature (I<sup>2</sup>t)</b> Only if I <sup>2</sup> t - Motor (P535) is programmed.	I <sup>2</sup> t - Motor has triggered <ul style="list-style-type: none"> <li>• Reduce motor load</li> <li>• Increase motor speed</li> </ul>

Display in the ControlBox		Error text in the Parameter Box	Cause • Remedy
Group	Detail in P700 / P701		
<b>E003</b>	<b>3.0</b>	<b>Inverter overcurrent</b>	$I^2t$ limit has triggered, e.g. $> 1.5 \times I_n$ for 60s (please also note P504) <ul style="list-style-type: none"> <li>Avoid continuous overload at FI output</li> </ul>
	<b>3.1</b>	<b>Overcurrent chopper</b>	$I^2t$ limit for brake chopper triggered <ul style="list-style-type: none"> <li>Avoid overcurrent in braking resistor</li> </ul>
<b>E004</b>	<b>4.0</b>	<b>Overcurrent module</b>	Error signal from module (short duration) <ul style="list-style-type: none"> <li>Rectify short-circuit or earthing at FI output</li> <li>Use external output choke (motor cable is too long)</li> </ul>
<b>E005</b>	<b>5.0</b>	<b>Overvoltage dc-link voltage</b>	DC link voltage is too high <ul style="list-style-type: none"> <li>Reduce energy return by means of a braking resistor</li> <li>Extend deceleration (P103)</li> <li>If necessary, set disconnection mode (P108) with delay (not for lifting equipment)</li> <li>Extend quick stop time (P426)</li> </ul>
	<b>5.1</b>	<b>Overvoltage mains</b>	Mains voltage is too high <ul style="list-style-type: none"> <li>Please check 380V-20% ... 480V+10% or 200 ... 240V <math>\pm</math> 10%</li> </ul>
<b>E006</b>	<b>6.0</b>	<b>DC-Link voltage undervoltage (charging error)</b>	Inverter mains/link voltage too low <ul style="list-style-type: none"> <li>Check mains voltage 380V-20% ... 480V+10% or 200 ... 240V <math>\pm</math> 10%</li> </ul>
	<b>6.1</b>	<b>Mains undervoltage</b>	
<b>E007</b>	<b>7.0</b>	<b>Mains phase failure</b>	One of the three mains input phases was or is interrupted. <ul style="list-style-type: none"> <li>Check mains phases 380V-20% ... 480V+10% or 200 ... 240V <math>\pm</math> 10%, possibly too low?</li> <li>All three mains phases must be symmetrical.</li> </ul>
	<b>OFF</b>	<b>NOTE:</b>	OFF appears in the display when the three mains phases are uniformly reduced, i.e. when a normal mains switch off occurs during operation.



Display in the ControlBox		Error text in the Parameter Box	Cause • Remedy
Group	Detail in P700 / P701		
<b>E008</b>	<b>8.0</b>	<b>EEPROM parameter loss</b> (maximum value exceeded )	Error in EEPROM data <ul style="list-style-type: none"> <li>• Software version of the stored data set not compatible with the software version of the FI.</li> </ul> <b>NOTE:</b> <u>Faulty parameters</u> are automatically reloaded (factory setting). <ul style="list-style-type: none"> <li>• EMC interferences (see also E020)</li> </ul>
	<b>8.1</b>	<b>Invalid inverter type</b>	<ul style="list-style-type: none"> <li>• Un-initialised frequency inverter</li> </ul>
	<b>8.3</b>	<b>EEPROM CIU not recognised</b> (interface equipment)	EEPROM not present in adapter unit. <ul style="list-style-type: none"> <li>• Switch mains voltage off and on again.</li> </ul>
	<b>8.4</b>	<b>EEPROM not recognised internally</b>	EEPROM not present in frequency inverter <ul style="list-style-type: none"> <li>• Switch mains voltage off and on again.</li> </ul>
	<b>8.5</b>	<b>No EEPROM recognised</b>	No EEPROM memory present in system <ul style="list-style-type: none"> <li>• Switch mains voltage off and on again.</li> </ul>
	<b>8.6</b>	<b>Back-up copy used</b>	Internal data used <ul style="list-style-type: none"> <li>• Switch mains voltage off and on again.</li> </ul>
	<b>8.7</b>	<b>Different back-up copy</b>	Internal data overwritten <ul style="list-style-type: none"> <li>• Switch mains voltage off and on again.</li> </ul>
	<b>8.8</b>	<b>Empty EEPROM memory</b>	Un-initialised EEPROM memory <ul style="list-style-type: none"> <li>• Switch mains voltage off and on again.</li> </ul>
<b>E009</b>	<b>---</b>	<b>ControlBox error</b>	SPI Bus faulty, no communication with ControlBox. <ul style="list-style-type: none"> <li>• Check ControlBox for correct position.</li> <li>• Switch mains voltage off and on again.</li> </ul>

Display in the ControlBox		Error text in the Parameter Box	Cause
Group	Detail in P700 / P701		
<b>E010</b>	10.0	Telegram time out	Data transfer is faulty. Check P513. <ul style="list-style-type: none"> <li>• Check external Bus connection.</li> <li>• Check Bus Protocol program process.</li> <li>• Check Bus master.</li> <li>• Check 24V supply of internal CAN/CANopen Bus.</li> <li>• <i>Nodeguarding</i> error (internal CANopen)</li> <li>• <i>Bus Off</i> error (internal CAN Bus)</li> </ul>
	10.2	External bus module telegram time-out	Telegram transfer is faulty. <ul style="list-style-type: none"> <li>• Check external connection.</li> <li>• Check Bus Protocol program process.</li> <li>• Check Bus master.</li> </ul>
	10.4	External bus module initialisation failure	<ul style="list-style-type: none"> <li>• Check P746.</li> <li>• Bus module not correctly plugged in.</li> <li>• Check Bus module current supply.</li> </ul>
	10.1	External Bus module system failure	Further details can be found in the respective additional BUS operating instructions.
	10.3		
	10.5		
	10.6		
10.7			
10.8	External module communication failure	Connection fault / error in the external component	
<b>E011</b>	11.0	ADU customer unit error	Reference voltage of customer unit faulty (10V/15V). Only displayed if control is via the control terminals (P509 = 0/1). <ul style="list-style-type: none"> <li>• Check control terminals connection for short-circuit.</li> </ul>
<b>E012</b>	12.0	Watchdog customer / customer error	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<.
<b>E013</b>	13.0	reserved	
	13.2	Slip error switch-off monitoring	The slip error monitoring was triggered; the motor could not follow the setpoint. <ul style="list-style-type: none"> <li>• Increase setting value for torque limit in P112.</li> <li>• Check motor data (motor circuit, stator resistor)</li> </ul>
<b>E018</b>	18.0	Safety circuit	The safety circuit triggered while the FI was enabled. <p>- Still under preparation. -</p>

Display in the ControlBox		Error text in the Parameter Box	Cause • Remedy
Group	Detail in P700 / P701		
<b>E019</b>	<b>19.0</b>	<b>Parameter identification error</b>	Automatic identification of the connected motor was unsuccessful  <ul style="list-style-type: none"> <li>• Check motor connections</li> <li>• Check pre-set motor data (P201 ... P209)</li> </ul>
	<b>19.1</b>	<b>Motor star/delta circuit is not correct</b>	
<b>E020</b>	<b>20.0</b>	reserved	System error in program execution, triggered by EMC interference. Please comply with wiring guidelines in Chap. 2.5 . Use additional external mains filter. (Chap. 9.5 EMC) FI must be very well "earthed".
	<b>20.1</b>	<b>Watchdog</b>	
	<b>20.2</b>	<b>Stack Overflow</b>	
	<b>20.3</b>	<b>Stack Underflow</b>	
	<b>20.4</b>	<b>Undefined Opcode</b>	
	<b>20.5</b>	<b>Protected Instruction</b>	
	<b>20.6</b>	<b>Illegal Word Access</b>	
	<b>20.7</b>	<b>Illegal Instruction Access</b>	
	<b>20.8</b>	<b>EEPROM error</b>	
	<b>20.9</b>	Reserved	
	<b>21.0</b>	<b>NMI error</b> (not used by hardware)	
	<b>21.1</b>	<b>PLL Error</b>	
	<b>21.2</b>	<b>ADU Overrun</b>	
<b>21.3</b>	<b>PMI Access Error</b>		

## 9 Technical data

### 9.1 General Data

Function	Specification
Output frequency	0.0 ... 400.0 Hz
Pulse frequency	3.0 ... 10.0kHz, standard setting = 6kHz
Rated overload capacity	150% for 30 s, peak value 200% for 3 s
Protective measures against	Overtemperature of the frequency inverter      Short-circuit, earth fault, over/under-voltage      overload, idle running
Regulation and control	Sensorless current vector control (ISD), linear V/f characteristic
Analog setpoint input / PI input *	0 ... 10 V (Ra ≈ 28kΩ) or 0 / 4 ... 20 mA (Ra ≈ 250Ω)
Analog setpoint resolution *	10 bit based on measurement range
Setpoint constancy	Analog < 1%      Digital < 0.02%
Analog output *	0...10V, max. 5mA scalable, digital functions possible
Motor temperature monitoring	I <sup>2</sup> t motor (UL/cUL certified), PTC / Bimetal switch (not UL/cUL)
Control outputs	1 relay 24V DC max. 500mA load
Interface *	<u>Standard:</u> RS485  <u>Optional:</u> Profibus DP CAN Bus CANopen DeviceNet InterBus AS-Interface
Efficiency of frequency inverter	Approx. 95 %
Ambient temperature	-10°C ... +50°C (without condensation)
Storage/Transport temperature	-20°C ... +60°C / +70°C, (max. 85% without condensation)
Long-term storage	Connect the frequency inverter to the mains voltage for 60 minutes at least once a year. Maintain this cycle throughout the storage period.
Protection type	IP55 / IP66 (option), dependent on motor used
Galvanic isolation	Control terminals (digital inputs / outputs)
Max. mounting height above zero	Up to 1000m: No power reduction 1000...4000m: 1%/ 100m power reduction (up to 2000m overvoltage category 3) 2000...4000m: Only overvoltage category 2 is maintained, external overvoltage protection at the mains input is necessary
Wait time between two mains switch on cycles	60 sec for all devices in normal operating cycle
Supply voltage 15V/5V	see page 22
Certifications	CE, UL, cUL

\*) optional, with SK CU2-BSC or -STD, BUS units SK TU2-...

**Power derating for high ambient temperatures (motor-attached layout)**

If the frequency inverter is operated at high ambient temperatures in a motor-attached layout, power reduction must be taken into account in individual cases. The power percentages available for the respective frequency inverters in various ambient temperatures are listed below. The values listed apply for a pulse frequency of 6 kHz (factory setting).



400V devices		Ambient temperature		
		40° C	45° C	50° C
Frequency inverter nominal power	0.55 kW	100 %	100 %	100 %
	0.75 kW	100 %	100 %	100 %
	1.1 kW	100 %	100 %	100 %
	1.5 kW	100 %	96 %	92 %

**Power derating for high ambient temperatures (version with wall-mounting kit):**

If the inverter is mounted close to the motor using the wall-mounting kit, power reduction may need to be considered in some cases where operation occurs under high ambient temperatures. The power percentages available for the respective frequency inverters in various ambient temperatures are listed below. The values listed apply for a pulse frequency of 6 kHz (factory setting).



400V devices		Ambient temperature		
		40° C	45° C	50° C
Frequency inverter nominal power	0.55 kW	100 %	100 %	100 %
	0.75 kW	100 %	100 %	100 %
	1.1 kW	100 %	100 %	100 %
	1.5 kW	82 %	79 %	75 %

## 9.2 Electrical data 230V

Size 1				
Device type:	SK 300E ...	-370-323-B(-C)	-550-323-B(-C)	-750-323-B(-C)
Material number	...-B	275120370	275120550	275120750
	...-B-C	275160370	275160550	275160750
Nominal motor power (4-pole standard motor)	230V	0.37 kW	0.55 kW	0.75 kW
	240V	0.5 hp	0.75 hp	1 hp
Mains phases <sup>1</sup>		1/3 AC		
Mains voltage		200-240 V, ±10 %, 47 ... 63 Hz		
Output voltage		3 AC 0 - Mains voltage		
Rated output current (230V)	rms [A]	2.2	3.0	4.0
Rated input current <sup>1</sup> (230V)	rms [A]	5.0/3.1	7.2/4.2	9.7/5.6
Recom. mains fuse <sup>1</sup> (230V)	Slow-blowing [A]	16/10	16/10	16/10
Ventilation type		Free convection		
Weight	Approx. [kg]	4.0		

Size 2				
Device type:	SK 300E ...	-111-323-B(-C)	-150-323-B(-C)	-221-323-B(-C)
Material number	...-B	275121100	275121500	275122200
	...-B-C	275161100	275161500	275162200
Nominal motor power (4-pole standard motor)	230V	1.1 kW	1.5 kW	2.2 kW
	240V	1½ hp <sup>1</sup>	2 hp	3 hp
Mains phases <sup>2</sup>		1/3 AC	3 AC	
Mains voltage		200-240 V, ±10 %, 47 ... 63 Hz		
Output voltage		3 AC 0 - Mains voltage		
Rated output current (230V))	rms [A]	5.5	7.0	9.5
Rated input current <sup>2</sup> (230V)	rms [A]	13.1/7.7	9.8	13.3
Recom. mains fuse <sup>2</sup> (230V)	Slow-blowing [A]	20/16	16	20
Ventilation type		Free convection		
Weight	Approx. [kg]	8.4		

<sup>1</sup> Single phase / three phase operation

## 9.3 Electrical data 400V

Size 1					
Device type:	SK 300E ...	-550-340-B(-C)	-750-340-B(-C)	-111-340-B(-C)	-151-340-B(-C)
Material number	...-B	275120555	275120755	275121105	275121505
	...-B-C	275160555	275160755	275161105	275161505
Nominal motor power (4-pole standard motor)	400V	0.55 kW	0.75 kW	1.1 kW	1.5 kW
	480V	0.75 hp	1 hp	1½ hp	2 hp
Mains phases	3 AC				
Mains voltage	3 AC 380-480 V, -20 %/+10 %, 47 ... 63 Hz				
Output voltage	3 AC 0 - Mains voltage				
Rated output current (400V) rms [A]		1.6	2.2	3.0	3.7
Recom. braking resistor Accessories	120 Ω S3-50%, 2 Min.				
Min. braking resistor	90 Ω S3-50%, 2 Min.				
Rated input current (400V) rms [A]		2.5	3.1	4.2	5.2
Rec. mains fuse (400V) Slow-blowing [A]		10	10	10	10
Ventilation type	Free convection				
Weight Approx. [kg]	4.0				

Size 2				
Device type:	SK 300E ...	-221-340-B(-C)	-301-340-B(-C)	-401-340-B(-C)
Material number	...-B	275122205	275123005	275124005
	...-B-C	275162205	275163005	275164005
Nominal motor power (4-pole standard motor)	400V	2.2 kW	3.0 kW	4.0 kW
	480V	3 hp	4 hp	5 hp
Mains phases	3 AC			
Mains voltage	3 AC 380-480 V, -20 %/+10 %, 47 ... 63 Hz			
Output voltage	3 AC 0 - Mains voltage			
Rated output current (400V) rms [A]		5.5	7.0	9.2
Recom. braking resistor Accessories	120 Ω S3-50%, 2 Min.			82 Ω S3-50%, 2 Min.
Min. braking resistor	90 Ω S3-50%, 2 Min.			80 Ω S3-50%, 2 Min.
Rated input current (400V) rms [A]		7.7	9.8	12.9
Rec. mains fuse (400V) Slow-blowing [A]		16	16	16
Ventilation type	Free convection			
Weight Approx. [kg]	8.4			

## 9.4 Electrical data for UL/cUL certification

The data given in this section must be taken into account to comply with UL/cUL certification.

Size 1 - 230V mains				
Device type:	SK 300E...	-370-323-B(-C)	-550-323-B(-C)	-750-323-B(-C)
Nominal motor power	230V	0.37 kW	0.55 kW	0.75 kW
(4-pole standard motor)	240V	½ hp	¾ hp	1 hp
FLA (output)	3 AC [A]	2.2	3.2	4.2
Rec. mains fuse	J Class Fuse	LPJ 10A	LPJ 10A	LPJ 10A

Size 2 - 230V mains				
Device type:	SK 300E...	-111-323-B(-C)	-151-323-B(-C)	-221-323-B(-C)
Nominal motor power	230V	1.1 kW	1.5 kW	2.2 kW
(4-pole standard motor)	240V	1½ hp	2 hp	3 hp
FLA (output)	3 AC [A]	6	6.8	9.6
Rec. mains fuse	J Class Fuse	LPJ 15A	LPJ 15A	LPJ 20A

Size 1 - 400V mains					
Device type:	SK 300E...	-550-340-B(-C)	-750-340-B(-C)	-111-340-B(-C)	-151-340-B(-C)
Nominal motor power	400V	0.55 kW	0.75 kW	1.1 kW	1.5 kW
(4-pole standard motor)	460...480V	¾ hp	1 hp	1½ hp	2 hp
FLA (output)	3 AC [A]	1.6	2.1	3.0	3.4
Rec. mains fuse	J Class Fuse	LPJ 10A	LPJ 10A	LPJ 10A	LPJ 10A

Size 2 - 400V mains				
Device type:	SK 300E...	-221-340-B(-C)	-301-340-B(-C)	-401-340-B(-C)
Nominal motor power	400V	2.2 kW	3.0 kW	4.0 kW
(4-pole standard motor)	460...480V	3 hp	4 hp	5 hp
FLA (output)	3 AC [A]	4.8	6.2	7.6
Rec. mains fuse	J Class Fuse	LPJ 15A	LPJ 15A	LPJ 15A



## 9.5 Electromagnetic compatibility (EMC)

All electrical equipment that have an intrinsic, independent function and are placed on the market as individual units for users must comply from January 1996 with the EEC directive EEC/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 can 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 300E frequency inverters only have an intrinsic function when they are connected to other equipment (e.g. with a motor). The base units cannot therefore carry the CE mark that would confirm compliance with the EMC directive. Precise details are therefore given below about the EMC behaviour of this product, based on the proviso that it is installed according to the guidelines and instructions described in this documentation.

### **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 industry environments**

In this operating class, the manufacturer can certify that his equipment meets the requirements of the EMC directive for domestic, commercial and light industry 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.

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#### **Attention**



The NORDAC SK 300E frequency inverters are designed solely for commercial applications. They are therefore not subject to the requirements of the standard EN 61000-3-2 for radiation of harmonics.

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## 9.6 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.

Moreover it is absolutely necessary that the wiring meets the EMC standards as well. The motor cable shielding must be applied on both sides (frequency inverter shield angle and the metal motor terminal box).

Device type	Motor integrated layout (directly mounted on motor)	Near to motor layout (with wall mounting kit)
SK 300E-550-340-B (-C) -	Class B (1)	Class A (1)
SK 300E-401-340-B (-C)		
SK 300E-370-323-B (-C) -	Class B (1)	Class A (1)
SK 300E-221-323-B (-C)		
Max. motor cable, shielded	---	15 m

## 10 Motor data

### 10.1 Motor data rated point 50Hz

(→ Adjustment range 1:5)

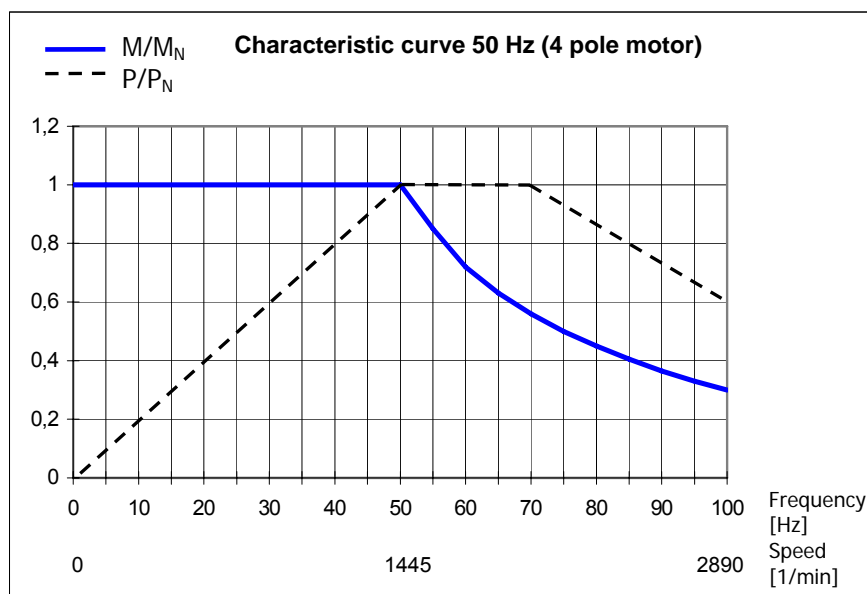
#### a) 230V frequency inverter

The motor used for 50 Hz operation can be operated up to its rated point 50 Hz/230V with the nominal torque. Operation over 50 Hz is still possible, however the torque output reduces in non-linear form (see diagram below). Above the rated point, the motor enters its field weakening range, as the voltage cannot be raised over 230 V when the frequency is increased above 50 Hz. Because of the mains voltage, maximum 230 V are available.

The following data is based up to an output of 2.2 kW using a 230/400 V motor winding.

Frequency inverter type	Parameterisation data of frequency inverter								
	$F_N$ [Hz]	$n_N$ [ $\text{min}^{-1}$ ]	$I_N$ [A]	$U_N$ [V]	$P_N$ [kW]	$\cos \varphi$	Connection	$R_{St}$ [ $\Omega$ ]	
SK...71L/4 TI 0/1 D -SK 300E-370-323-B	50	1360	1.9	230	0.37	0.77	Delta	23.80	
SK...80S/4 TI 0/1 D -SK 300E-550-323-B	50	1375	2.63	230	0.55	0.73	Delta	15.10	
SK...80L/4 TI 0/1 D -SK 300E-750-323-B	50	1375	3.63	230	0.75	0.74	Delta	10.20	
SK...90S/4 TI 0/1 D -SK 300E-111-323-B	50	1385	4.81	230	1.1	0.78	Delta	6.28	
SK...90L/4 TI 0/1 D -SK 300E-151-323-B	50	1385	6.3	230	1.5	0.80	Delta	4.37	
SK...100L/4 TI 0/1 D -SK 300E-221-323-B	50	1440	9.03	230	2.2	0.74	Delta	2.43	

Frequency inverter type	Performance data at rated point		
	$P_B$ [kW]	$n_B$ [ $\text{minP}^{-1P}$ ]	$M_B$ [Nm]
SK...71L/4 TI 0/1 D -SK 300E-370-323-B	0.37	1360	2.6
SK...80S/4 TI 0/1 D -SK 300E-550-323-B	0.55	1375	3.82
SK...80L/4 TI 0/1 D -SK 300E-750-323-B	0.75	1375	5.21
SK...90S/4 TI 0/1 D -SK 300E-111-323-B	1.1	1385	7.58
SK...90L/4 TI 0/1 D -SK 300E-151-323-B	1.5	1385	10.34
SK...100L/4 TI 0/1 D -SK 300E-221-323-B	2.2	1440	14.59



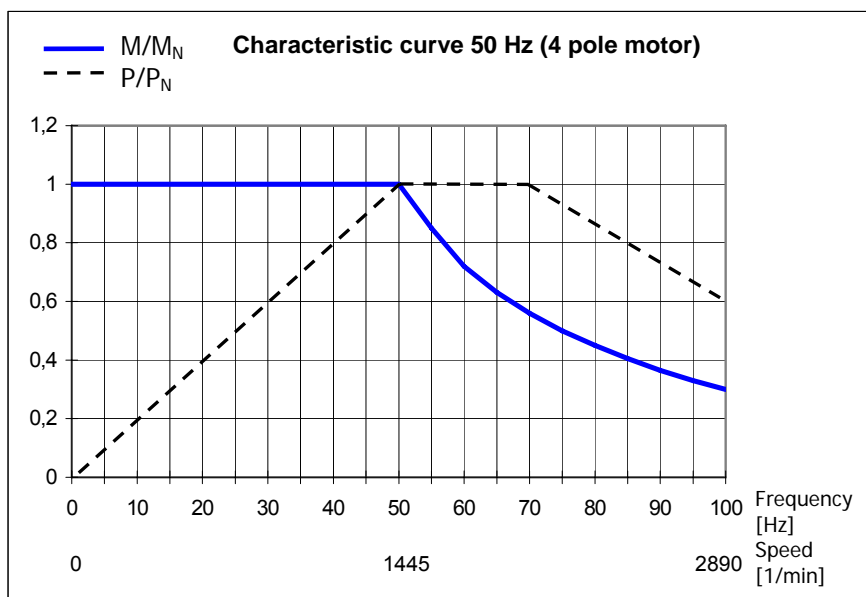
**b) 400V frequency inverter**

The motor used for 50 Hz operation can be operated up to its rated point 50 Hz/400V with the nominal torque. Operation over 50 Hz is still possible, however the torque output reduces in non-linear form (see diagram below). Above the rated point, the motor enters its field weakening range, as the voltage cannot be raised over 400V when the frequency is increased above 50 Hz. Because of the mains voltage, maximum 400V are available.

The following data is based on an output of 2.2 kW using a 230/400 V motor winding. 400/690 V windings are used for 3 kW and higher.

Frequency inverter type	Parameterisation data of frequency inverter							
	$F_N$ [Hz]	$n_N$ [ $\text{min}^{-1}$ ]	$I_N$ [A]	$U_N$ [V]	$P_N$ [kW]	$\cos \varphi$	Connection	$R_{St}$ [ $\Omega$ ]
SK...80S/4 TI 0/1 S -SK 300E-550-340-B	50	1375	1.52	400	0.55	0.73	Star	15.10
SK...80L/4 TI 0/1 S -SK 300E-750-340-B	50	1375	2.10	400	0.75	0.74	Star	10.20
SK...90S/4 TI 0/1 S -SK 300E-111-340-B	50	1385	2.78	400	1.1	0.78	Star	6.28
SK...90L/4 TI 0/1 S -SK 300E-151-340-B	50	1385	3.64	400	1.5	0.80	Star	4.37
SK...100L/4 TI 0/1 S -SK 300E-221-340-B	50	1440	5.22	400	2.2	0.74	Star	2.43
SK...100L/40 TI 0/1 D -SK 300E-301-340-B	50	1410	6.90	400	3	0.80	Delta	5.45
SK...112M/4 TI 0/1 D -SK 300E-401-340-B	50	1445	8.30	400	4	0.80	Delta	3.44

Frequency inverter type	Performance data at rated point		
	$P_B$ [kW]	$n_B$ [ $\text{min}^{-1}$ ]	$M_B$ [Nm]
SK...80S/4 TI 0/1 S -SK 300E-550-340-B	0.55	1375	3.82
SK...80L/4 TI 0/1 S -SK 300E-750-340-B	0.75	1375	5.21
SK...90S/4 TI 0/1 S -SK 300E-111-340-B	1.1	1385	7.58
SK...90L/4 TI 0/1 S -SK 300E-151-340-B	1.5	1385	10.34
SK...100L/4 TI 0/1 S -SK 300E-221-340-B	2.2	1440	14.59
SK...100L/40 TI 0/1 D -SK 300E-301-340-B	3	1410	20.32
SK...112M/4 TI 0/1 D -SK 300E-401-340-B	4	1445	26.44



## 10.2 Motor data rated point 87Hz (400V devices only)

The 87 Hz characteristic represents an extension of the speed adjustment range with a constant motor nominal torque. The following points must be met for realisation:

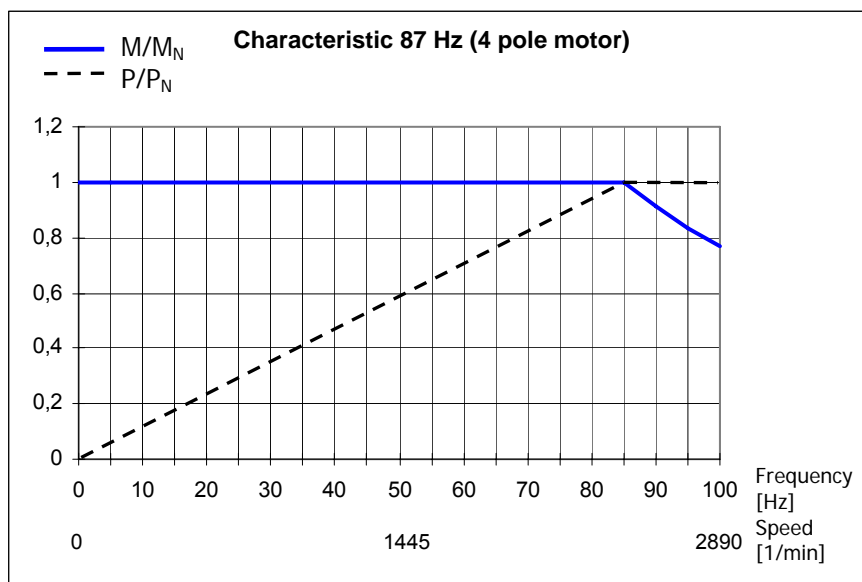
- Motor delta connection with a motor winding for 230/400V
- Frequency inverter with an operating voltage 3~400V
- Output current of frequency inverter must be greater than the delta current of the motor used  
(ref. value → frequency inverter power  $\geq \sqrt{3}$  x motor power)

In this configuration, the motor used has a rated operating point at 230V/50Hz and an extended operating point at 400V/ 87Hz. This increases the power of the drive by the factor  $\sqrt{3}$ . The nominal torque of the motor remains constant up to a frequency of 87 Hz. Operation of a 230 V winding with 400 V is totally uncritical as the insulation is designed for test voltages of > 1000 V.

**NOTE: The following motor data applies to standard motors with 230V/400V windings.**

Frequency inverter type	Parameterisation data of frequency inverter							
	$F_N$ [Hz]	$n_N$ [min <sup>-1</sup> ]	$I_N$ [A]	$U_N$ [V]	$P_N$ [kW]	cos $\varphi$	Connection	$R_{St}$ [ $\Omega$ ]
SK...71S/4 TI 0/1 D -SK 300E-550-340-B	50	1380	1.32	230	0.25	0.77	Delta	36.50
SK...71L/4 TI 0/1 D -SK 300E-750-340-B	50	1360	1.91	230	0.37	0.75	Delta	23.77
SK...80S/4 TI 0/1 D -SK 300E-111-340-B	50	1375	2.63	230	0.55	0.73	Delta	15.10
SK...80L/4 TI 0/1 D -SK 300E-151-340-B	50	1375	3.64	230	0.75	0.74	Delta	10.20
SK...90S/4 TI 0/1 D -SK 300E-221-340-B	50	1385	4.81	230	1.1	0.78	Delta	6.28
SK...90L/4 TI 0/1 D -SK 300E-301-340-B	50	1385	6.30	230	1.5	0.80	Delta	4.67
SK...100L/4 TI 0/1 D -SK 300E-401-340-B	50	1440	9.03	230	2.2	0.74	Delta	2.43

Frequency inverter type	Performance data at rated point		
	$P_B$ [kW]	$n_B$ [min <sup>-1</sup> ]	$M_B$ [Nm]
SK...71S/4 TI 0/1 D -SK 300E-550-340-B	0.43	2475	1.65
SK...71L/4 TI 0/1 D -SK 300E-750-340-B	0.64	2455	2.49
SK...80S/4 TI 0/1 D -SK 300E-111-340-B	0.95	2470	3.67
SK...80L/4 TI 0/1 D -SK 300E-151-340-B	1.3	2470	5.01
SK...90S/4 TI 0/1 D -SK 300E-221-340-B	1.9	2480	7.32
SK...90L/4 TI 0/1 D -SK 300E-301-340-B	2.6	2480	10.01
SK...100L/4 TI 0/1 D -SK 300E-401-340-B	3.8	2535	14.32



### 10.3 Motor data rated point 100Hz (400V devices only)

(→ Adjustment range 1:10)

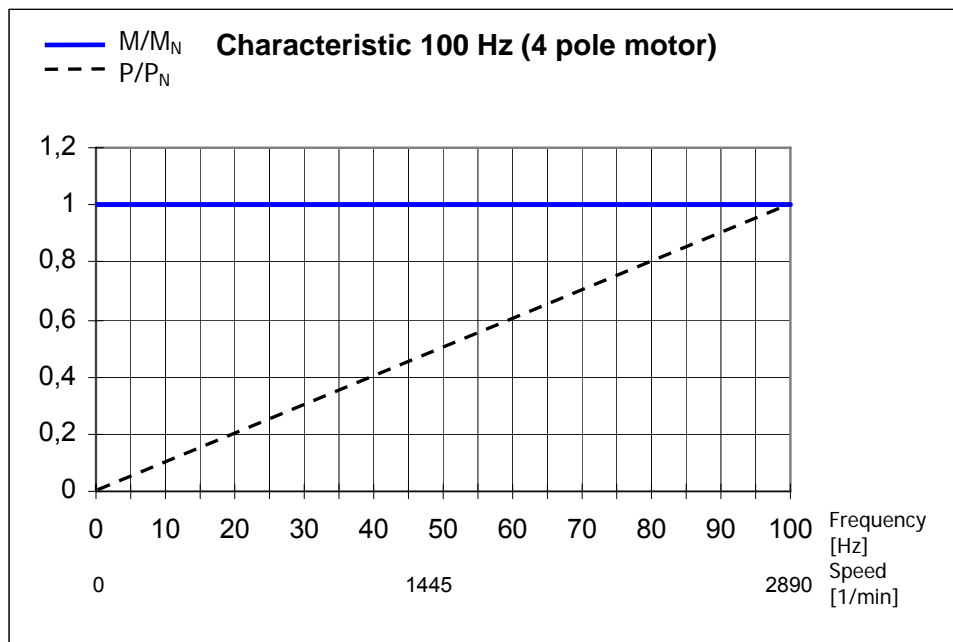
An operating point 100 Hz/400V can be selected for a greater speed adjustment range with up to a ratio of 1:20. Special motor data are required (see below) that differ from the normal 50 Hz data. It must be ensured in this case that a constant torque is generated across the entire adjustment range but that it is smaller than the nominal torque for 50 Hz operation.

The advantage, in addition to the greater speed adjustment range, is the improved motor temperature behaviour. An external fan is not absolutely essential for smaller output speed ranges.

**NOTE: The following motor data applies to standard motors with 230V/400V windings.**

Frequency inverter type	Parameterisation data of frequency inverter							
	$F_N$ [Hz]	$n_N$ [ $\text{min}^{-1}$ ]	$I_N$ [A]	$U_N$ [V]	$P_N$ [kW]	$\cos \varphi$	Connection	$R_{St}$ [ $\Omega$ ]
SK...71L/4 TI 0/1 D -SK 300E-550-340-B	100	2900	1.5	400	0.55	0.72	Delta	27.30
SK...80S/4 TI 0/1 D -SK 300E-750-340-B	100	2900	2.0	400	0.75	0.71	Delta	15.10
SK...80L/4 TI 0/1 D -SK 300E-111-340-B	100	2910	2.9	400	1.1	0.72	Delta	10.20
SK...90S/4 TI 0/1 D -SK 300E-151-340-B	100	2925	3.6	400	1.5	0.74	Delta	6.40
SK...90L/4 TI 0/1 D -SK 300E-221-340-B	100	2920	4.9	400	2.2	0.79	Delta	4.67
SK...100L/4 TI 0/1 D -SK 300E-301-340-B	100	2940	6.7	400	3	0.77	Delta	2.43
SK...100L/40 TI 0/1 D -SK 300E-401-340-B	100	2940	8.5	400	4	0.79	Delta	1.77

Frequency inverter type	Performance data at rated point		
	$P_B$ [kW]	$n_B$ [ $\text{min}^{-1}$ ]	$M_B$ [Nm]
SK...71L/4 TI 0/1 D -SK 300E-550-340-B	0.55	2900	1.81
SK...80S/4 TI 0/1 D -SK 300E-750-340-B	0.75	2900	2.47
SK...80L/4 TI 0/1 D -SK 300E-111-340-B	1.1	2910	3.61
SK...90S/4 TI 0/1 D -SK 300E-151-340-B	1.5	2925	4.90
SK...90L/4 TI 0/1 D -SK 300E-221-340-B	2.2	2920	7.20
SK...100L/4 TI 0/1 D -SK 300E-301-340-B	3	2940	9.75
SK...100L/40 TI 0/1 D -SK 300E-401-340-B	4	2940	12.99



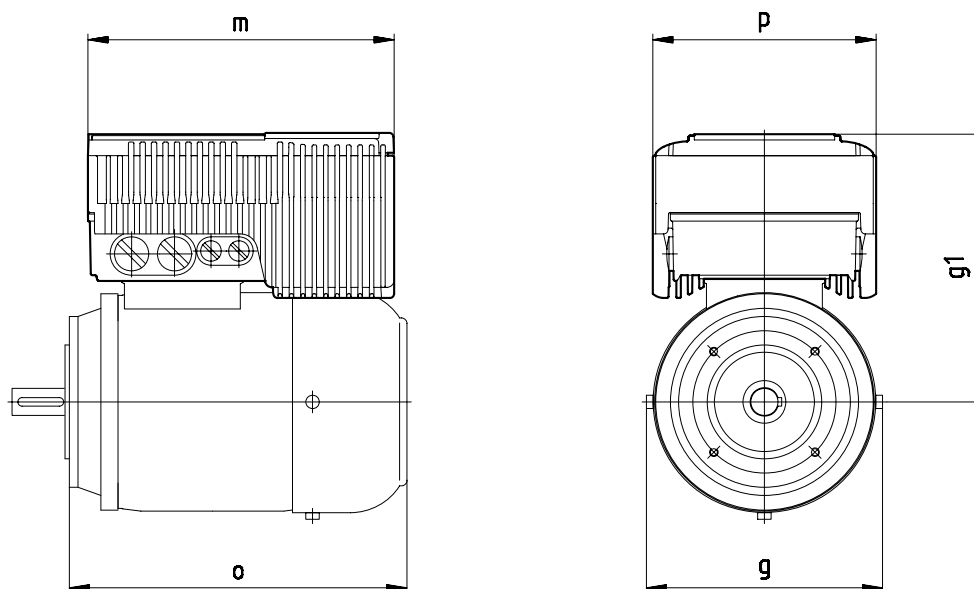
## 11 Dimensions

### 11.1 230V devices

Motor type	Motor output [kW]	Size	g	g1	m	o	p	Weight (frequency inverter only)
71 L/4, /2	0.37 / 0.55	1	138	194	214	214	156	4.0
80 S/4 /2	0.55 / 0.75		156	189	214	236	156	
90 S/6	0.75		176	194	214	276	156	
80 L/2	1.1	2	156	211	283	236	196	8.4
80 L/40	1.1		156	211	283	236	196	
90 S/2, /4	1.5 / 1.1		176	216	283	276	196	
90 L/4, /6	1.5 / 1.1		176	216	283	276	196	
100 L/6	1.5		194	234	283	306	196	
100L/4	2.2		194	234	283	306	196	
All dimensions in [mm]								Approx. [kg]

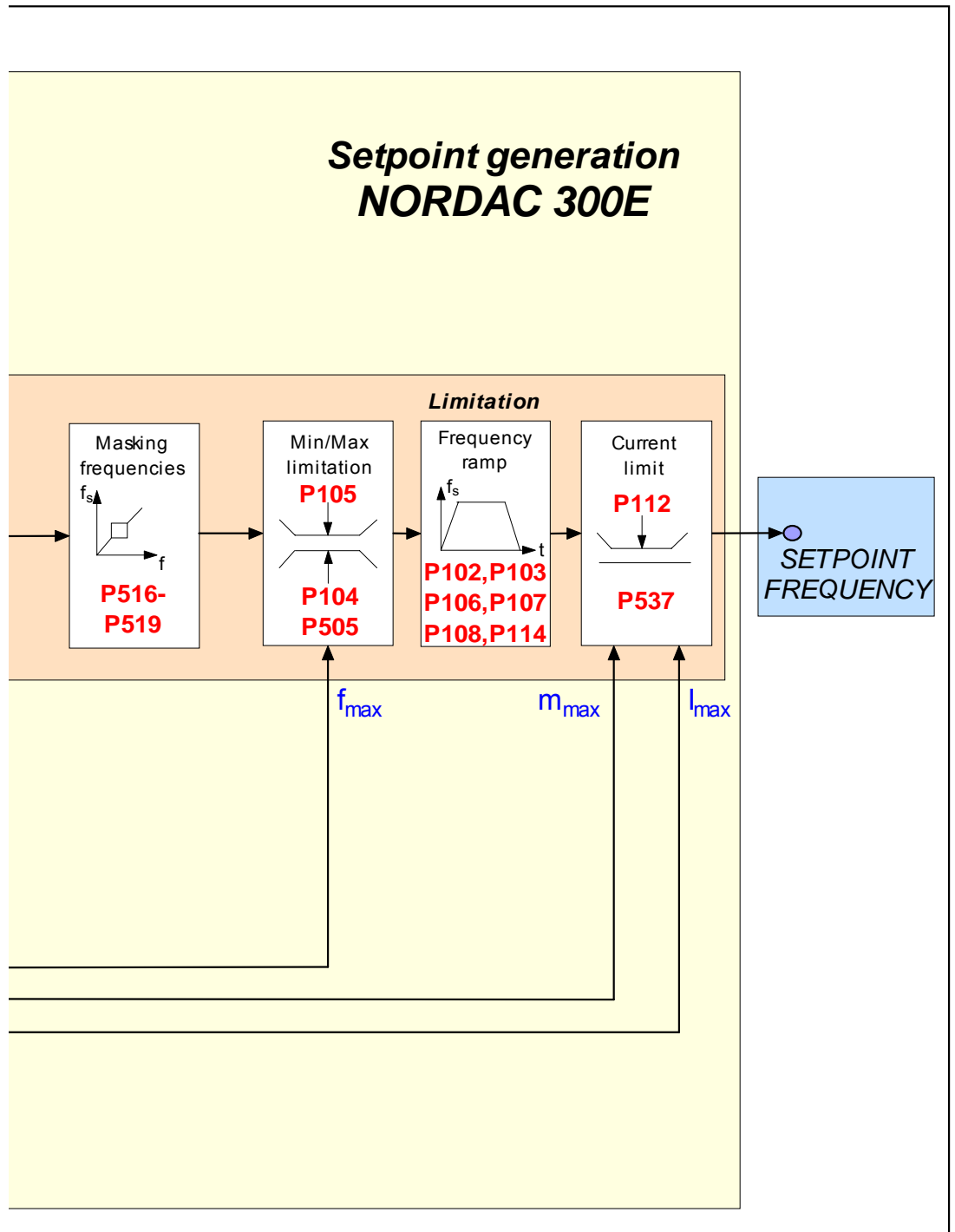
### 11.2 400V devices

Motor type	Motor output [kW]	Size	g	g1	m	o	p	Weight (frequency inverter only)
80 S/4	0.55	1	156	189	214	236	156	4.0
80 L/2, /4	1.1 / 0.75		156	189	214	236	156	
80 L/40	1.1		156	189	214	236	156	
90 S/2, /4, /6	1.5 / 1.1 / 0.75		176	194	214	276	156	
90 L/4, /6	1.5 / 1.1		176	194	214	276	156	
100 L/6	1.5		194	212	214	306	156	
100L/4	2.2	2	194	234	283	306	196	8.4
100L/40	3.0		194	234	283	306	196	
112M/4	4.0		218	244	283	326	196	
All dimensions in [mm]								Approx. [kg]

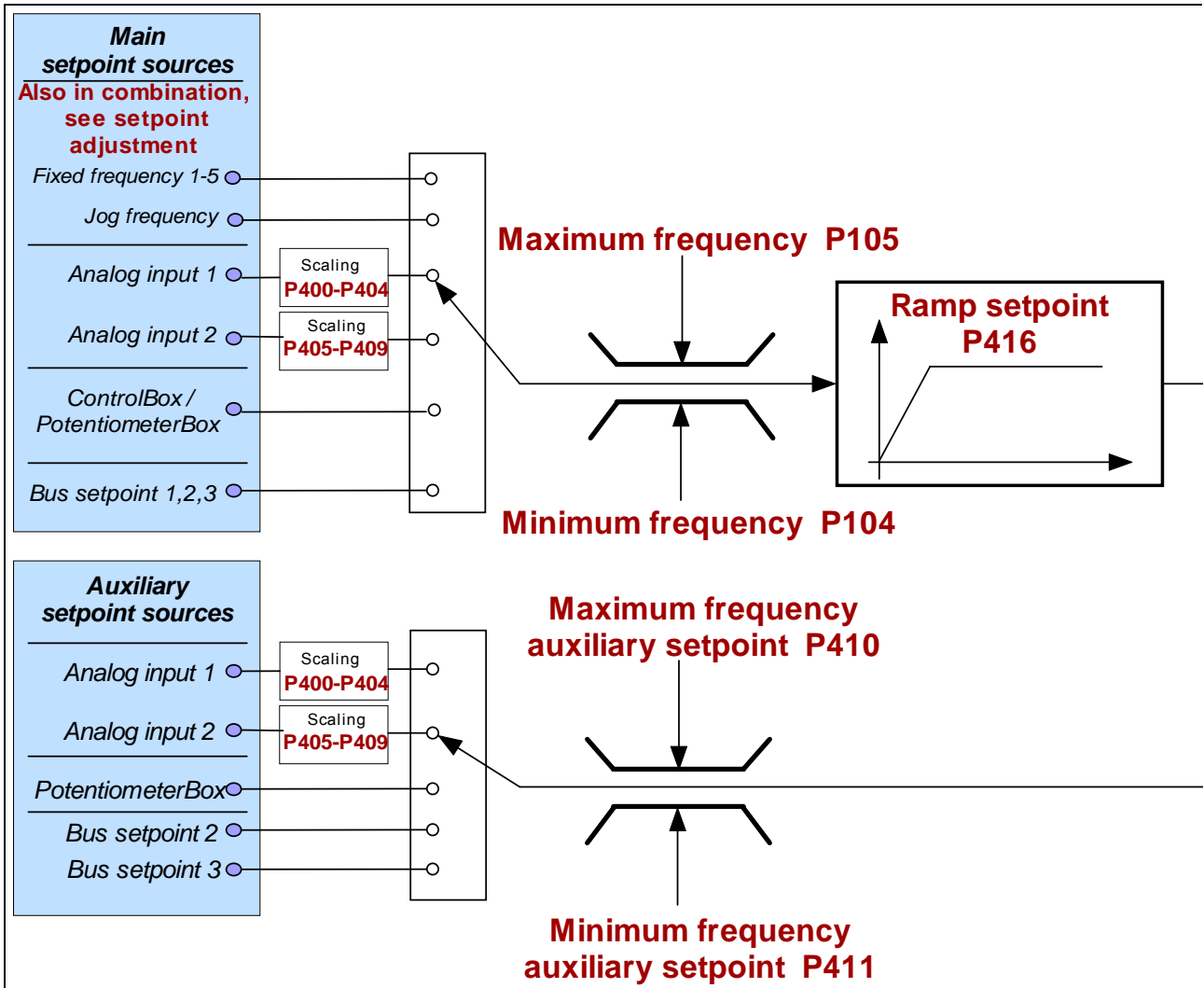


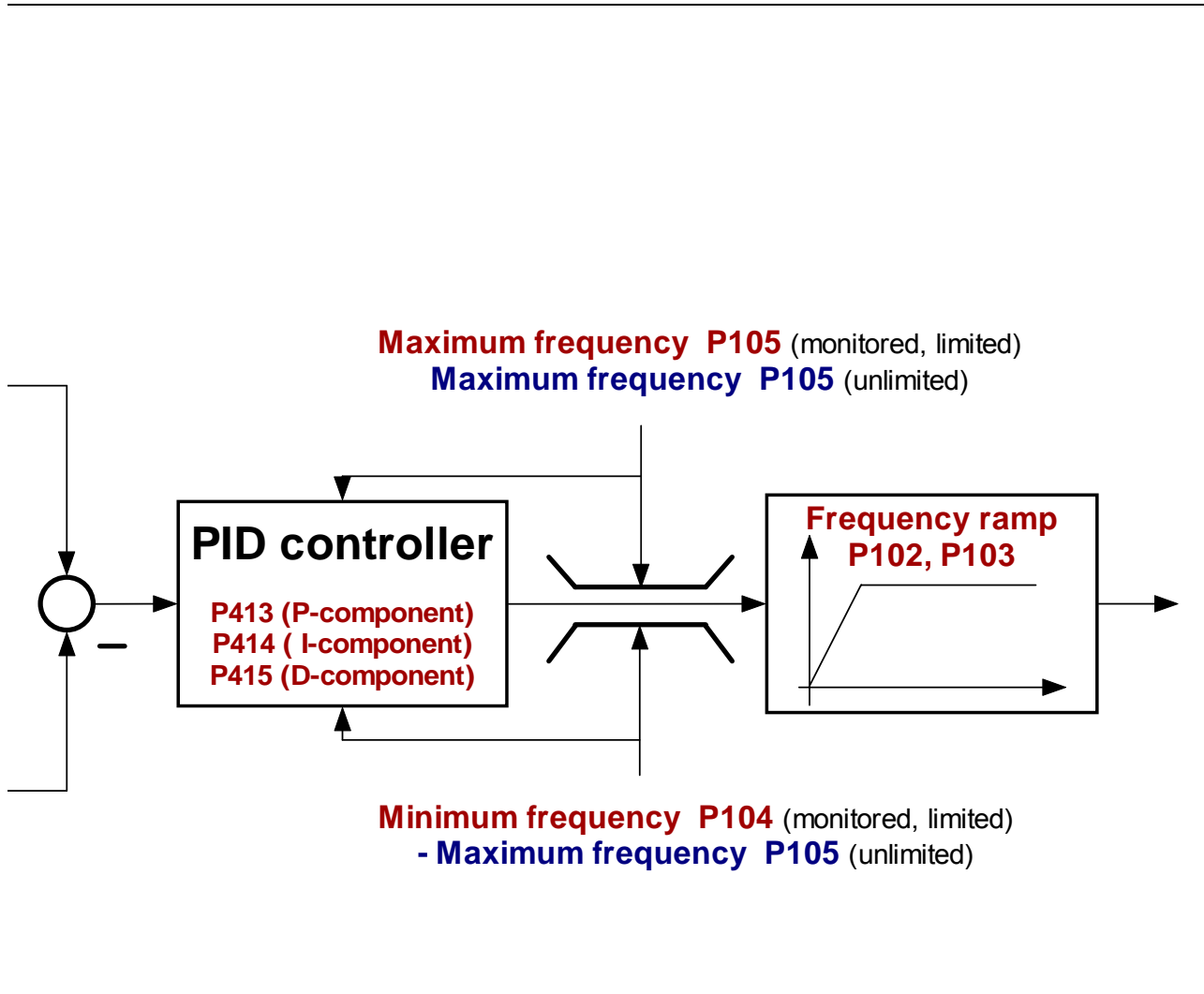






12.2 PID controller in the SK 300E





### 12.3 Process controller

The process controller is a PI controller which can be used to limit the controller output. In addition, the output is scaled as a percentage of a master setpoint. This allows the possibility of controlling an existing downstream drive with the reference frequency and to adjust it with the PI controller.

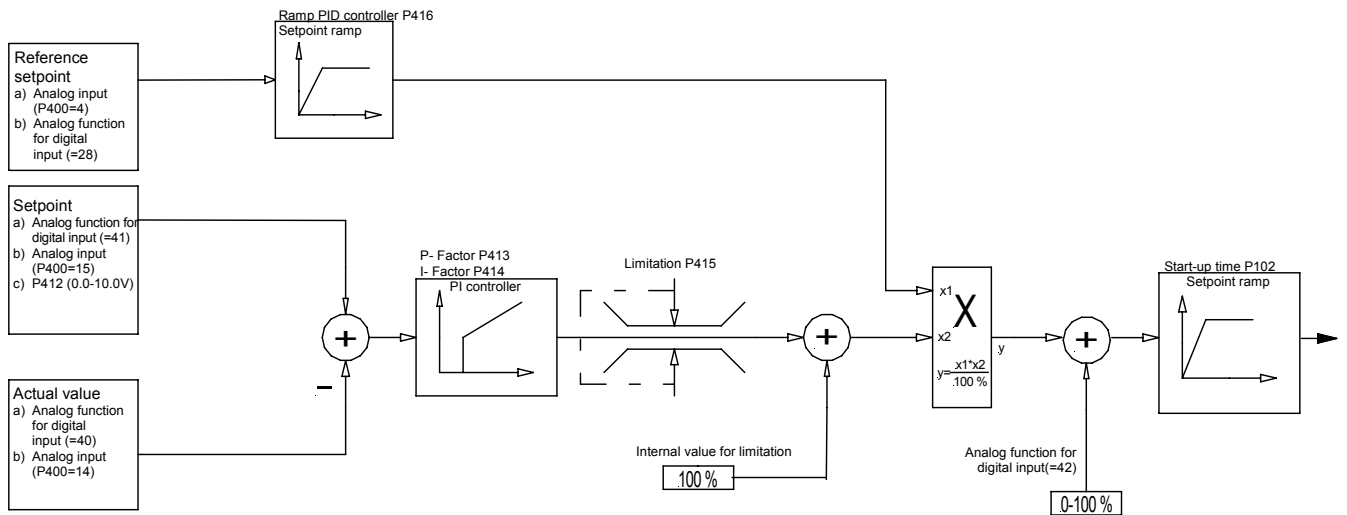
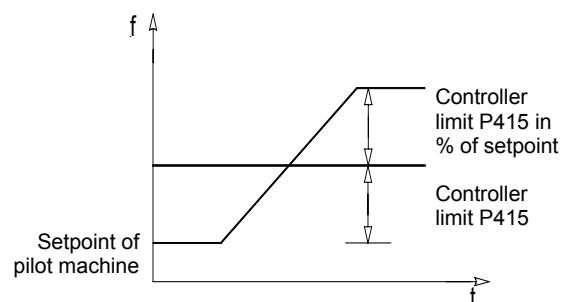
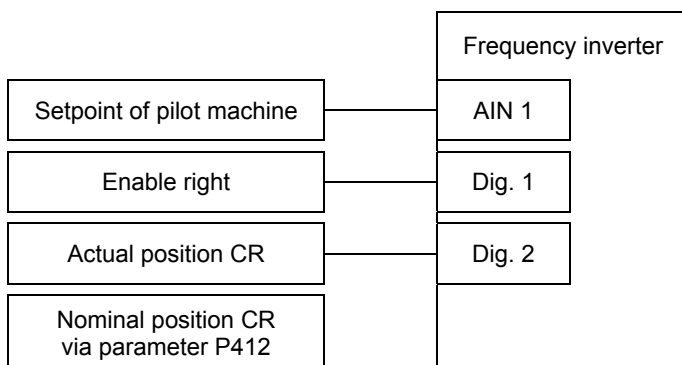
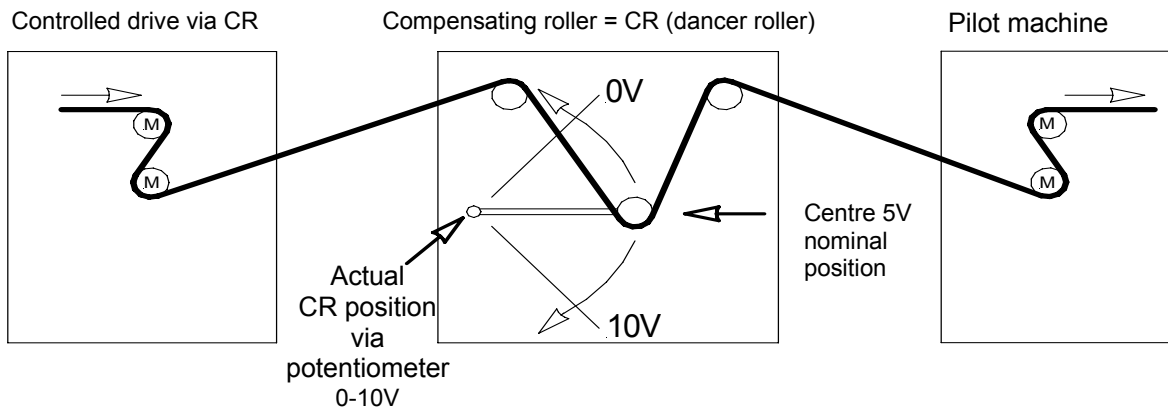


Fig.: Flow diagram process controller

#### Process controller application example



## Process controller parameter settings

(Example: Setpoint frequency: 50 Hz, control limits: +/-25%)

$$P105 \text{ (maximum frequency) [Hz]} : \geq \text{Setpointfreq. [Hz]} + \left( \frac{\text{Setpointfreq. [Hz]} \times P415 [\%]}{100\%} \right)$$

$$\text{Example: } \geq 50\text{Hz} + \frac{50\text{Hz} \times 25\%}{100\%} = \mathbf{62.5 \text{ Hz}}$$

P400 (Funct. analog input) : "4" (frequency addition)

P411 (setpoint frequency) [Hz] : Set frequency with 10 V at analog input 1

Example: **50 Hz**

P412 (Process controller setpoint) : CR middle position / Default setting **5 V** (adapt if necessary)

P413 (P controller) [%] : Factory setting **10%** (adapt if necessary)

P414 (I-controller) [% / ms] : recommended **0.1 %/ms**

P415 (limitation +/-) [%] : Controller limitation (see above)

**Note:** In the function process controller, parameter P415 is used as a controller limiter downstream from the PI controller. This parameter therefore has a double function.

Example: **25%** of setpoint

P416 (ramp before controller) [s] : Factory setting **2s** (if necessary, adjust to controller behaviour)

P420 (Funct. digital input 1) : "1" Enable right

P421 (Funct. Digital input 2) : "40" actual value PID process controller



## 12.4 Maintenance and servicing information

NORDAC *trio* SK 300E frequency inverters are maintenance-free when used correctly. Please note the "General data" in Chap. 9.1 .

If the frequency inverter is being used in a dusty environment, then the cooling-vane surfaces should be regularly cleaned with compressed air. Always ensure that the surface of the entire frequency inverter is free of coarse contamination and not covered by anything so that heat can be dissipated properly.

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**

Telephone: 0049 / 4532 / 401-515  
Fax: 0049 / 4532 / 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.

### Internet information

You can also find the comprehensive manual in various languages, including German, English, French and Spanish on our Internet site.

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