Intelligent Drivesystems, Worldwide Services

GB

BU 0750

NORDAC SK 750E

Manual for Frequency inverters

NORD DRIVESYSTEMS

SK 750E Frequency Inverter

Safety and operating instructions for drive power converters

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

1. General

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

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

Further information can be found in this documentation.

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

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

2. Proper use in Europe

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

When installed in machines, the drive power converter cannot be commissioned (i.e. commencement of the proper use) until it has been ensured that the machine meets the provisions of the EC Directive 2006/42/EEC (Machine Directive); EN 60204 must also be complied with.

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

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

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

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

3. Transport, storage

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

4. Installation

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

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

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

5. Electrical connections

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

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

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

6. Operation

Where necessary, systems where drive power converters are installed must be equipped with additional monitoring and protective equipment according to the applicable safety requirements, e.g. legislation concerning technical equipment, accident prevention regulations, etc.

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

All covers must be kept closed during operation.

7. Maintenance and repairs

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

Further information can be found in this documentation.

These safety instructions must be kept in a safe place!

Documentation

Designation: BU 0750 EN
Part No.: 607 75 01
Device series: SK 750E

Version list

Designation of previous issues	SW status	Comments
BU 0750 GB, December 2004	V 3.1 R1	First issue based on BU 0700 DE
BU 0750 GB, December 2005	V 3.1 R2	Revision, supplementation and correction
BU 0750 GB, April 2006	V 3.2 R0	Revision, wall-mounting kit, motor mounting, differentiation of the options for IP54 and IP65 version, cable glands
BU 0750 GB, March 2007 Part No.: 6077502 / 1207	V 3.2 R0	Data backup via P550 only right hand slot, Section 3.2 right / left slot
BU 0750 GB, March 2008 Part No.: 6077502 / 1208	V3.4 R4	Control for electromagnetic motor brakes, P217, P426, P533, P535
BU 0750 GB, August 2011 Part No.: 6077502 / 3311	V3.5 R1	Addition of UL-relevant details; revision of Sections 2.6, 3.3.3, 3.3.4; revision of parameter P208, P215; P216, function of digital inputs: 47/48; addition of environmental classes, long-term storage and min. brake resistances (Section 9)

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Intended use of the frequency inverter

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

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

SK 750E frequency inverters are devices for industrial and commercial plants for operating three-phase asynchronous motors with squirrel-cage rotors. These motors must be suitable for operation with frequency inverters, other loads must not be connected to the devices.

SK 750E frequency inverters are devices for fixed installation in control cabinets. All details regarding technical data and permissible conditions at the installation site must be complied with.

Commissioning (commencement of the intended use) is prohibited until it has been ensured that the machine complies with the EMC Directive 2004/108/EEC and that the conformity of the end product meets the Machinery Directive 2006/42/EEC (observe EN 60204).

1 General information

The NORDAC SK 750E series is based on the proven SK 700E series. However, it is designed for use in harsher ambient conditions (up to 60°C, at least IP54). These devices are characterised by the high modularity and excellent control characteristics.

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

Due to its modular construction, the variously combinable technology units, customer units and special extension units, this device series is suitable for all possible applications.

Due to the wide range of setting options, these inverters are capable of controlling all three-phase motors. The power range is from **5.5kW to 22kW** (3~ 400V...480V) and **5.5 to 11kW** (3~ 200…240V) with integrated line filter. The overload capacity of these devices is 150% for 60 seconds and 200% for 3.5 seconds.

This manual is based on the device software V3.5R1 (P707) for the SK 750E. 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
- Can be mounted next to each other without additional spacing
- Permissible environmental temperature range: 0 to 50°C (or up to 60°C please refer to the technical data)
- Integrated EMC line filter for limit curve A as per EN55011
- Automatic measurement of the stator resistance
- Programmable direct current braking
- Integrated brake chopper for 4 quadrant drive
- Integrated RS485 interface on M12 socket
- Four separate online switchable parameter sets
- High protection class IP54 (air cooling), IP65 with water cooled version (special version)

NOTE: The characteristics of the basic device with an additional technology unit, customer unit or special extension are described in Section 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 carry out a thorough assessment.

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

1.3 Scope of supply

Standard version:

State the protection class, IP54 (air cooling) / (IP65 water cooling as special version)
→ when ordering!
Integrated brake chopper
Integrated EMC line filter for limit curve A as per EN55011
Blank cover for the 1st and 2nd technology unit slots
Shield angle
Operating Instructions

Available accessories:

Brake resistor with high protection class on request, otherwise as for SK 700E (IP20)
Interface converter RS232 → RS485 (additional description BU 0010)
NORD CON, PC parameterisation software > www.nord.com <
ParameterBox, external control panel with LCD plain text display, connection cable (supplementary description BU 0040 DE)

Technology Unit:

SK TU2-CTR, ControlBox
detachable control panel, 4 figure 7 segment LED display, keyboard
SK TU2-POT, PotentiometerBox
Additional module with switch (R/L) and infinitely variable potentiometer
SK TU2-PBR, Profibus, additional module for Profibus communication (1.5MBaud)
SK TU2-PBR-24V, with external 24V supply (12MBaud)
SK TU2-PBR-KL, Connection to terminal bar with cover (1.5MBaud)
SK TU2-CAN, CANbus, additional module for CANbus communication
SK TU2-CAO, CANopen, bus switching
SK TU2-DEV, DeviceNet, bus switching
SK TU2-IBS, InterBus, bus switching
SK TU2-AS1, AS interface, bus switching

NOTE: Additional bus manuals are available – BU 0020 … BU 0090..
>>> www.nord.com <<<

Customer interfaces:

SK CU1-BSC, basic I/O, limited scope for signal processing
SK CU1-BSC, standard I/O, moderate scope for signal processing
SK CU1-MLT, multi-I/O, high level of scope for signal processing
SK CU1-MLT-20mA, multi-I/O, high level of scope for signal processing
SK CU1-CAN, CANbus I/O, bus switching via the CANbus
SK CU1-PBR, Profibus I/O, bus switching via Profibus DP

Special extension units:

SK XU1-POS, PosiCon I/O, positioning module
(Supplementary instruction BU 0710 GB)
SK XU1-ENC, Encoder I/O, incremental encoder input for speed control

1.4 Safety and installationinformation

NORDAC SK 750E frequency inverters are devices for use in industrial high voltage systems and are operated at voltages which could lead to severe injuries or death if they are touched.

- Installation and other work may only be carried out by qualified electricians and with the device disconnected. The operating instructions must always be available to these persons and must be strictly observed.
- Local regulations for the installation of electrical equipment and accident prevention must be complied with.
- The equipment continues to carry hazardous voltages for up to 5 minutes after being switched off at the mains. The equipment may only be opened or the cover or control element removed 5 minutes after the equipment has been disconnected from the power supply. All covers must be put back in place before the line voltage is switched back on again.
- For safe isolation from the mains, all poles of the supply cable to the frequency inverter must be able to be disconnected.
- Even during motor standstill (e.g. caused by 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 identical to electrical isolation from the mains.
- **Caution**, even parts of the control card and, in particular, the connection plug for the removable technology units can conduct hazardous voltages. The control terminals are mains voltage free.

- **Caution**, with certain settings, the frequency inverter/motor can start up automatically after the mains are switched on.
- The circuit boards contain highly-sensitive MOS semiconductor components that are particularly sensitive to static electricity. Avoid touching circuit tracks and components with the hand or metallic objects. Only the terminal strip screws may be touched with insulated screwdrivers when connecting the cables.
- The frequency inverter is only intended for permanent connection and may not be operated without effective earthing connections which comply with local regulations for large leakage currents (> 3.5mA). VDE 0160 stipulates the installation of a second earthing conductor or an earthing conductor cross-section of at least 10 mm^2.
- In case of three-phase frequency inverters, common ground-fault circuit interrupters are not suitable only for protection if the local regulations do not permit possible DC components in the leakage current. The standard FI circuit breaker must comply with the new design as per VDE 0664.
- In normal use, NORDAC SK 750E frequency inverters are maintenance free. The cooling surfaces must be regularly cleaned with compressed air if the ambient air is dusty.

CAUTION

The heat sink and all other metal components can heat up to temperatures above 70°C.
When mounting, sufficient distance from neighbouring components must be maintained.
When working on the components, allow sufficient cooling time before starting work.

ATTENTION

DANGER TO LIFE

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 carry voltage!
Touching open or free terminals, cables and equipment components can lead to severe injury or death!
Work may only be carried out by qualified electricians and with the electrical supply to the equipment disconnected.

CAUTION

- Children and the general public must be kept away from the equipment!
- The equipment may only be used for the purpose intended by the manufacturer. Unauthorised modifications and the use of spare parts and additional equipment which has not been purchased from or recommended by the manufacturer of the device may cause fire, electric shock and injury.
- Keep these operating instructions in an accessible location and give them to all operators!

WARNING

This is a product with a restricted sale class as per IEC 61800-3. In a domestic environment this product may cause high frequency interference, in which case the operator may be required to take suitable measures.

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

1.5 Certifications

1.5.1 UL and cUL certification

(Use in North America)

"Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 200…240 Volts or 380…480 Volts (three phase)" and "when protected by J class fuses." as indicated."

Suitable for use on a circuit capable of delivering not more than 5000A (symmetrical), 200...240V or 380...460 Volts (three phase) and when protected by "J class fuses" as described in Section 9.4.

NORDAC SK 750E frequency inverters have a motor overload protection. Further technical details can be found in Section 9, "Technical Data".

UL File: E171342

"Relays on extension units and customer interface units may only be used at 230V ac maximum, same phase only."

The relays of the extension units and customer interface units may only be used at max. 230V ac. The same polarity must be used for all relays.

„Use 75°C Copper Conductor Only, Maximum Surrounding Air Temperature 50°C."

"Copper cable with an insulation rating of at least 75°C must be used for connection. A maximum ambient temperature of 50°C must be maintained.

Frequency inverter size1:

„The torque value for the field wiring terminals for mains circuit terminals and motor terminals must be 10.62 … 13.27 lb-in (1.2 … 1.5Nm). The torque value for the supplemental terminal blocks, external brake resistor and thermal sensor must be 4.42 … 5.31 lb-in (0.5 … 0.6Nm)."

Frequency inverter size 1:

The tightening torque value for the terminals the mains and motor cables, must be between 10.62 … 13.27 lb-in (1.2 … 1.5Nm). Control cable terminals, thermistor and PTC connections and connections to the brake resistor must be tightened with 4.42 … 5.31 lb-in (0.5 … 0.6Nm).

Frequency inverter size2:

„The torque value for the field wiring terminals for mains circuit terminals and motor terminals must be 22.12 … 39.82 lb-in (2.5 … 4.5Nm). The torque value for the supplemental terminal blocks and thermal sensor must be 4.42 … 5.31 lb-in (0.5 … 0.6Nm). The torque value for the external brake resistor must be 10.62 … 13.27 lb-in (1.2 … 1.5Nm)."

Frequency inverter size 2:

The tightening torque value for the terminals the mains and motor cables, must be between 22.12 … 18.06 lb-in (2.5 … 4.5Nm). Control terminal connections and thermistor/PTC connection must be tightened with 4.42 … 5.31 lb-in (0.5 … 0.6Nm).

1.5.2 European EMC Directive

If the NORDAC SK 750E is installed according to the recommendations in this instruction manual, it meets all EMC directive requirements, as per the EMC product standard for motor-operated systems EN 61800-3.

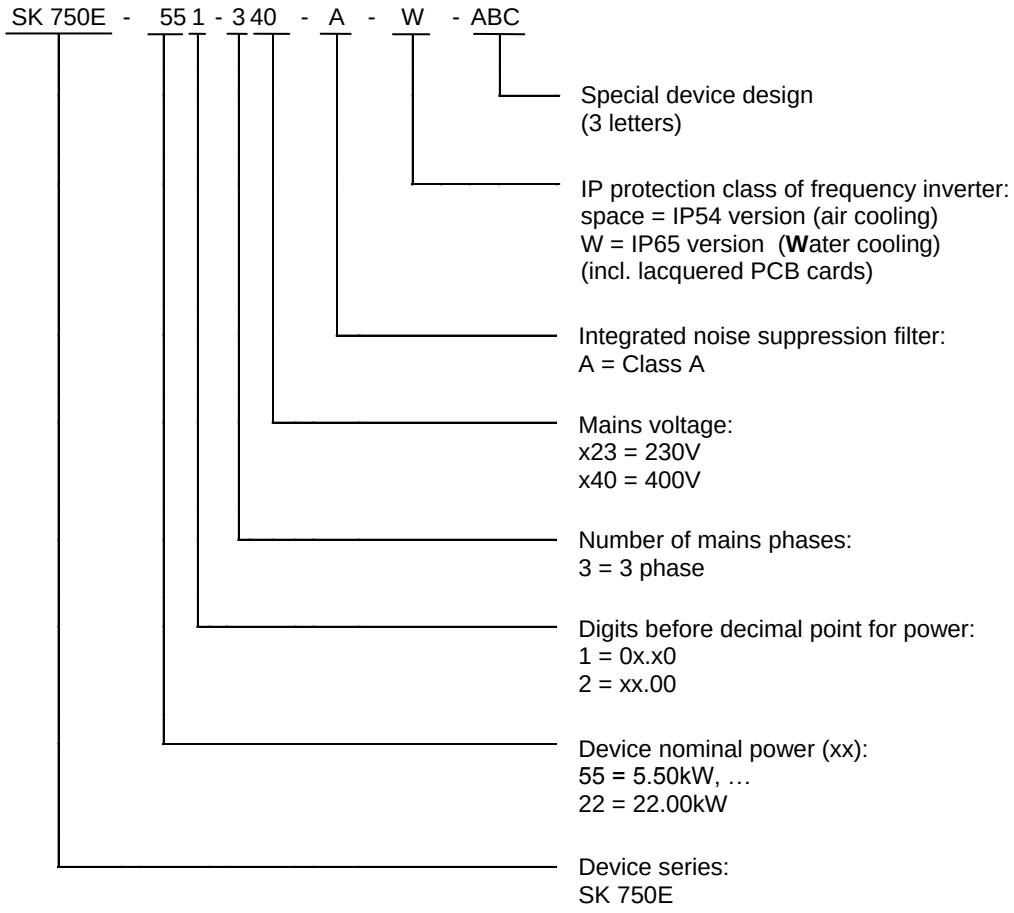
(See also Chapter 8.3 Electromagnetic compatibility [EMC].)

1.6 Nomenclature / Type code

The **NORDAC SK 750E** frequency inverter has a nomenclature with the same structure as for 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.

NOTE

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



1.7 Version with protection class IP54 / IP65

The**NORDAC SK 750E** frequency inverter can be ordered in any size and therefore any power stage with the protection classes IP54 (air cooling) or IP65 (water cooling). These versions can be differentiated by the type designation. The water cooled version has a **"-W"** (→ **W**ater cooling) at the end of the type designation.

The protection classes IP54 or IP65 must always be stated when ordering!

The protection classes are determined by the type of cooling. With the air cooled device, the integrated fans determine the protection class IP54; with the IP65 devices this is determined by the flange to the water cooling. With the technology units, customer interfaces and special extensions there are no restrictions of functionality between the IP54 and IP65 versions.

IP54 version:

The protection class IP54 applies for the air cooled SK 750E. Both versions (motor-integrated, close to motor) are available. The standard modules of the SK 300E (SK TU2-…) and SK 700E (SK CU1-…, SK XU1-…) can be inserted.

IP65 version:

The water cooled IP65 version has an additional **"-W"** (→ **W**ater cooling). Both versions (motor-integrated, close to motor) are also available. In addition, for IP65 devices the technology units (SK TU2-…-C) of the SK 300E, have an additional "-C" (**C**oated → lacquered PCBs) in their type designation. As with the IP54 devices, the same standard modules of the SK 700E are inserted as customer interfaces (SK CU1-...) and special extensions (SK XU1-...).

Note

The IP65 components and IP66 options (technology units) for the water cooled IP65 version have an additional "-C" and are modified with the **special measures** listed below!

Special measures:

- Coated circuit boards

Note

With the the IP65 version it must be ensured that the cable lines and cable connections are carefully matched so that no leaks occur in the SK 750E or any other problems occur that could affect the maintenance of the IP65 protection class!

2 Assembly and installation

2.1 Motor-integrated and close to motor layouts

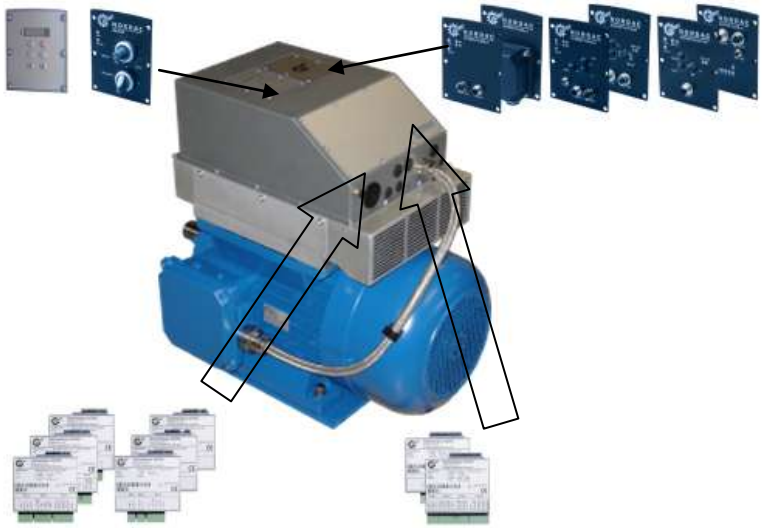
With the motor-integrated version the SK 750E frequency inverter is directly mounted on the motor by means of an attachment frame and "mounting feet", which integrate it into the drive unit.

Motor-integrated version:

Fig.: SK 750E in IP54 version (air cooling)

Optional technology unit
SK TU2-CTR
SK TU2-POT

Optional technology unit
Bus modules



Optional customer unit
SK CU1-...

Optional special extension
SK XU1-...

With the SK 750E close-to-motor version, the frequency inverter can be mounted close to the motor, i.e. on a wall or a machine frame for example. A wall-mounting kit is required for this (see Section 2.5).

Close-to-motor version:

Fig.: SK 750E in IP54 version (air cooling)

Optional technology unit
SK TU2-CTR
SK TU2-POT

Optional technology unit
Bus modules

Optional customer unit
SK CU1-...

Optional special extension
SK XU1-...

2.2 Installation

NORDAC SK 750E frequency inverters are available in various sizes depending on their output. Attention must be paid to a suitable position when installing.

The equipment requires sufficient ventilation to protect against overheating. For this the minimum guideline distances from adjacent components above and below the frequency inverter, which could obstruct the air flow apply. (above > 100 mm, below > 100 mm)

Mounting can be immediately next to each other. The installation position is normally vertical.

Warm air must be vented above the device!

If several inverters are arranged above each other, it must be ensured that the upper air entry temperature limit is not exceeded. (See also Section 9, Technical data). If this is the case, it is recommended that an "obstacle" (e.g. a cable duct) is mounted between the inverters so that the direct air flow (rising warm air) is impeded.

2.3 Dimensions of the SK 750E

Frequency inverter type	L	B	D	Wall mounting kit (optional, Section 2.5)				Weight
				L1	B1	L2	∅	
SK 750E-551-323-A … SK 750E-751-323-A	414 372 *	255	237.5 165 *	443 401*	220.5	457.5 415.5*	6.5	18.0
SK 750E-551-340-A … SK 750E-152-340-A								
SK 750E-921-323-A … SK 750E-112-323-A	472 430*	305	253 179 *	501 459*	270.5	516 474*	6.5	23.0
SK 750E-182-340-A … SK 750E-222-340-A								
	All dimensions in [mm]							Approx. [kg]
	*) water cooled version							

2.4 Attachment accessories for the SK 750E

1. **Wall mounting, SK WMK-750E Size 1 or. ...Size 2:** For the close-to-motor version of the SK 750E frequency inverter, attachment to a suitable mounting surface is by means of an optional mounting bracket.
2. **Motor mounting:** Alternatively, there is the possibility of direct mounting on NORD DS standard motors (motor-integrated version). Additional mounting material is required for this.

2.5 SK 750E wall mounting kit

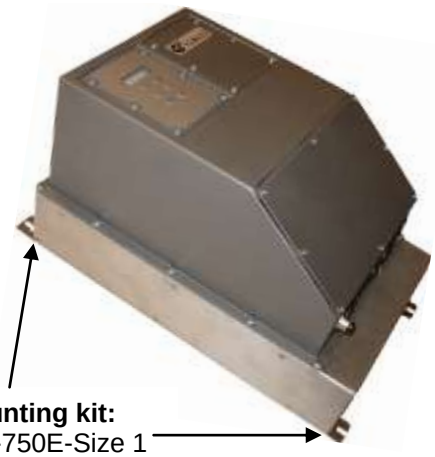
For use of the SK 750E frequency inverter close to the motor, the wall mounting kit enables the geared motor and the frequency inverter to be installed separately. For wall mounting of the SK750E, 2 suitable brackets are required, which can be ordered as accessories. These are screwed to the rear of the SK 750E with the fastening material provided. Both of the wall mounting kits comply with protection classes IP54 or IP65. The same wall mounting kit is required for Size 1 air cooled and water cooled versions. For Size 2, there are differences in the wall mounting kits for the two versions.

Type	for device	Part number
SK WMK-750E-Size 1	SK 750E-551-323-A (-W) ... SK 750E-751-323-A (-W) SK 750E-551-340-A (-W) ... SK 750E-152-340-A (-W)	275219000
SK WMK-750E-Size 2	SK 750E-921-323-A ... SK 750E-112-323-A SK 750E-182-340-A ... SK 750E-222-340-A	275219010
SK WMK-750E-Size 2-W (in preparation)	SK 750E-921-323-A -W... SK 750E-112-323-A-W SK 750E-182-340-A -W... SK 750E-222-340-A-W	275219020 (in preparation)

Components of the wall mounting kits:

SK WMK-750E-Size 1

SK WMK-750E-Size 2



Wall mounting kit:
SK WMK-750E-Size 1

2.5.1 Dimensions of the SK 750E with wall mounting kit

Note

Please refer to the table in Section 2.2 for the dimensions.

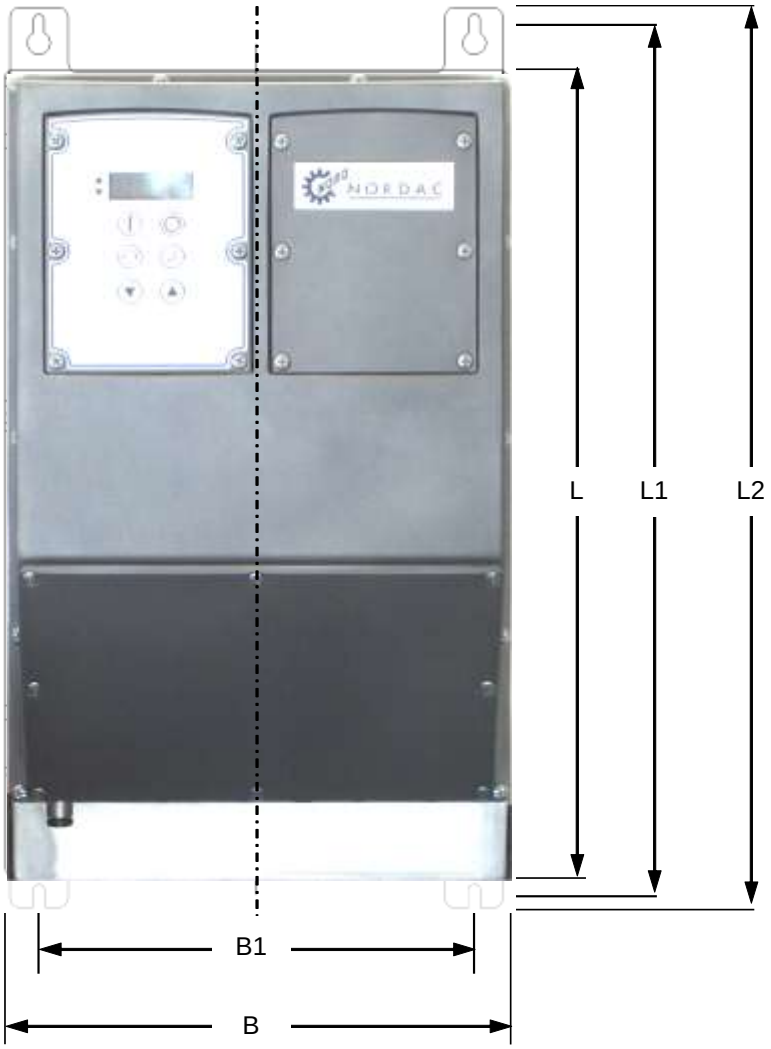
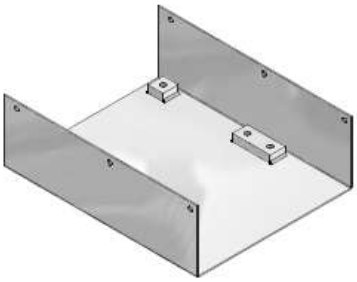


Fig.: SK 750E with SK WMK-750E-Size 1

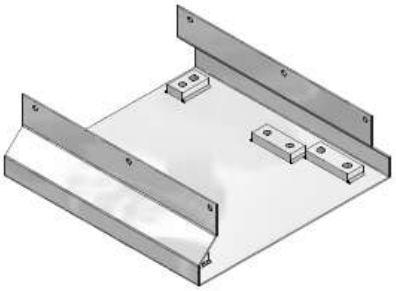
2.6 Mounting of the SK750E directly on a motor

For motor-mounted (motor-integrated) use of the SK 750E frequency inverter direct installation of the geared motor and the frequency inverter is possible using the attachment frame and the additional "motor mounting feet". Three different attachment frames are available for mounting on the various sizes of motor (132, 160, 180MX/LX).

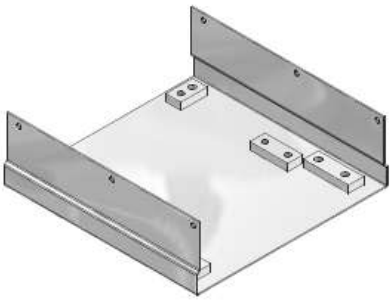
Attachment frame	for device	Part number
Attachment frame 750E-Size 1-IEC132	SK 750E-551-323-A ... SK 750E-751-323-A SK 750E-551-340-A ... SK 750E-751-340-A	275218000
Attachment frame 750E-Size 1-IEC160*	SK 750E-112-340-A ... SK 750E-152-340-A	275217000
Attachment frame 750E-Size 2-IEC160*	SK 750E-921-323-A ... SK 750E-112-323-A SK 750E-182-340-A ... SK 750E-222-340-A	275216000
*Also suitable for motor size IEC132		



Attachment frame 750E-Size 1-IEC132



Attachment frame 750E-Size 1-IEC160

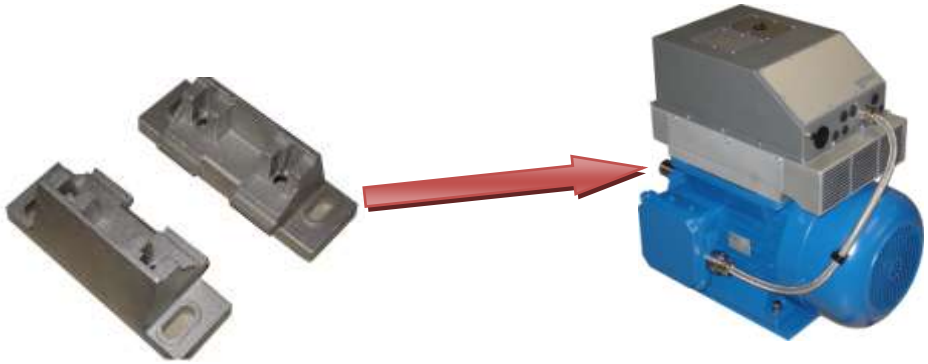


Attachment frame 750E-Size 2-IEC160

The number and version of the attachment feet to be used depends on the type of motor and can be obtained from the following table.

Part number	Motor size	Number per drive unit
16630900	132	2
17481000 ("Foot") 17181010 (Screw set)	160, 180MX, 180LX (Siemens)	2 4
17430900	160 L, 160 LH, 160 MH, 180MX, 180LX (NORD)	2
17130900	160M (NORD)	2

Example: "Attachment feet" for size 132 motor, Part No. 16630900:



2.7 Wiring guidelines

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

1) Ensure that all equipment in the control cabinet or field is securely earthed using short earthing cables which have large cross-sections and are connected to a common earthing point or earthing rail. It is especially important that 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 lead of the motor controlled by the frequency inverter must be connected as directly as possible to the earth connection of the cooling element, together with the PE of the corresponding frequency inverter mains supply. The presence of a central earthing bar in the control cabinet and the grouping together of all bonding conductors to this bar normally ensures safe operation. (See also Chapter 8.3/8.4 EMC guidelines)
3) Where possible, shielded cables should be used for control circuits. The shielding at the cable end should be carefully sealed and it must be ensured that the wires are not laid over longer distances without shielding.

   The shields of analog setpoint cables should only be earthed on one side on the frequency inverter.
4) The control cables should be installed as far as possible from power cables, using separate cable ducts, etc. Where cables cross, an angle of 90° should be ensured as far as possible.
5) Ensure that the contactors in the cabinet are interference protected, either by RC circuits in the case of AC contactors or by free-wheeling diodes for DC contactors, **for which interference suppressors must be connected to the contactor coils**. Varistors for over-voltage limitation are also effective. This interference suppression is particularly important when the contactors are controlled by the relay in the frequency inverter.
6) Shielded or protected cables should be used for load connections (motor cable) and the shielding/protection should be earthed at both ends, if possible directly to the frequency inverter PE/EMC terminal.

   In addition, *EMC-compliant wiring* must be ensured. (see also Section 8.3/8.4 EMC). If required, an optional integrated motor filter is available.
7) Select the lowest possible switching frequency. This will reduce the intensity of the electromagnetic interference produced 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. Under no circumstances may they be laid in the same protective conduit or cable duct.
The test equipment for high voltage insulation must not be used for cable which are connected to the frequency inverter.

2.8 Electrical Connection

WARNING

NOTE

THESE DEVICES MUST BE EARTHED.

Safe operation of the devices requires that is installed and commissioned by qualified personnel in compliance with the instructions provided in this Manual.

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

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

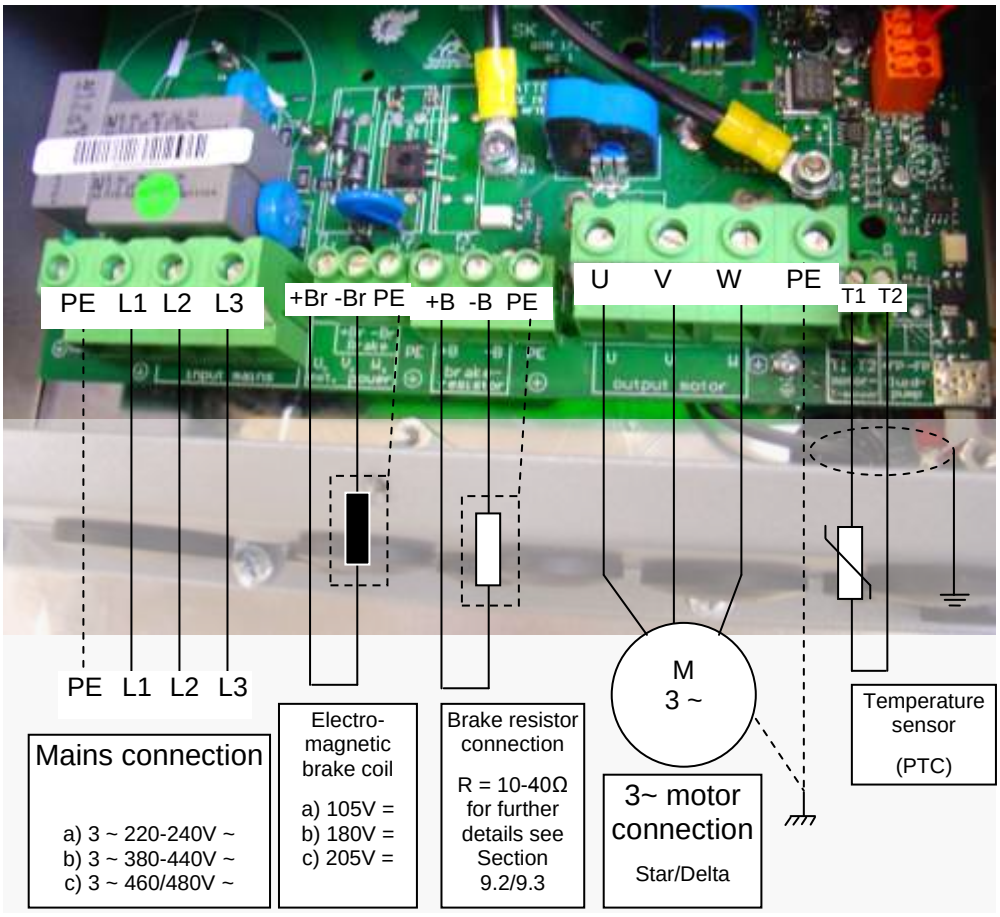
Ensure that the input voltage source is not live before setting up or changing connections to the unit.

Make sure that the inverter and motor have the correct supply voltage set.

Switching of the motor or brake resistor cable in not permitted when they are connected to a voltage.

2.9 Electrical connection of power unit

The line, motor, brake resistor and control connections are located on the underside of the device. To gain access to the terminals, the device covers (cover and terminal cover) must be removed. The connection terminals are now accessible from the front or from above. The cables must be fed into the frequency inverter via suitable screw fittings and pretected from tension. All covers must be put back in place before switching on the supply voltage!



Before connecting the device, the following must be observed:

1. Ensure that the voltage source provides the correct voltage and is suitable for the current required (see Section 9 Technical data). In addition, care must be taken that suitable power switch with the specified rated current range is installed between the voltage source and the frequency inverter.
2. Connect the mains voltage directly to the mains terminals L_1 - L_2 - L_3 and connect the earth (PE).
3. A four-core cable must be used to connect the motor. The cable must be connected to the motor terminals U - V - W and the PE.
4. If shielded motor cables are used (recommended), the cable shielding must also be connected to a large area of the metal screw fittings.

Note: The use of shielded cables is essential in order to maintain the specified radio interference suppression level. (See also Section 10.5 EMC limit value classes)

ATTENTION

Proper earthing must be ensured for all metal covers. Otherwise the frequency inverter must not be put into operation (see illustration).

Usually, the line, motor and brake resistor cables are connected first as their terminals are located on the bottom circuit board. The various metric screw fittings on the underside of the device are used as cable glands (see 2.9.7 Cable Glands)

NOTE

If using certain **wire end sleeves** are used, the maximum cross-section which can be connected can be reduced.

NOTE

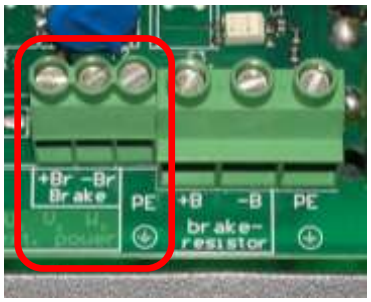
If **synchronous machines** are connected or **several motors** are connected in parallel, the frequency inverter must be operated with linear voltage/frequency characteristic curves, P211 = 0 and P212 = 0.

2.9.1 Mains supply (PE, L1, L2, L3)

No special safety devices are required on the mains input side for the frequency inverter, the use of the normal mains protection (see 9 Technical Data) and a master switch or contactor is recommended.

Note: Use of this frequency inverter on an **IT network** is possible after minor modifications. Please consult your supplier.

2.9.2 Electromagnetic brake (+Br, -Br, PE)



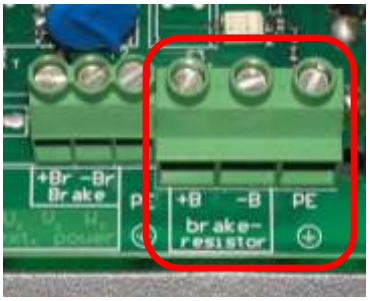
An output voltage is generated by the frequency inverter at the terminals -Br/+Br to actuate an electromechanical motor brake (see Section 2.9, Electrical connections to the power unit).

This depends on the supply voltage present in the frequency inverter. The assignment is as follows:

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

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

2.9.3 Brake resistor (+B, -B, PE)



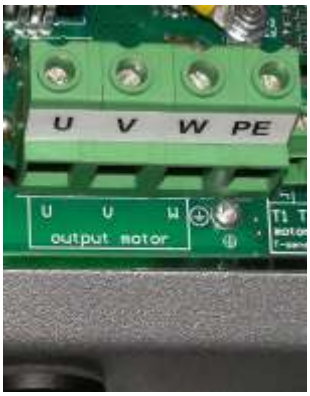
During dynamic braking (frequency reduction) of a three-phase motor, electrical energy is returned to the inverter. In order to avoid overcurrent switch-off of the frequency inverter, the integrated brake chopper can convert the returned energy into heat by connection of an external braking resistor.

The connection for the frequency inverter → brake resistor should be shielded and as short as possible.

Switching of this connection must only be made when no voltage is present!

Note: The possible generation of large amounts of heat in the braking resistor must be taken into account.

2.9.4 Motor cable (U, V, W, PE)



The motor cable **maximum length of 150m** (Please note also Section 10.5 EMC limit value classes). If a shielded motor cable is used, or the metallic cable duct is well earthed, the **maximum length of 50m** should not be exceeded. For longer cable lengths, the frequency inverter can be equipped with an optional internal motor filter (at extra charge).

Switching (contactor or motor protection switch) at the output (U, V, W), is not permitted while the frequency inverter is delivering current!

Note: For multiple motor operation the total cable length consists of the sum of the individual cable lengths. If the sum of the cable lengths is too large, an optional internal motor filter should also be ordered.

2.9.5 Temperature sensor (T1, T2)

This input can be used to evaluate a temperature sensor (thermistor or temperature-controlled switch) in order to prevent overheating.

If the thermistor has a high resistance or the temperature controlled switch opens, the frequency inverter switches off and reports a motor overtemperature error (E001).

If no temperature sensor is used, terminals T1 and T2 must be bridged.

An error message can be acknowledged by switching the mains off and on again, or by pressing the ENTER key on a control display (ControlBox or ParameterBox).

NOTE

The cable routing of the control cables or temperature sensor should always be separate from the motor cable and be made with shielded cables.

Internal switching in the inverter prevents excessive voltage to the thermistor. Further details can be found in Section 8, Error messages.

Evaluation of a temperature sensor is also possible by means of the optional **customer units** (**SK CU1-...**). Further details can be found in Section 3.3, Overview of customer units.

2.9.6 PowerConnection Terminals

Size 1:
SK 750E-551-323-A **...** SK 750E-751-323-A (5.5 / 7.5kW, 230V)
SK 750E-551-340-A **...** SK 750E-152-340-A (5.5 … 15kW, 400V)

Terminal block	Mains input	Mech. Brake	Brake resistor	Motor output	Temp. Sensor
VDE rigid	0.5 - 16mm²	0.2 - 6mm²	0.2 - 6mm²	0.5 - 16mm²	0.14 - 2.5mm²
VDE flexible	0.5 - 10mm²	0.2 - 4mm²	0.2 - 4mm²	0.5 - 10mm²	0.14 - 2.5mm²
UL/cUL	AWG 20-6	AWG 24-10	AWG 24-10	AWG 20-6	AWG 26-14

Size 2:
SK 750E-921-323-A **...** SK 750E-112-323-A (9.2 / 11kW, 230V)
SK 750E-182-340-A **...** SK 750E-222-340-A (18.5 / 22kW, 400V)

Terminal block	Mains input	Mech. Brake	Brake resistor	Motor output	Temp. Sensor
VDE rigid	0.5 - 35mm²	0.2 - 6mm²	0.5 - 16mm²	0.5 - 35mm²	0.14 - 2.5mm²
VDE flexible	0.5 - 25mm²	0.2 - 4mm²	0.5 - 10mm²	0.5 - 25mm²	0.14 - 2.5mm²
UL/cUL	AWG 20-2	AWG 24-10	AWG 20-6	AWG 20-2	AWG 26-14

2.9.7 Control connections (optional)

The manner and type of control unit connections are dependent on the options chosen (customer unit / special extension unit). The possible variants are described in Section 3.3/3.4.

Here you will find general data and information on all customer units and special extension units.

Connection terminals:	-	Plug-in clip connectors can be released with a small screwdriver
Maximum connection cross-section:	-	1.5mm^2 or 1.0mm^2 (AWG 26-14 or 26-16), according to option
Cable:	-	laid separately from the mains/motor cables and shielded
Control voltages: *(Short-circuit proof)*	-	5V, max. 300mA, for the supply of a ParameterBox SK PAR-2H
	-	10V, max. 10mA, reference voltage for an external potentiometer
	-	15V, max. 300mA, for the supply of digital inputs or an incremental or absolute encoder
	-	analog output 0 - 10V, max. 5mA for an external display unit

NOTE

All control voltages refer to a common reference potential 0V / GND.

If necessary, 5 / 15V can be taken from several terminals. The sum the currents must not exceed 300mA.

2.9.8 Cable connections

With the cable connections, a differentiation must be made between Size 1 and Size 2 of the SK 750E frequency inverter. Both have different cable connections for the line input and the output from the frequency inverter to the motor (see the table below). The cable connections for the control level, control of the brake resistor and the temperature sensor input are the same for both sizes.

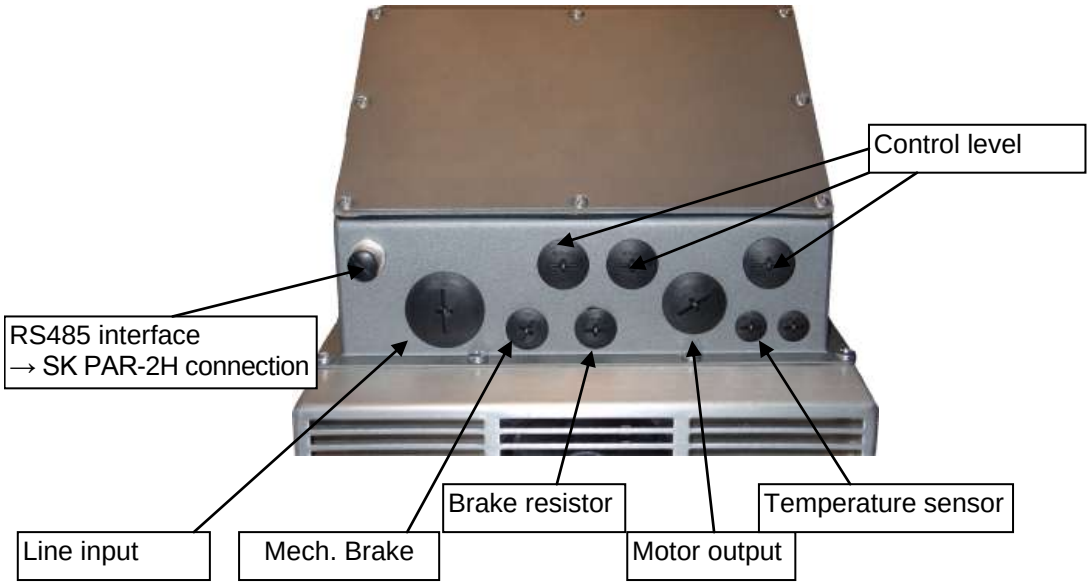


Fig.: Air cooled SK 750E, Size 1

Available cable connections for Size 1 and 2:

Size	Line input	Motor output	Control level	Brake resistor	Temperature sensor
Size 1	M32	M25	3x M25	2x M16	2x M12
Size 2	M40	M32	3x M25	2x M16	2x M12

NOTE

For operation with an SK 750E, the motor should be equipped with a temperature sensor.

3 Options

3.1 Modular options

By combining various modules for display, control and parameterisation, the NORDAC SK 750E can be easily adapted to various requirements.

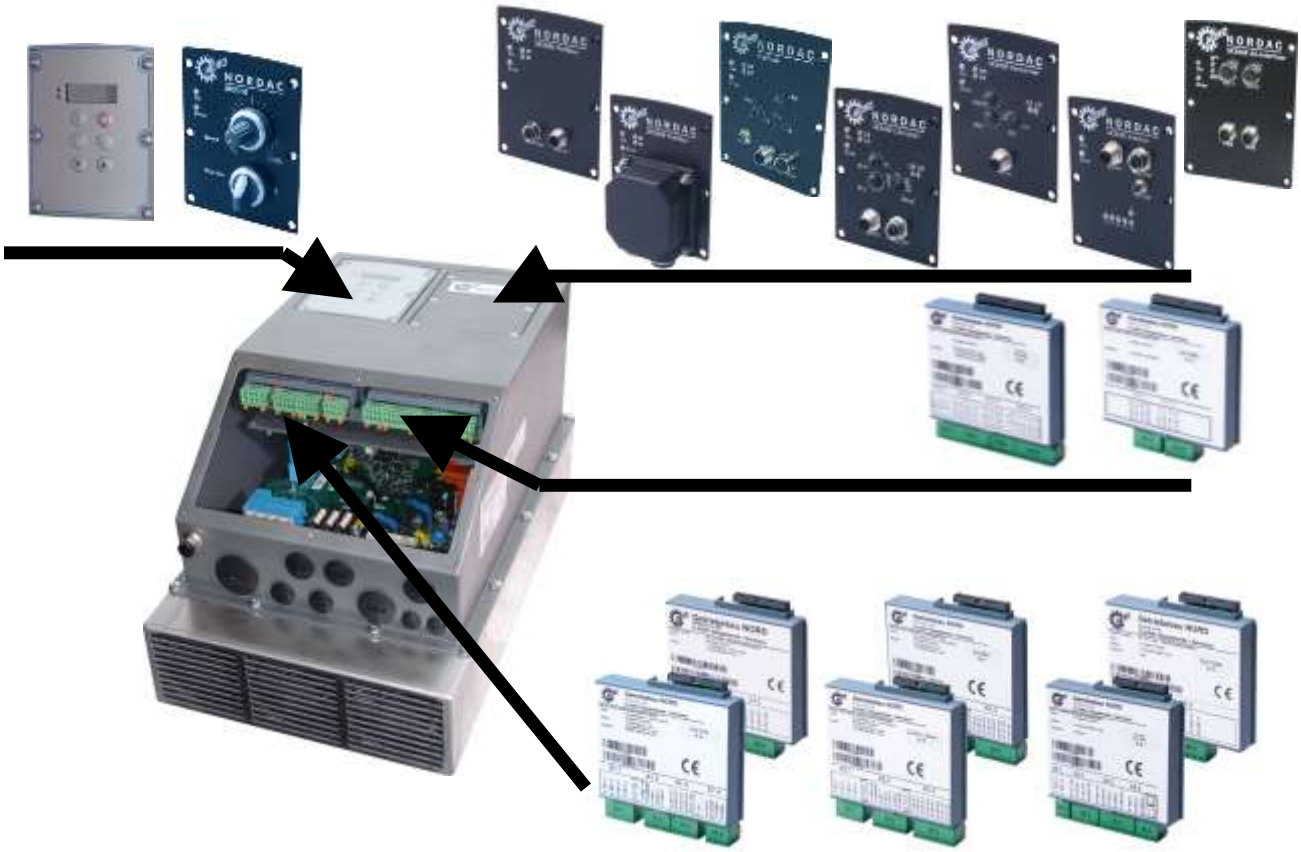
Modules are available for processing analog and digital signals and for all common Bus systems.

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

Technology units (Technology Unit, SK TU2-...) are located on the frequency inverter and are accessible from the outside for manual control or parameterisation, or to provide connection to field bus systems.

Customer interfaces (Customer Unit, SK CU1-...) are installed inside the frequency inverter. These allow control with analog and digital signals or connection to the bus systems.

Special extension units (Extension Unit, SK XU1-...) include special functions such as speed control with incremental encoders or position control with incremental or absolute encoders.



WARNING

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

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

NOTE

Further detailed information can be found in the Options manuals.

- www.nord.com –

3.2 Overview of Technology Units

Technology units are optional modules and are plugged onto the top of the frequency inverter. They are for the control or parameterisation of the inverter and for the display of the actual operating values. The PotentiometerBox and the ControlBox are available as technology units for simple control of the frequency inverter and various bus modules are available for connection to a higher level control unit.

A differentiation is made between IP55 and IP66 technology units. Technology units with protection class IP555 are used for the air cooled SK 750E and protection class IP66 is used for the water cooled SK 750E.

ATTENTION

Left / right TU slot

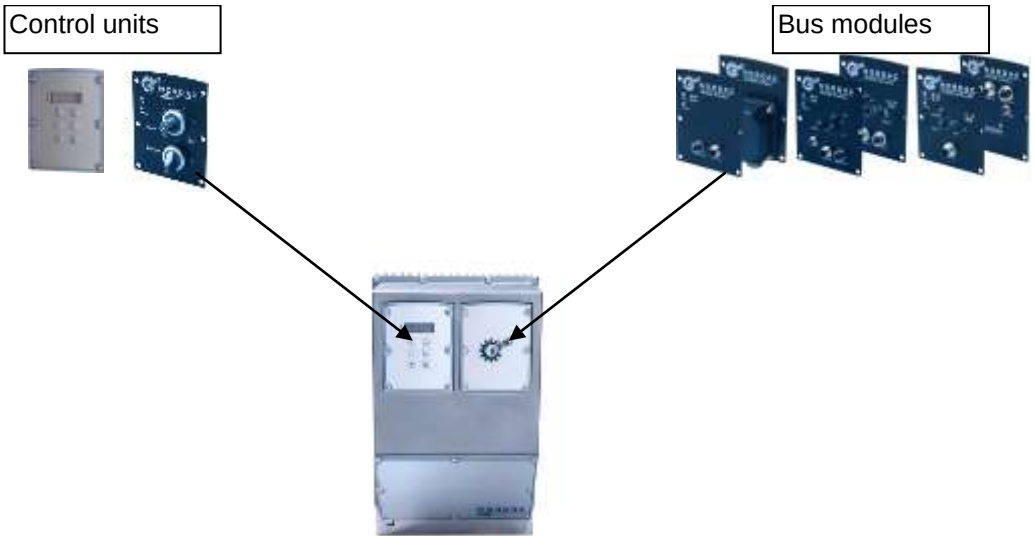
When inserting the technology units, the left and right slots must be considered separately. The left hand slot must only be used for the ControlBox or PotentiometerBox control unit. The right hand slot can be used for all modules. Combined operation of the PotentiometerBox and the ControlBox is not possible!

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, with the IP66 version **special measures**, such as coated PCBs are used in order to comply with the protection class.

Technology unit SK TU2-...	Protection class	Description	Data
ControlBox **SK TU2-CTR** Part. No. 275130130	IP55	Used for commissioning, parameterisation, configuration and control of the frequency inverter.	4-digit, 7-segment LED display, keyboard
ControlBox **SK TU2-CTR-C** Part. No. 275170130	IP66		
PotentiometerBox **SK TU2-POT** 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 **SK TU2-POT-C** Part. No. 275170060	IP66		
Profibus module (standard) **SK TU2-PBR** Part. No. 275130070	IP55	This interface enables control of the NORDAC SK 750E via the Profibus DP serial port.	Profibus interface Baud rate: 1.5 MBit/s 2x 5 pin M12 system connectors
Profibus module (standard) **SK TU2-PBR-C** Part. No. 275170070	IP66		
Profibus module (terminals) **SK TU2-PBR-KL** Part. No. 275130065	IP55	This interface enables control of the NORDAC SK 750E via the Profibus DP serial port.	Profibus interface Baud rate: 1.5 MBit/s 8 pin terminal
Profibus module (terminals) **SK TU2-PBR-KL-C** Part. No. 275170065	IP66		

Technology unit SK TU2-...	Protection class	Description	Data
Profibus module (ext. 24V) **SK TU2-PBR-24V** Part. No. 275130110	IP55	This interface enables control of the NORDAC SK 750E via the Profibus DP serial port.	Profibus interface Baud rate: 12 MBit/s 2x 5 pin M12 system connectors 1 external 24 V power supply
Profibus module (ext. 24V) **SK TU2-PBR-24V-C** Part. No. 275170110	IP66		
InterBus module **SK TU2-IBS** Part. No. 275130080	IP55	This interface enables control of the NORDAC SK 750E via the serial InterBus port.	InterBus interface Baud rate: 500 KBit/s 2x 5 pin M12 system connectors
InterBus module **SK TU2-IBS-C** Part. No. 275170080	IP66		
DeviceNet module **SK TU2-DEV** Part. No. 275130090	IP55	This option enables control of the NORDAC SK 700E via the DeviceNet serial port using the DeviceNet protocol.	DeviceNet interface Baud rate: 500 KBit/s 1x 5 pin M12 system connector
DeviceNet module **SK TU2-DEV-C** Part. No. 275170090	IP66		
CANopen module **SK TU2-CAO** Part. No. 275130100	IP55	This option enables control of the NORDAC SK 750E via the CANbus serial port using the CANopen protocol.	CANopen interface Baud rate: up to 1 MBit/s 2x 5 pin M12 system connectors
CANopen module **SK TU2-CAO-C** Part. No. 275170100	IP66		
AS interface module **SK TU2-AS1** Part. No. 275130120	IP55	This interface enables the control of sensors and actuators. In addition, the NORD SK 750E can be parameterised via the AS interface	AS interface 2 x 2 M12 5 pin sockets / connectors
AS interface module **SK TU2-AS1-C** Part. No. 275170120	IP66		



3.2.1 Installing the Technology Unit

Installation of the technology units must be carried out as follows:

1. Switch off the mains voltage, observe the waiting period.
2. Remove the blank cover by removing the 6 screws and the PE cable.
3. Connect the technology unit to the PE cable and push it in using slight pressure. Take care that the connector strip makes proper contact.
4. Tighten the 6 fastening screws.

ATTENTION

Operation is not permitted if there is no secure PE connection to the frequency inverter and to the technology unit (see adjacent illustration)!

WARNING

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

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

NOTE

3.2.2 ControlBox SK TU2-CTR

(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 750E.

Features:

- 4-digit, 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-digit, 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.

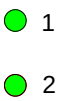
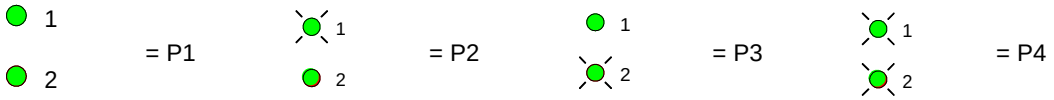
NOTE

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 must be entered via the relevant parameter >Jog frequency< (P113).

Settings should only be implemented by qualified personnel, strictly in accordance with the warning and safety information.

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

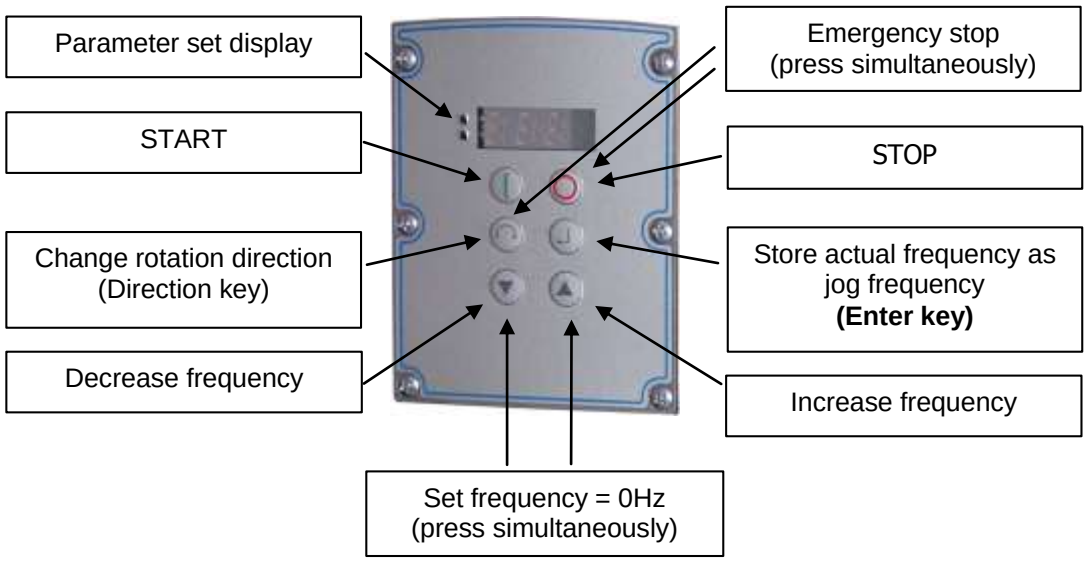
ControlBox functions:

	To switch 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.
	To switch off the frequency inverter. The output frequency is reduced to the absolute minimum frequency (P505) and the frequency inverter shuts down.
7-segment LED display	Shows the actual operating value set during operation (selection in P001) or an error code. During parameterisation, the parameter numbers or the parameter values are shown. When switched off, but in standby mode, four dashes "_ _ _ _" are displayed.
LEDs 	The LEDs indicate the actual operating parameter set in the display and the actual parameter set being parameterised during parameterisation. In this case the display is coded in binary form. 
	The direction of rotation of the motor changes when this key is pressed. "Rotation to the left" is indicated by a minus sign. **Attention!** Take care when operating pumps. screw conveyors, fans, etc. Block the key with parameter P540.
	Press key to increase the frequency. During parameterisation, the parameter number or parameter value is increased
	Press the key to reduce the frequency. During parameterisation, the parameter number or parameter value is reduced.
	Press "ENTER" to store a changed parameter value, or to switch between parameter number or parameter value. **NOTE:** If a changed value is not to be stored, the  key can be used to exit from the parameter without saving the change.

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 (≠ P000) the actual parameter set to be parameterised. In this case, the display appears in binary form.

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 ▲ permanently stored as the jog frequency in P113 by pressing the ENTER key.

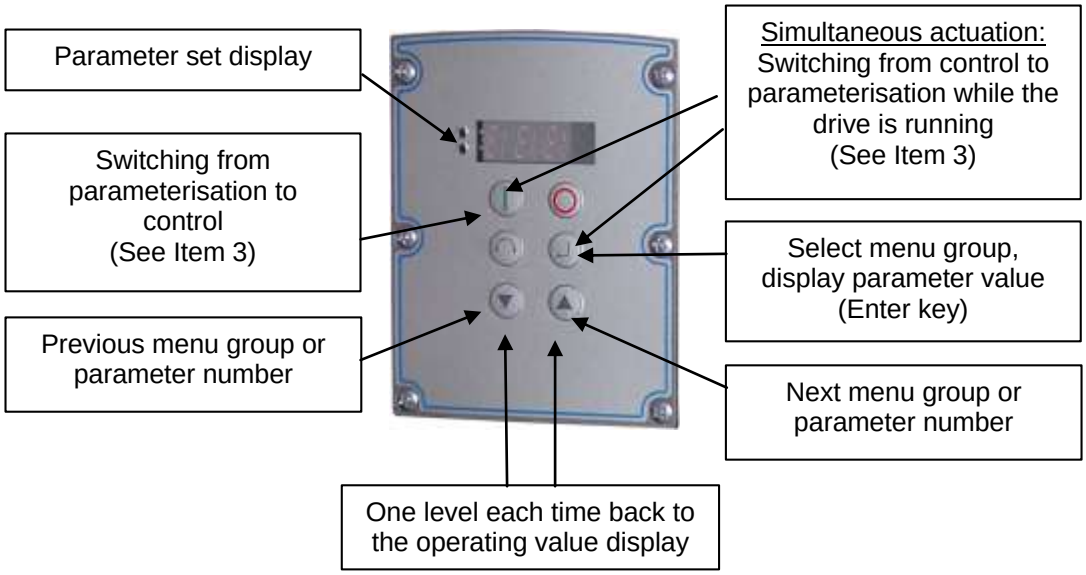
Emergency stop:

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

Parameterisation with the ControlBox

Parameterisation of the of the frequency inverter can be performed in the various operating states. All parameters can always be changed online. Switching to the parameter mode is carried out in different ways depending upon the operating states and the enabling source.

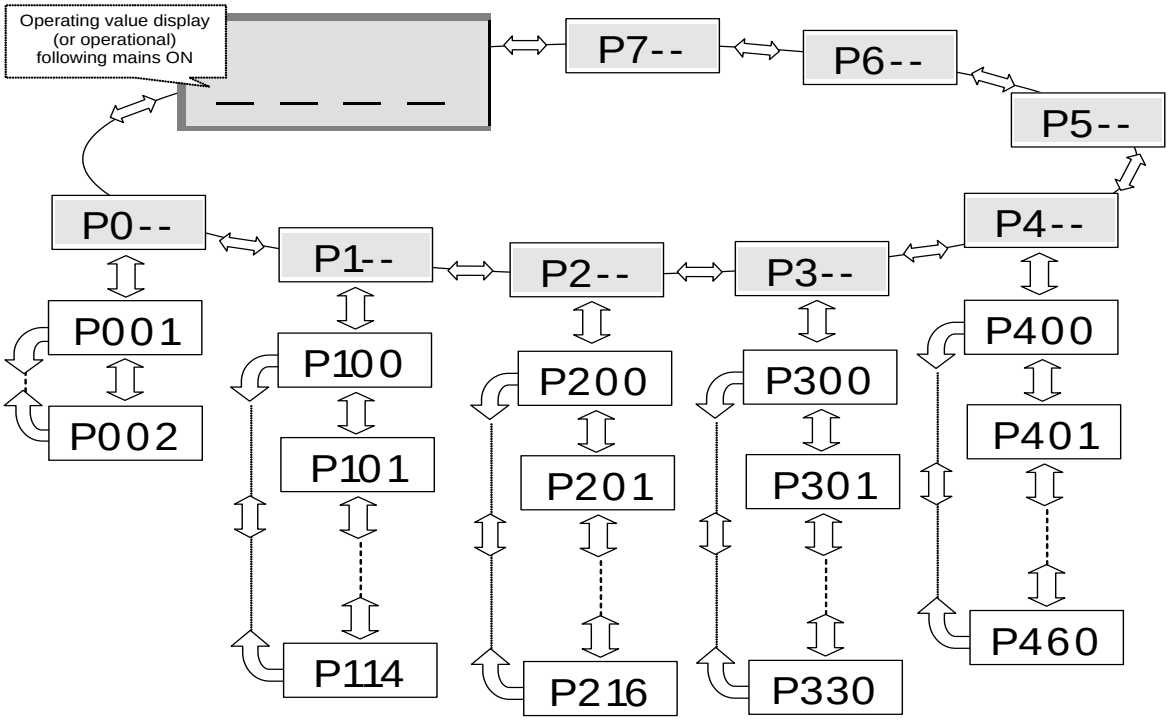
1. If there is noenable (if necessary press the STOP key) via the ControlBox, the control terminals or a serial interface, it is still possible to switch to parameterisation mode from the operating value display by means of the value keys or . → P 0 _ _ / P 7 _ _
2. If an enable is present via the control terminals or a serial interface and the frequency inverter is producing an output frequency, it is also possible to switch to the parameterisation mode directly from the operating value display using the value keys or . → P 0 _ _ / P 7 _ _
3. If the 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 menu group display P0__ ... P7__. After pressing the ENTER key access to the menu group is obtained and the required parameter can be selected with the value keys.
All parameters are arranged in order in the individual menu groups in a continuous scroll pattern. It is therefore possible to scroll forwards and backwards within this section.
Each parameter has a parameter number → Pxxx . The significance and description of the parameters starts in Section 7 "Parameterisation".

Menu structure with the ControlBox



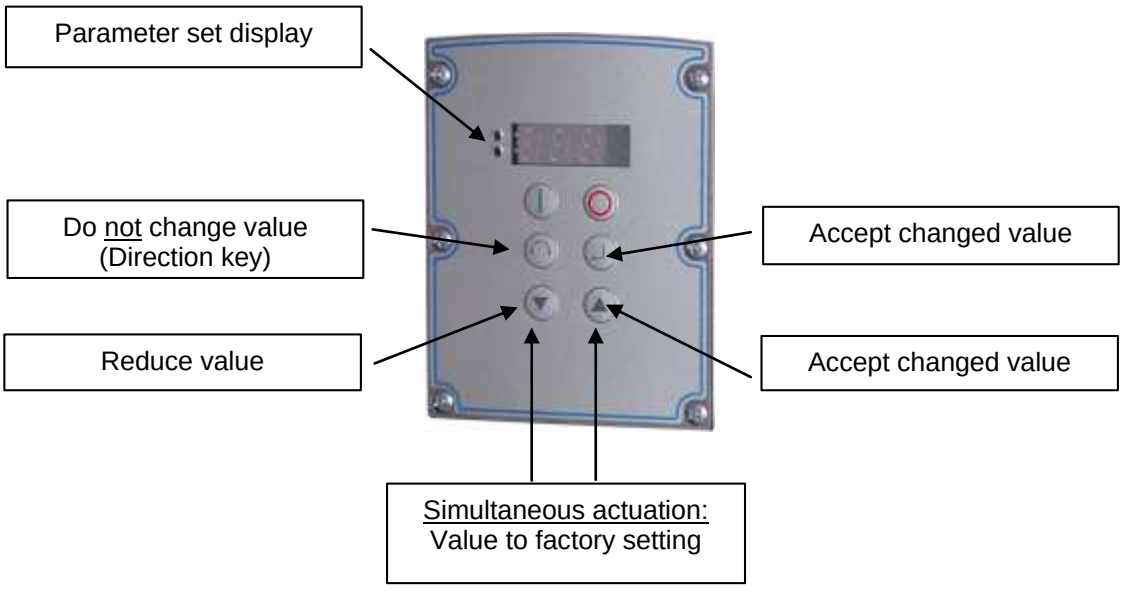
To **change** a **parameter value**, the ENTER key ↵ must be pressed when the relevant parameter number is displayed.

Changes can then be made using the VALUE keys ▼ or ▲ and must be confirmed with ↵ to save them and exit from 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 <u>not</u> to be saved, the "DIRECTION" key ↶ can be pressed to exit from the parameter.



3.2.3 PotentiometerBox SK TU2-POT

(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 only be controlled via the PotentiometerBox, if parameter P509 >Interface< is set to "Control terminals or keyboard" (P509 = 0) and has not previously been enabled via the control terminals (customer unit).

LED	Description
Green LED [ON]	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.
Red LED [ERROR]	Indicates actual error by flashing with a frequency according to the number code of the error.

3.2.4 DeviceNet Module SK TU2-DEV

(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 a single 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 obtained from the operating instructions **BU 0080** or contact the supplier of the frequency inverter.

3.2.5 Profibus Module SK TU2-PBR

(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 the exchange of data between a wise range of automation devices. 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 obtained from the operating instructions **BU 0020** or contact the supplier of the frequency inverter.

3.2.6 CANopen BUS Module SK TU2-CAO

(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 standardised CANopen specifications. Up to 127 participants can be addressed on a single Bus. A termination resistor is integrated and can be switched on. The transfer rate (10kBaud and 500kBaud) 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 obtained from the operating instructions **BU 0060** or contact the supplier of the frequency inverter.

3.2.7 InterBus Module SK TU2-IBS

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

With InterBus, up to 256 participants from a wide range of 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.

Module status LEDs	ST (red/green)	Module error/ready
InterBus status LEDs	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 obtained from the operating instructions **BU 0070** or contact the supplier of the frequency inverter.

3.2.8 AS interface SK TU2-AS1

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

The **A**ctuator**S**ensor **Interface** (AS-Interface) is a bus system for the lower 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 energy 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*.

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

NOTE: Detailed information can be obtained from 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 Size1/Size2, 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 which 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 actual device status.

LED	Description
Green LED [ON]	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.
Red LED [ERROR]	Indicates actual error by flashing with a frequency according to the number code of the error.

NOTE

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

3.3 Customer unit overview

Customer units are optional push-in modules. Their slots are located on the left guide rail inside the frequency inverter housing. After insertion, they are automatically identified by the frequency inverter.

The cable connection is established using spring terminals. This makes the connection of devices very easy and convenient.

NOTE

With the **customer units (SK CU1-…)** there is no difference between IP protection classes. This means that the same customer units are used for both the air cooled SK 750E (IP54) and for the water cooled version (IP65).

Option	Description	Data
Basic I/O **SK CU1-BSC**	Simplest custom interface for optimum adaptation to the application.	1 x multi-function relays 3 x digital inputs 1 x analog input, 0...10V
Standard I/O **SK CU1-STD**	Extended functionality of control signals, including USS bus (RS485) control.	2 x multi-function relays 4 x digital inputs 1 x analog input, 0...10V, 0/4...20mA 1 x analog outputs, 0..0.10V 1 x RS 485
Multi I/O **SK CU1-MLT**	Highest functionality with digital and analog signal processing. Analog voltage output.	2 x multi-function relays 6 x digital inputs 2 x analog inputs, -10...+10 V, 0/4...20mA 2 x analog outputs, **0...10V**
Multi I/O **SK CU1-MLT-20mA**	Highest functionality with digital and analog signal processing. Analog current output.	2 x multi-function relays 6 x digital inputs 2 x analog inputs, -10...+10 V, 0/4...20mA 2 x analog outputs, **0/4…20mA**
CANbus **SK CU1-CAN-RJ**	This interface enables control of the NORDAC SK 750E via the serial CAN port.	1 x multi-function relays 5 x digital inputs 2 x RJ45 CANbus connectors
Profibus **SK CU1-PBR**	This interface enables control of the NORDAC SK 750E via the Profibus DP serial port.	1 x multi-function relays 1 x digital inputs 1 x Profibus

NOTE

for 5V / 15V power supplies

The customer units and special extension units have various power supplies (5V / 15V) which can be used externally. The maximum permissible external load current is 300mA. This can be taken from one or more power supplies. The total current must however not exceed 300mA.

All control voltages are related to a common reference potential!

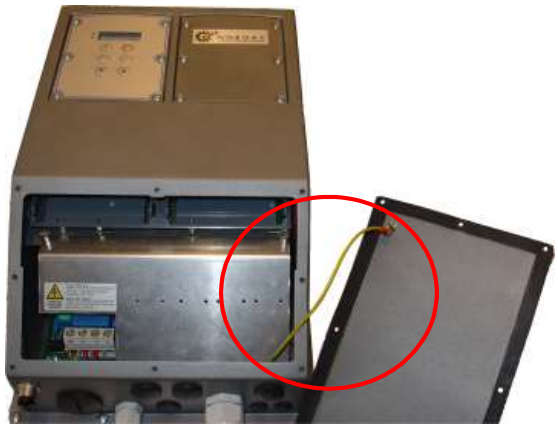
Potentials AGND /0V and GND /0V are internally linked in the device.

3.3.1 Installation of customer units

1. Switch off the mains voltage, observe the waiting period.
2. Remove the cover by unscrewing the 8 screws, noting the PE connection.
3. Using light pressure push the customer unit into the left guide rail until it engages.
4. Remove the connector by pressing the releases and make the necessary connections. Then push on the connector.
5. Replace all covers.

ATTENTION

The PE connection must be reconnected. Otherwise the device must not be used (see adjacent illustration)!



WARNING

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

Customer units must not be inserted/removed when live.

Following the insertion, replacement or removal of modules, and once the equipment has been switched on again, this procedure is indicated with the message E017 ***Customer unit changed***.

Restore all PE connections!

3.3.2 Removal of Customer Units

1. Switch off the mains voltage, observe the waiting period.
2. Remove the cover by unscrewing the 8 screws, noting the PE connection (see illustration of the PE connection on the previous page).
3. Lever the customer unit out of its engaged position with a screwdriver (see adjacent illustration). If necessary disengage the hooks on the right and left. Completely remove the module by hand.
4. Replace all covers.

ATTENTION

The PE connection must be reconnected. Otherwise the device must not be operated!

3.3.3 Customer unit Basic I/O

(SK CU1-BSC, Part No.: 278200000)

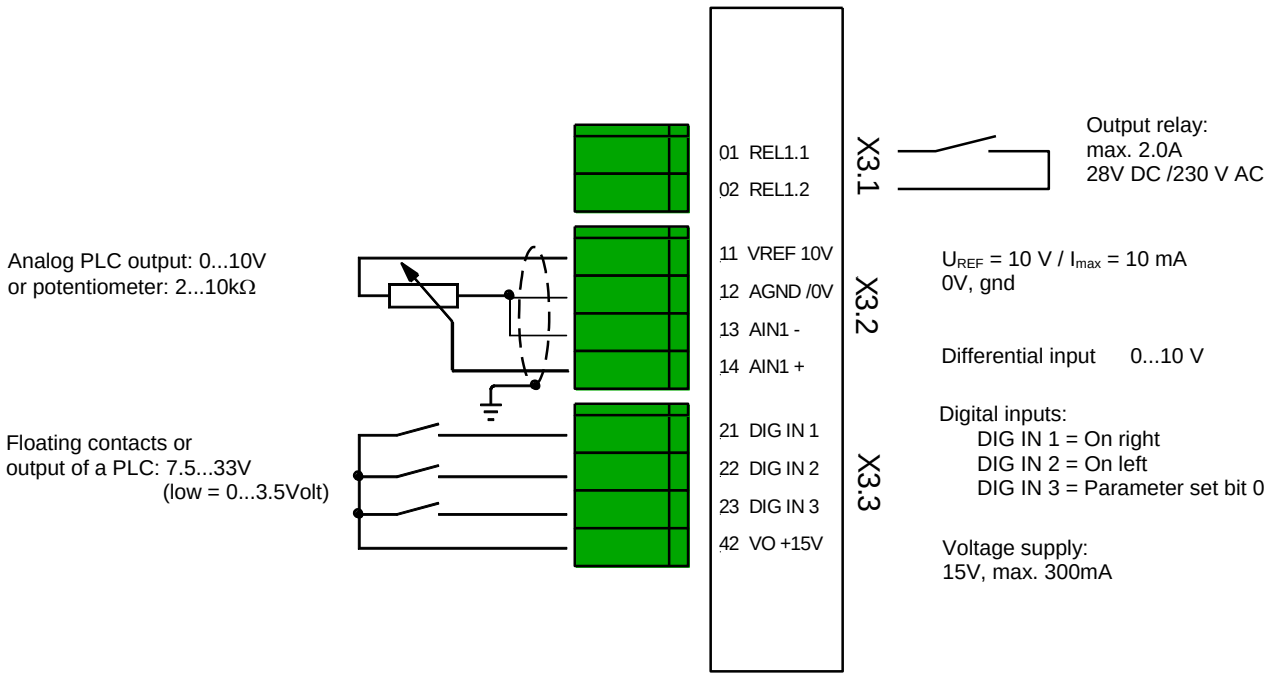
The (**C**ustomer **U**nit) I/O provides sufficient control terminals for simple control tasks and is therefore an economic solution for many applications.

There are 1 analog input and 3 digital inputs available for control of the frequency inverter. The analog differential input can process positive signals of 0...10V.

By means of a relay contact, brake control can be actuated or warnings can be sent to another system. A total of 13 different relay functions are available.

The digital inputs of the Basic I/O can also be assigned analog functions (see process controller, Section 10.3). Here, input voltages ≥10V are processed as 10V signals and correspond to 100% (9V = 90%, ... , 0V=0%).

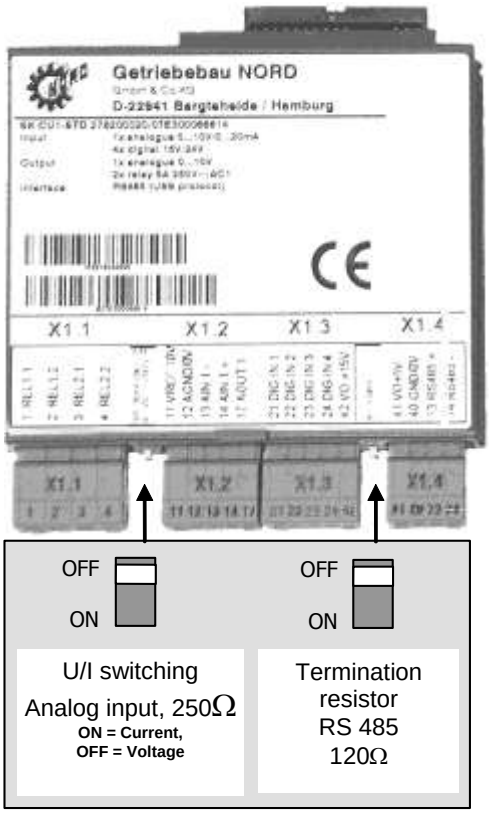
Connector	Functions	Maximum cross-section	Parameter
X3.1	Output relay	1.5 mm^2	P434 ... P436
X3.2	Analog input	1.5 mm^2	P400 ... P408
X3.3	Digital inputs	1.5 mm^2	P420 ... P422



NOTE: All control voltages are based on a common reference potential!
Potentials AGND /0V and GND /0V are internally linked in the device.
The maximum total current 5/15V is 300mA!

3.3.4 Customer unit Standard I/O

(SK CU1-STD, Part No.: 278200020)



The standard I/O of the customer interface (**C**ustomer **U**nit) provides sufficient control terminals for most applications and is also equipped with an RS485 interface.

There are 1 differential analog input and 4 digital inputs available for control of the frequency inverter. The analog input can process signals from 0...10V or 0...20mA or 4...20mA (with additional burden resistance).

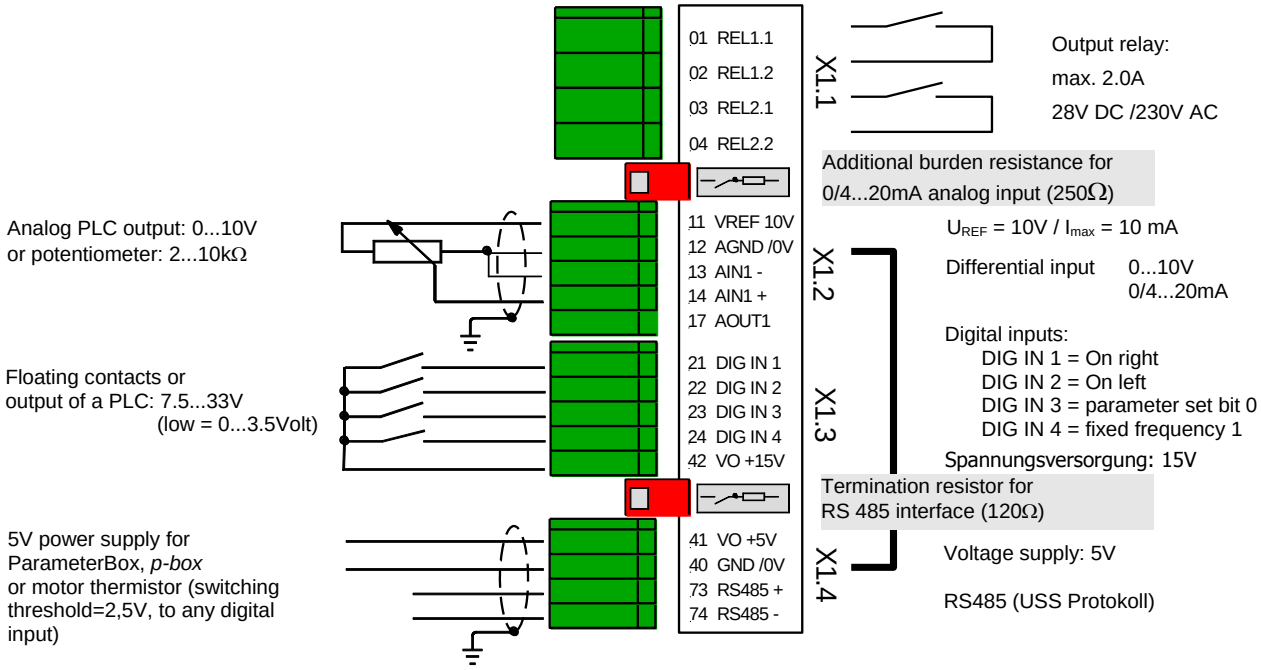
The analog output allows actual operating parameters to be transmitted to a display device or process control system The output signal is scalable and is available in the voltage range 0...10V.

By means of the two relay contacts, a brake control can be actuated or warnings can be transferred to another system.

The connected inverter can be controlled and parameterised with a PC via the RS485 interface. NORD CON software is required for this. Following successful parameterisation, the complete data set can be stored as a file.

The digital inputs of the Standard I/O can also be assigned with analog functions (see process controller, Section 10.3). Here, input voltages ≥10V are processed as 10V signals and correspond to 100% (9V = 90%, ... , 0V=0%).

Connector	Functions	Maximum cross-section	Parameter
X1.1	Output relay	1.5 mm^2	P434 ... P443
X1.2	Analog signals IN / OUT	1.0 mm^2	P400 ... P419
X1.3	Digital inputs	1.0 mm^2	P420 ... P423
X1.4	Bus signals / power supply	1.0 mm^2	P507 ... P513



NOTE: All control voltages are based on a common reference potential!
Potentials AGND /0V and GND /0V are internally linked in the device.
The maximum total current 5/15V is 300mA!

3.3.5 Multi I/O Customer Unit

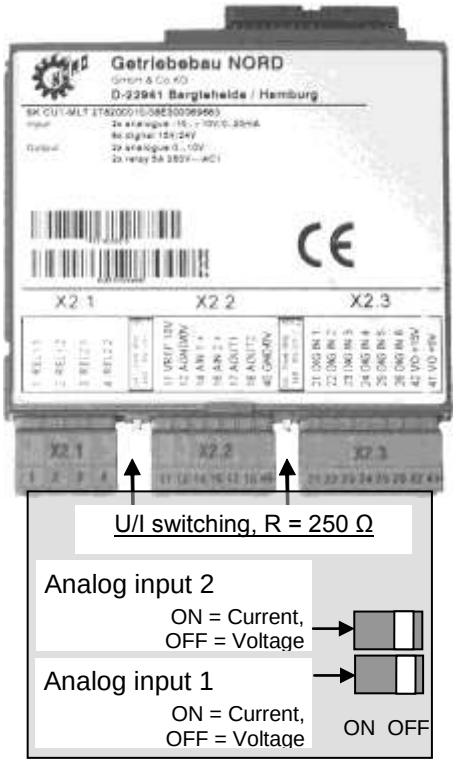
(SK CU1-MLT, Part No.: 278200010)

The Multi I/O (**C**ustomer **U**nit)provides the highest functionality of digital and analog signal processing. There are 2 differential analog input and 6 digital inputs available for control of the frequency inverter. Both analog inputs can process signals from 0...10V, 0...20mA (4...20mA) or -10V...+10V.

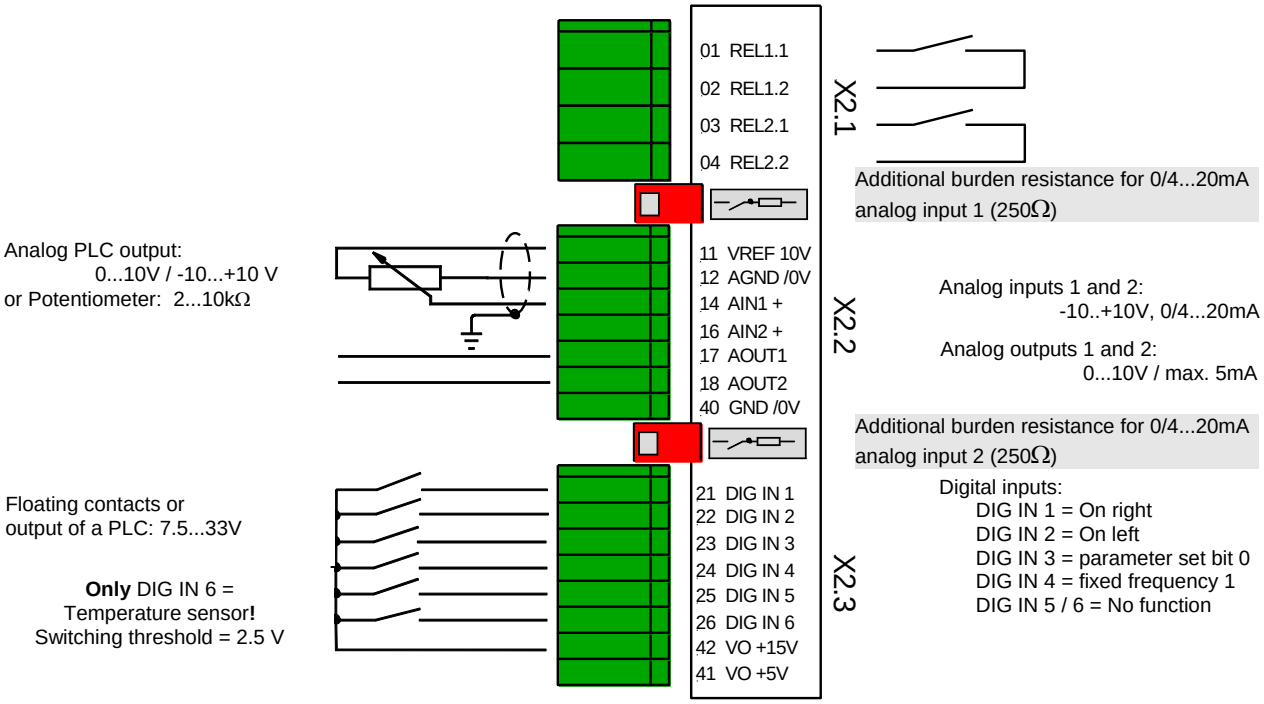
Two programmable and scaleable analog outputs 0...10V enable actual operating parameters to be transmitted to a display device or process control system.

Via the two relay contacts, a brake control can be actuated or warnings can be transferred to another system.

The digital inputs of the multi I/O cannot process analog setpoints! (See also Section "Control terminals", P420-P425)



Connector	Functions	Maximum cross-section	Parameter
X2.1	Output relay	1.5 mm^2	P434 ... P443
X2.2	Analog signals IN / OUT	1.0 mm^2	P400 ... P419
X2.3	Digital inputs	1.0 mm^2	P420 ... P425



NOTE: All control voltages are based on a common reference potential!
Potentials AGND /0V and GND /0V are internally linked in the device.
The maximum total current 5/15V is 300mA!

3.3.6 Multi I/O 20mA Customer Unit

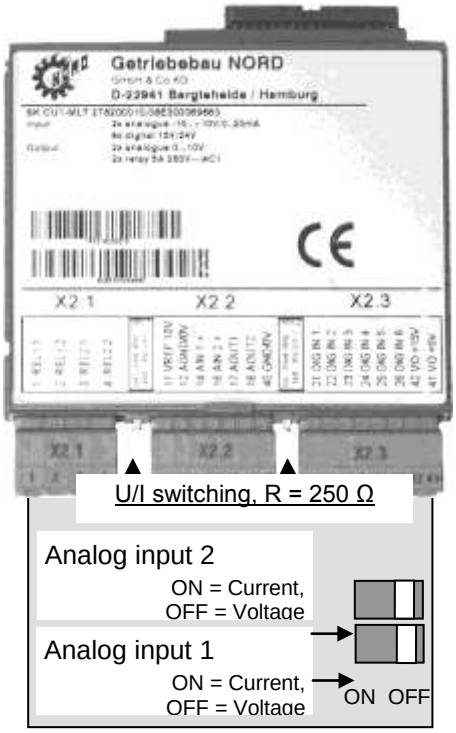
(SK CU1-MLT-20mA, Part No.: 278200015)

The Multi I/O (**C**ustomer **U**nit) Multi I/O 20mA provides the highest functionality of digital and analog signal processing. There are 2 differential analog input and 6 digital inputs available for control of the frequency inverter. Both analog inputs can process signals from 0...10V, 0...20mA (4...20mA) or -10V...+10V.

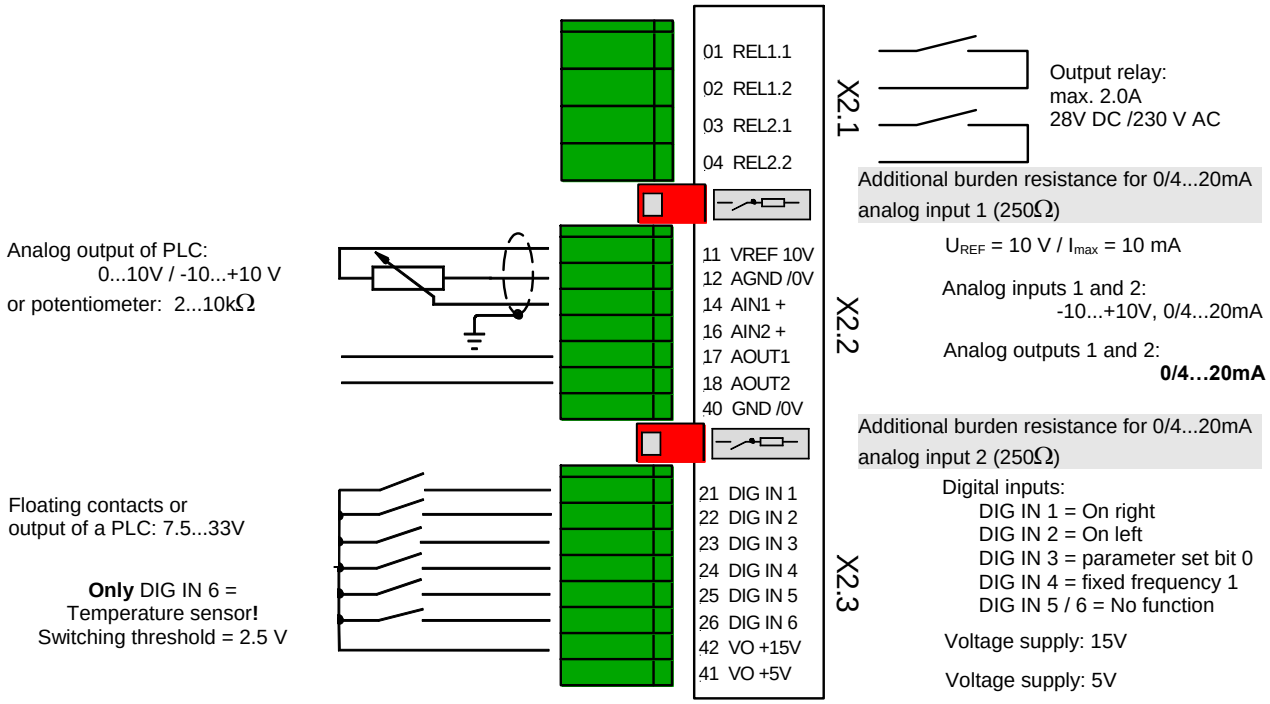
Two programmable and scaleable analog outputs 0/4..20mA enable actual operating parameters to be transmitted to a display device or process control system.

Via the two relay contacts, a brake control can be actuated or warnings can be transferred to another system.

The digital inputs of the multi I/O 20mAcannot process analog setpoints! (See also Section "Control terminals", P420-P425)



Connector	Functions	Maximum cross-section	Parameter
X2.1	Output relay	1.5 mm^2	P434 ... P443
X2.2	Analog signals IN / OUT	1.0 mm^2	P400 ... P419
X2.3	Digital inputs	1.0 mm^2	P420 ... P425



NOTE: All control voltages are based on a common reference potential!
Potentials AGND /0V and GND /0V are internally linked in the device.
The maximum total current 5/15V is 300mA!

3.3.7 BUS Customer Units, SK CU1-CAN-RJ, SK CU1-PBR

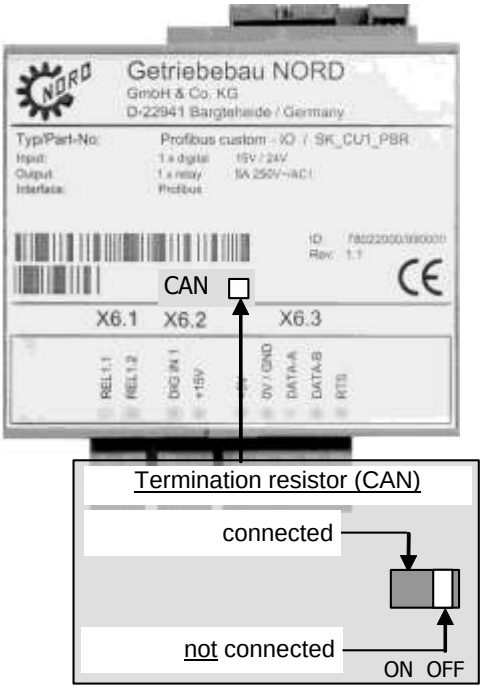
(SK CU1-CAN-RJ, Part No.: 278200052)
(SK CU1-PBR, Part No.: 278200030)

In addition to data connections, all Bus customer units also provide conventional digital inputs and outputs.

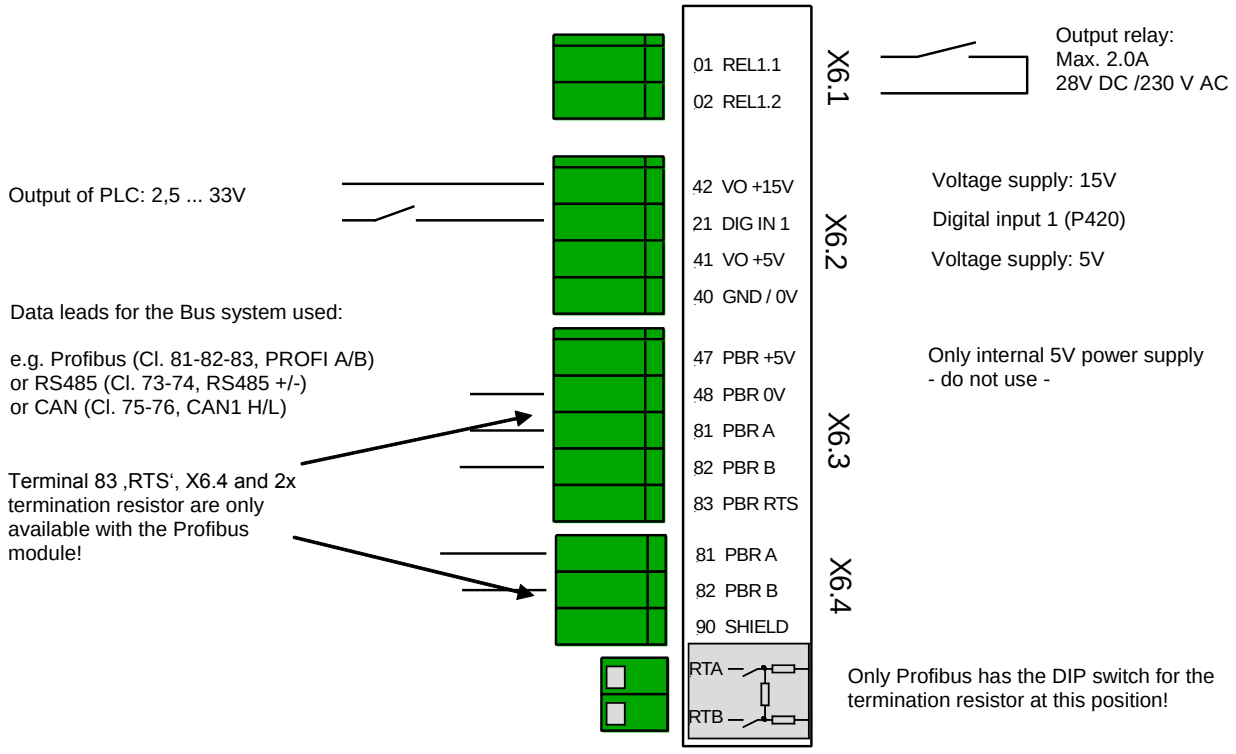
By means of a relay contact, brake control can be actuated or warnings can be sent to another system. The digital input has a 2.5V switching threshold for the evaluation of the temperature sensor. The input can, however, also be used for an emergency stop function.

All BUS switching components have the same basic design. However, the **Profibus option** has an RTS signal output on connector X6.3.83 in addition to the data leads. In addition, the Profibus module also has a second set of data connections (X6.4) and a DIP switch for the termination resistors at the front.

Note: Further details can be found in the relevant special operating instructions for the bus systems.



CANbus SK CU1-CAN-RJ	Profibus SK CU1-PBR	Functions	Maximum cross-section
X7.1	X6.1	Output relay	1.5 mm^2
X7.2	X6.2	Digital input	1.5 mm^2
X7.3 (2x RJ45)	X6.3	Data cables	1.5 mm^2 (Profibus)
	X6.4	Data leads, parallel	1.5 mm^2 (Profibus)



NOTE: All control voltages are based on a common reference potential!
Potentials AGND /0V and GND /0V are internally linked in the device.
The maximum total current 5/15V is 300mA!

3.4 Overview of Special Extensions

The special extensions (E**X**tension **U**nit) turn the standard frequency inverter into a high-precision control unit, which can flexibly react to all requirements. The extensions can be used on the right hand guide rail in the frequency inverter, in addition to the customer units. After insertion, they are automatically identified by the frequency inverter.

Cable connection is via *direct plug-in clip connectors* with spring terminals. This makes the connection of devices very easy and convenient.

NOTE

With the **customer units (SK CU1-…)** there is no difference between IP protection classes. This means that the same customer units are used for both the air cooled SK 750E (IP54) and for the water cooled version (IP65).

Option	Description	Data
Encoder **SK XU1-ENC**	For highly accurate speed control from standstill to double the rated speed	1 x digital inputs 1 x incremental encoder input, 5V TTL up to 250kHz
PosiCon **SK XU1-POS**	Position and speed regulation Programmable positions are reached and maintained by means of path calculations. The detection of the actual value is by means an incremental and/or absolute encoder	Up to 252 positions 6 x digital inputs 2 x multi-function relays 1 x absolute encoder input, SSI 1 x incremental encoder input, 5V TTL up to 250kHz

NOTE

for 5V / 15V power supplies

The customer units and special extension units have various power supplies (5V / 15V) which can be used externally. The maximum permissible external load current is 300mA. This can be taken from one or more power supplies. The total current must however not exceed 300mA.

All control voltages are related to a common reference potential!

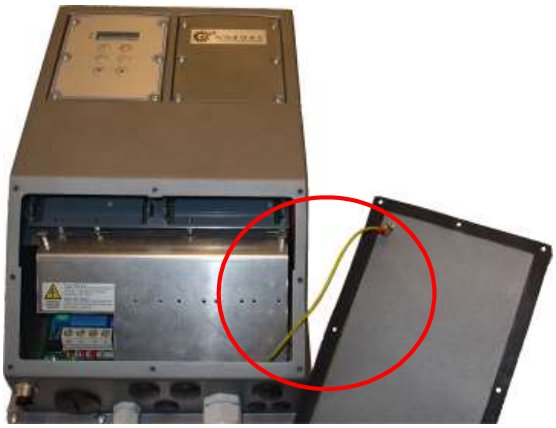
Potentials AGND /0V and GND /0V are internally linked in the device.

3.4.1 Installation of the special extension units

1. Switch off the mains voltage, observe the waiting period.
2. Remove the cover by unscrewing the 8 screws, noting the PE connection.
3. Using light pressure push the special extension unit into the right hand guide rail until it engages.
4. Remove the connector by pressing the releases and make the necessary connections. Then push on the connector.
5. Replace all covers.

ATTENTION

The PE connection must be reconnected. Otherwise the device must not be used (see adjacent illustration)!



WARNING

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

Customer units must not be inserted/removed when live.

Following the insertion, replacement or removal of modules, and once the equipment has been switched on again, this procedure is indicated with the message E017 ***Customer unit changed***.

Restore all PE connections!

3.4.2 Removal of Special Extensions

1. Switch off the mains voltage, observe the waiting period.
2. Remove the cover by unscrewing the 8 screws, noting the PE connection.
3. Lever the special extension out of its engaged position with a screwdriver (see illustration). If necessary disengage the hooks on the right and left. Completely remove the module by hand.
4. Replace all covers.

ATTENTION

The PE connection must be reconnected. Otherwise the device must not be used (see adjacent illustration)!

3.4.3 Special Extension Encoder I/O

(SK XU1-ENC, Part No.: 278200120)

The special extension (E**X**tension **U**nit) encoder I/O offers the possibility of connecting an incremental encoder with a TTL signal level. The incremental encoder must be mounted directly on the motor shaft.

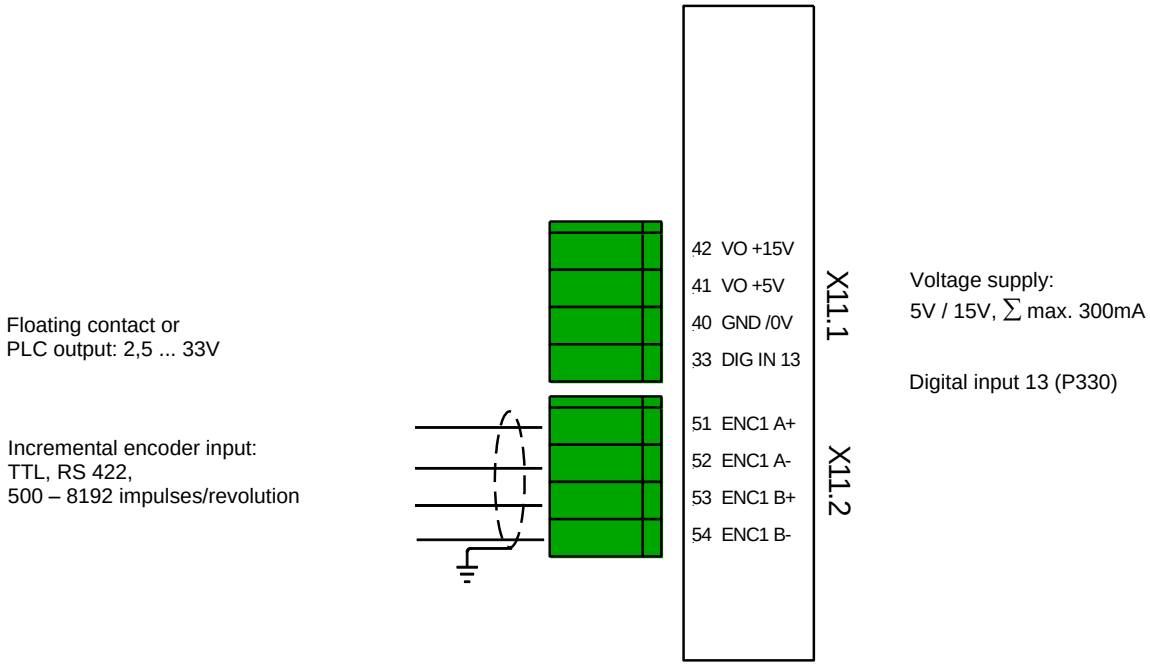
This accessory enables highly accurate speed control from standstill to double the rated speed.

As this special extension provides the best control of the load, this option is especially recommended for lifting applications.

Connection details can also be found in Section 3.6 "Colour coding and contact assignments for incremental encoders".

Maximum connection cross-section of the control leads:

Connector	Functions	Maximum cross-section	Parameter
X11.1	Power supply and digital Input	1.5 mm^2	P300 ... P330
X11.2	Incremental encoder	1.5 mm^2	



NOTE: All control voltages are based on a common reference potential!
Potentials AGND /0V and GND /0V are internally linked in the device.
Max. permitted current loading from all current sources = 300mA

3.4.4 Special Extension PosiCon I/O

(SK XU1-POS, Part No.: 278200130)

The special extension unit (E**X**tension **U**nit) PosiCon I/O is a positioning control system which is integrated in the frequency inverter. Previously programmed positions are reached dynamically and precisely by means of path calculations.

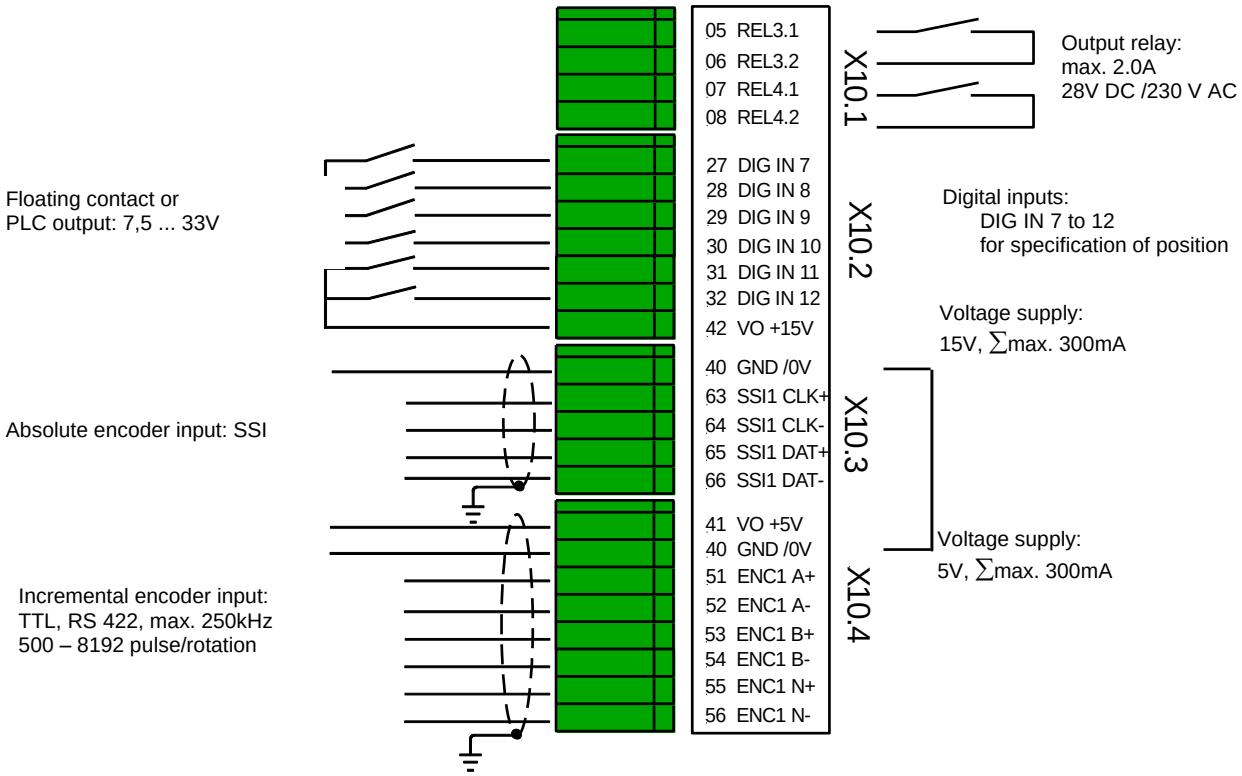
The position acquisition is implemented by an incremental (RS422) or absolute encoder (SSI protocol).

The encoder can be fitted on the motor or the load, step-up/step-down can be freely selected.

Note: Further details can be found in the operating instructions **BU 0710**, which were specially produced for this option.

Maximum connection cross-section of the control leads:

Connector	Functions	Maximum cross-section	Parameter
X10.1	Output relay	1.0 mm^2	P624 ... P629
X10.2	Digital inputs	1.0 mm^2	P617 ... P623
X10.3	SSI Input	1.0 mm^2	P605 ... P609
X10.4	Incremental encoder input	1.0 mm^2	



NOTE: All control voltages are based on a common reference potential!
Potentials AGND /0V and GND /0V are internally linked in the device.
Max. permitted current loading from all current sources = 300mA

3.5 Control Terminals of Customer I/Os

Function	Data	Designation	Customer Units / Special Extension Units							
			Terminal							
Relay	Closing contact I_{max} = 2A U_{max} = 28V DC / 230V AC		BSC	STD	MLT	MLT 20mA	CAN-RJ	PBR	POS	ENC
		REL 1.1	X3.1.01	X1.1.01	X2.1.01	X2.1.01	X7.1.01	X6.1.01	-	-
		REL 1.2	X3.1.02	X1.1.02	X2.1.02	X2.1.02	X7.1.02	X6.1.02	-	-
		REL 2.1	-	X1.1.03	X2.1.03	X2.1.03	-	-	-	-
		REL 2.2	-	X1.1.04	X2.1.04	X2.1.04	-	-	-	-
		REL 3.1	-	-	-	-	-	-	X10.1.05	-
		REL 3.2	-	-	-	-	-	-	X10.1.06	-
		REL 4.1	-	-	-	-	-	-	X10.1.07	-
		REL 4.2	-	-	-	-	-	-	X10.1.08	-
Reference voltage source +10V	I_{max} = 10 mA		BSC	STD	MLT	MLT 20mA	CAN-RJ	PBR	POS	ENC
		VREF 10V	X3.2.11	X1.2.11	X2.2.11	X2.2.11	-	-	-	-
Reference potential GND	Reference potential for the inverter connected to PE via resistor and capacitor		BSC	STD	MLT	MLT 20mA	CAN-RJ	PBR	POS	ENC
		AGND / 0V	X3.2.12	X1.2.12	X2.2.12	X2.2.12	-	-	-	-
		GND / 0V	-	X1.4.40	X2.2.40	X2.2.40	X7.2.40	X6.2.40	X10.3.40	X11.1.40
									X10.4.40	
Analogue input	AIN1 = Differential voltage input with 0V ... 10V Ri ≈ 40 kΩ AIN1 + AIN 2 = -10V...+10V Ri ≈ 20 kΩ		BSC	STD	MLT	MLT 20mA	CAN-RJ	PBR	POS	ENC
		AIN1 -	X3.2.13	X1.2.13	-	-	-	-	-	-
		AIN1 +	X3.2.14	X1.2.14	-	-	-	-	-	-
		AIN1 +	-	-	X2.2.14	X2.2.14	-	-	-	-
		AIN2 +	-	-	X2.2.16	X2.2.16	-	-	-	-
Analog output	0V ... 10V I_{max} = 5 mA Resolution = 8 Bit Accuracy = 0.1 V		BSC	STD	MLT	MLT 20mA	CAN-RJ	PBR	POS	ENC
		AOUT1	-	X1.2.17	X2.2.17	X2.2.17	-	-	-	-
		AOUT2	-	-	X2.2.18	X2.2.18	-	-	-	-
Digital input	Ri ≈ 4 kΩ High = 7.5V .... 33 V Low = 0V ... 7.5V Reaction time = 5ms...15ms NOTE: Input for temperature sensor under option >BUS< is only DIG IN 1! and under >MLT< is only DIG IN 6!! Here, Ri ≈ 2 kΩ High = 2.5V .... 33 V Low = 0V ... 2.5V		BSC	STD	MLT	MLT 20mA	CAN-RJ	PBR	POS	ENC
		DIG IN 1	X3.3.21	X1.3.21	X2.3.21	X2.3.21	X7.2.21	X6.2.21	-	-
		DIG IN 2	X3.3.22	X1.3.22	X2.3.22	X2.3.22	X7.2.22	-	-	-
		DIG IN 3	X3.3.23	X1.3.23	X2.3.23	X2.3.23	X7.2.23	-	-	-
		DIG IN 4	-	X1.3.24	X2.3.24	X2.3.24	X7.2.24	-	-	-
		DIG IN 5	-	-	X2.3.25	X2.3.25	X7.2.25	-	-	-
		DIG IN 6	-	-	X2.3.26	X2.3.26	-	-	-	-
		DIG IN 7	-	-	-	-	-	-	X10.2.27	-
		DIG IN 8	-	-	-	-	-	-	X10.2.28	-
		DIG IN 9	-	-	-	-	-	-	X10.2.29	-
		DIG IN 10	-	-	-	-	-	-	X10.2.30	-
		DIG IN 11	-	-	-	-	-	-	X10.2.31	-
		DIG IN 12	-	-	-	-	-	-	X10.2.32	-
		DIG IN 13	-	-	-	-	-	-	-	X11.1.33
Power supply +15 V	Sum of the currents from all power supplies to one inverter: I_{max} = 300 mA		BSC	STD	MLT	MLT 20mA	CAN-RJ	PBR	POS	ENC
		VO +15 V	X3.3.42	X1.3.42	X2.3.42	X2.3.42	X7.2.42	X6.2.42	X10.2.42	X11.1.42
Power supply +5 V			BSC	STD	MLT	MLT 20mA	CAN	PBR	POS	ENC
		VO +5 V	-	X1.4.41	X2.3.41	X2.3.41	-	X6.2.41	X10.4.41	X11.1.41

Function	Data	Designation	Customer Units / Special Extension Units							
			Terminal							
Serial interface	Electrically isolated input Transfer rate USS up to 38400 Baud Transfer rate CAN up to 500 kBaud Transfer rate Profibus up to 1.5 MBaud (12 MBaud on request)		BSC	STD	MLT	MLT 20mA	CAN-RJ	PBR	POS	ENC
		RS485 +	-	X1.4.73	-	-	-	-	-	-
		RS485 -	-	X1.4.74	-	-	-	-	-	-
		CAN1 H	-	-	-	-	X7.3	-	-	-
		CAN1 L	-	-	-		X7.3	-	-	-
		PBR A	-	-	-	-	-	X6.3.81	-	-
		PBR B	-	-	-	-	-	X6.3.82	-	-
		PBR RTS	-	-	-	-	-	X6.3.83	-	-
		PBR A	-	-	-	-	-	X6.4.81	-	-
		PBR B	-	-	-	-	-	X6.4.82	-	-
		SHIELD	-	-	-	-	-	X6.4.90	-	-
Incremental encoder	TTL, RS 422 max. 250kHz 500 – 8192 impulses/revolution		BSC	STD	MLT	USS	CAN	PBR	POS	ENC
		ENC1 A+	-	-	-	-	-	-	X10.4.51	X11.2.51
		ENC1 A-	-	-	-	-	-	-	X10.4.52	X11.2.52
		ENC1 B+	-	-	-	-	-	-	X10.4.53	X11.2.53
		ENC1 B-	-	-	-	-	-	-	X10.4.54	X11.2.54
		ENC1 N+	-	-	-	-	-	-	X10.4.55	-
		ENC1 N-	-	-	-	-	-	-	X10.4.56	-
Absolute encoder	SSI, RS 422 24 bit		BSC	STD	MLT	USS	CAN	PBR	POS	ENC
		SSI1 CLK+	-	-	-	-	-	-	X10.3.63	-
		SSI1 CLK-	-	-	-	-	-	-	X10.3.64	-
		SSI1 DAT+	-	-	-	-	-	-	X10.3.65	-
		SSI1 DAT-	-	-	-	-	-	-	X10.3.66	-

3.6 Colour and contact assignments for the incremental encoders

Function	Cable colours, for incremental encoder	Assignment for encoder option **SK XU1-ENC**	Assignment for encoder option **SK XU1-POS**
15 V supply	brown / green	X11.1.**42** VO +15V	X10.2.**42** VO +15V
0 V supply	white / green	X11.1.**40** GND /0V	X10.4.**40** GND /0V
Track A	brown	X11.2.**51** ENC1 A+	X10.4.**51** ENC1 A+
Track A inverse	green	X11.2.**52** ENC1 A-	X10.4.**52** ENC1 A-
Track B	grey	X11.2.**53** ENC1 B+	X10.4.**53** ENC1 B+
Track B inverse	pink	X11.2.**54** ENC1 B-	X10.4.**54** ENC1 B-
Track 0	red	--	X10.4.**55** ENC1 N+
Track 0 inverse	black	--	X10.4.**56** ENC1 N-
Cable shield	connected to a large area of the frequency inverter housing or shielding angle		

NOTE

If there are deviations from the standard equipment (A.772.4) for the motors, please note the accompanying data sheet or consult your supplier.

RECOMMENDATION: For greater reliability, in particular with long connection cables, we recommend the use of a higher power supply (15V/24V) and an incremental encoder for 10-30V power supply. The signal level must still be 5V TTL.

ATTENTION

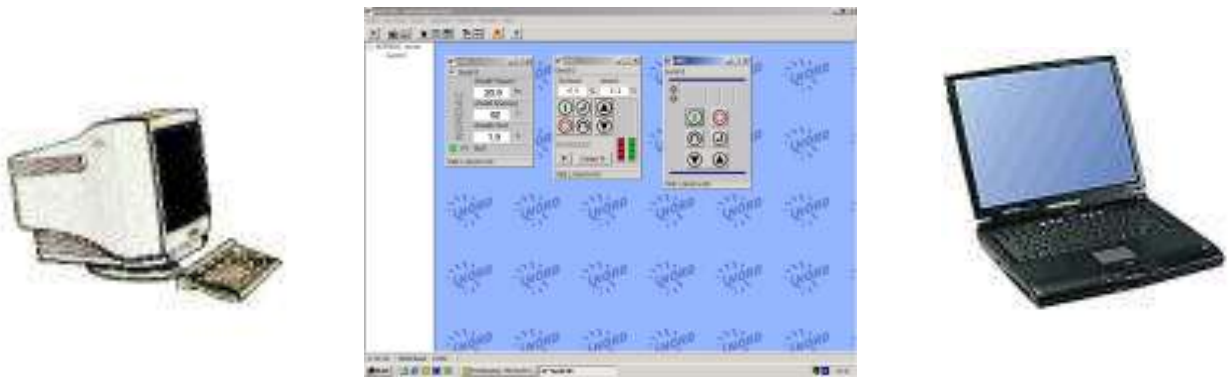
The rotation field of the incremental encoder must correspond to that of the motor. Because of this, according to how the encoder is mounted on the motor (possible mirror image), tracks A+ and A- may need to be switched over or a negative sign entered in parameter P301. **For SK 750E, inverted mounting has already been taken into account!**

4 Operation and display

There are various solutions for control of the SK 750E, dependent upon application. When used on site at the device, the *handheld version* 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 Section. 4.2, ParameterBox, handheld version).

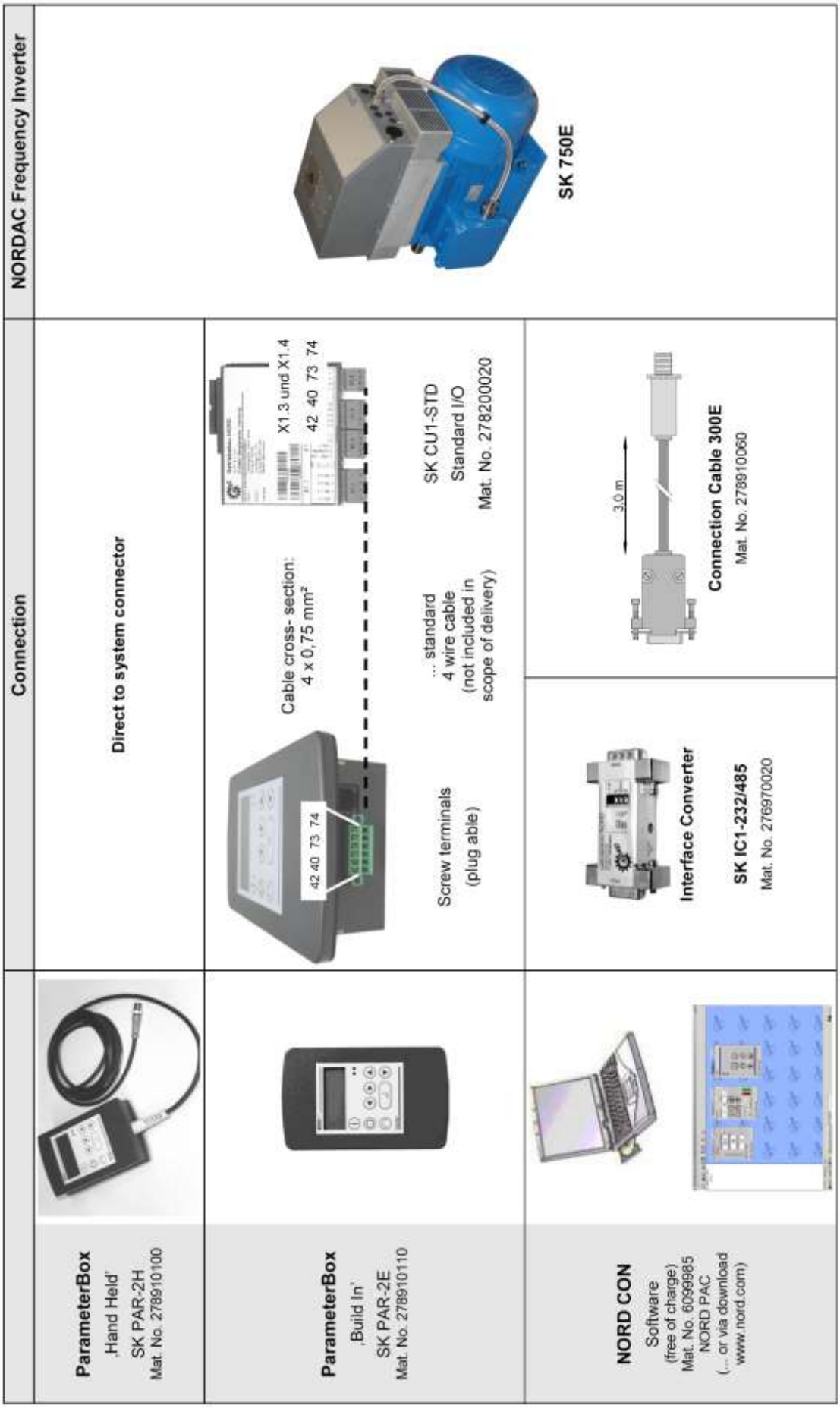
For permanent fixed installation in a control panel, the **ParameterBox** is also available as an *installation version*. The functionality is equivalent to that of the handheld type (see also Section 4.3 ParameterBox, Installation version).

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 Section 5 "NORD CON software".



→ Website for downloading NORD CON: > www.nord.com **<**

4.1 Control element connection variants



4.2 ParameterBox, Handheld Version, SK PAR-2H

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

The SK PAR-2H ParameterBox is a compact control device for direct connection to the SK 750E frequency 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 750E without additional components.

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

Connection to SK 750E

Connection to the trio SK 750E can be made using the existing M12 socket. The maximum protection class IP54/65 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: For further information, please refer to the operating instructions for the ParameterBox **"BU 0040 GB"**.

M12 plug	Description	Cable
2 (white)	+ 5V / 170mA	Length 3m 4 x 0.75mm²
1 (brown)	GND	
4 (black)	P+ (A) RS485 +	
3 (blue)	P- (B) RS485 -	

4.3 ParameterBox Installation Version, SK PAR-2E

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

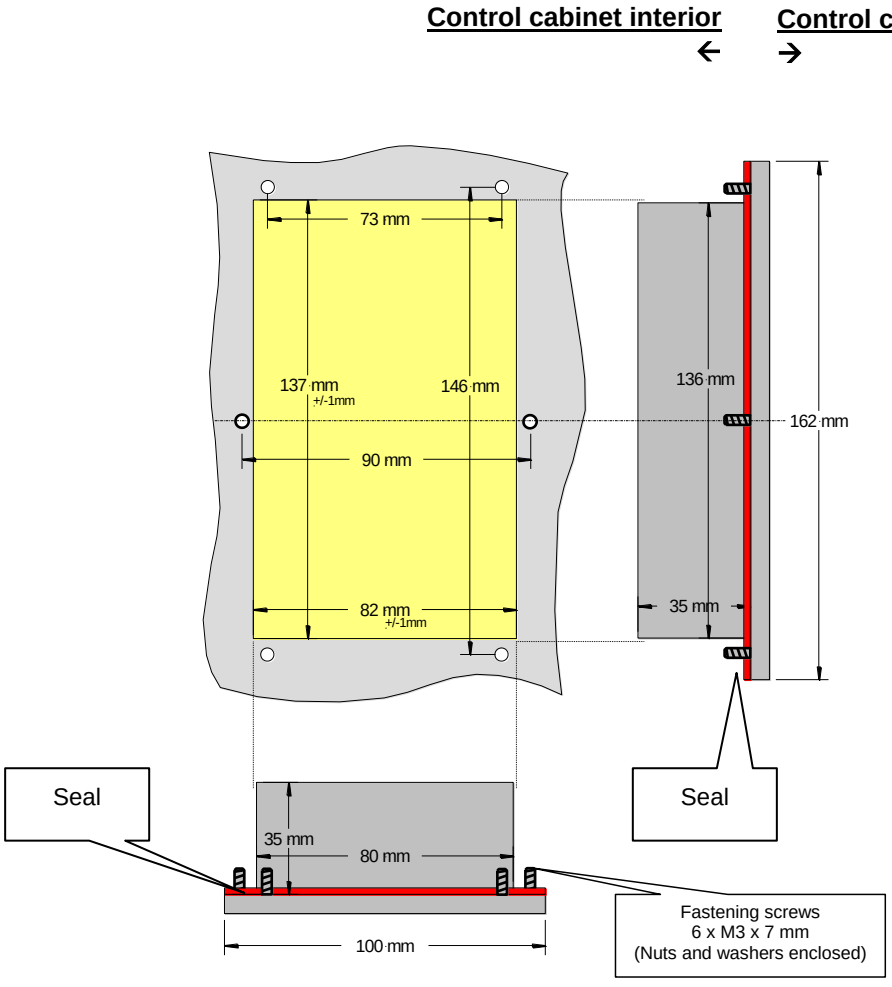
The SK PAR-2E ParameterBox is a compact control device for control panel installation. Up to 5 frequency inverters can be connected via the internal connection terminals. Protection class IP66 is complied with at the front face.

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^2 can be used in compliance with the general installation regulations.

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 connections of the installation version of the ParameterBox SK PAR-2E are made via the plug-in screw terminals 42/40/73/74. The assignment of the terminals can be found in the following section.



4.3.1 Electrical connection

The ParameterBox SK PAR-2E is connected via the screw terminal block.

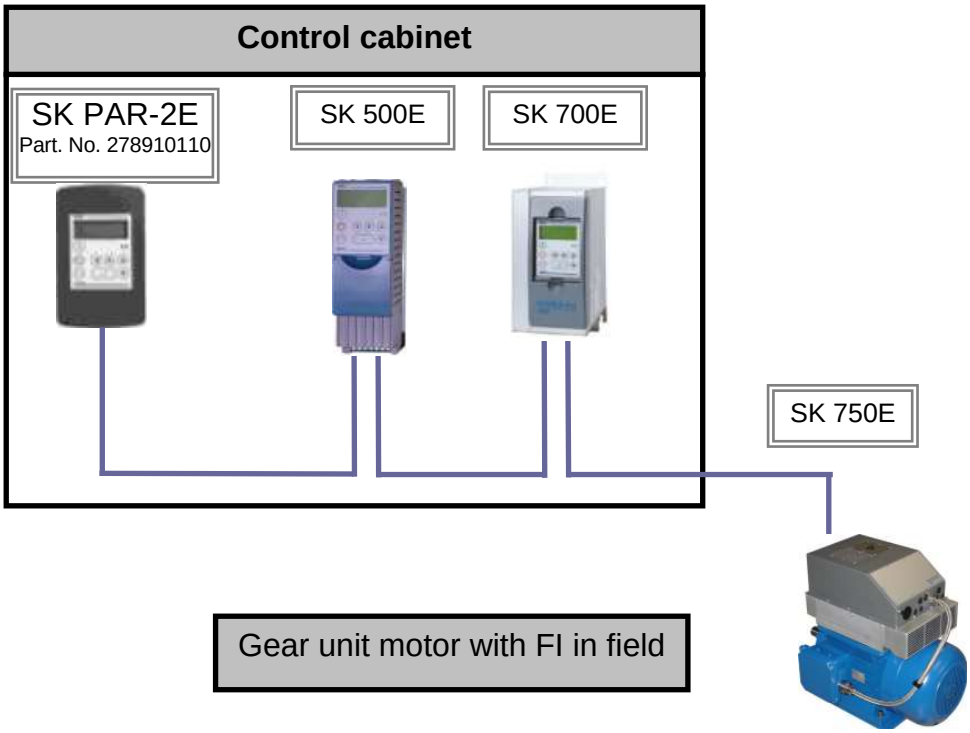
Number	Description	Terminals
1	+ 4.5V ... 30V with +15V / 60mA	0.14 ... 1.5 mm²
2	GND	
3	P+ (A) RS485 +	
4	P- (B) RS485 -	

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 illustrated 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.

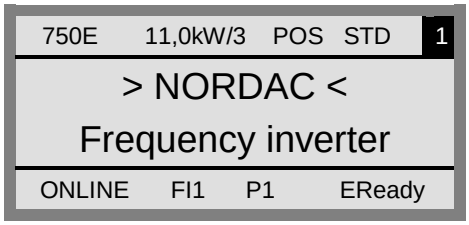


NOTE: For further information, refer to the ParameterBox instruction manual **BU 0040 GB**.

4.4 Functions of the ParameterBox

Language settings

In order to set the ParameterBox to the language of the particular operator, please refer to the following brief 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 ▲ key to select any of the languages in the following sequence:

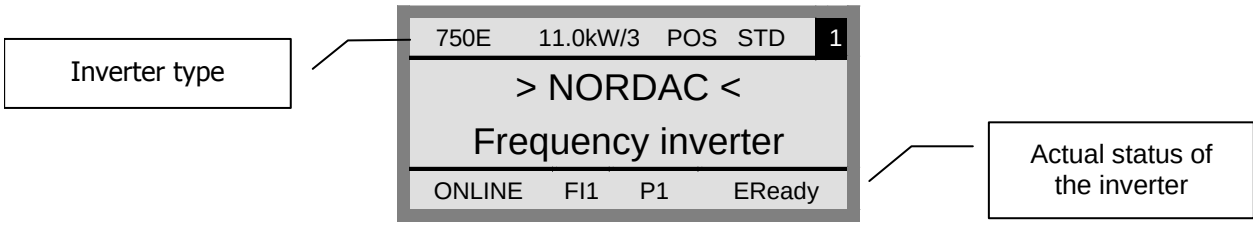
4.) English, Francais, Espanol, Sverige, Nederlands

5.) Press ↵ ' 'Enter' to switch to the language displayed or selected.

6.) Press the ◁ ▷ keys 2x together to return to the start.

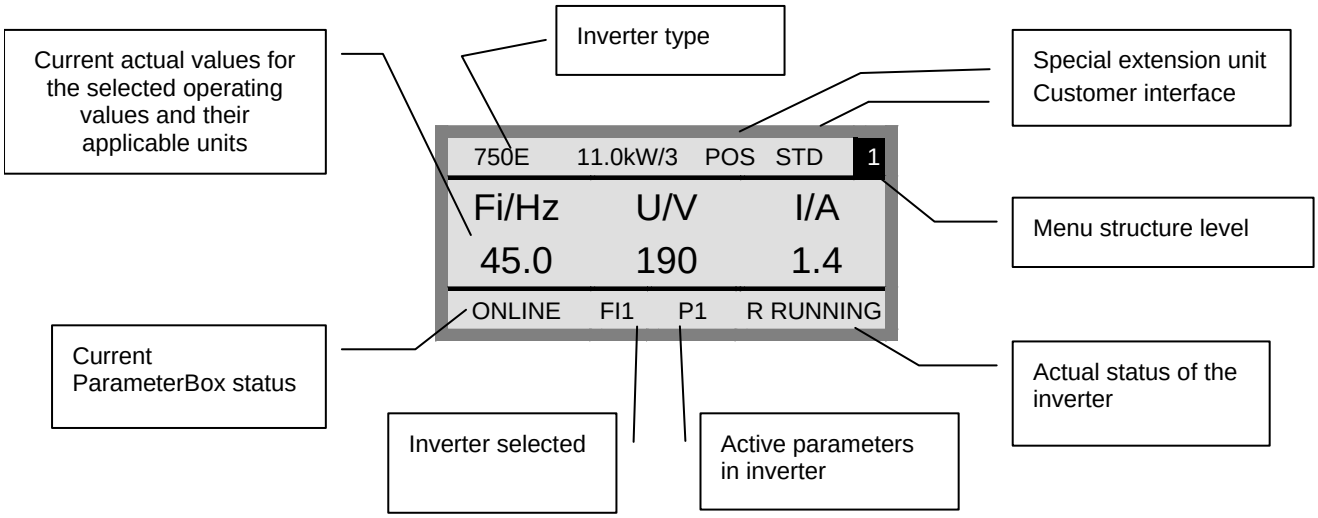
Display

After the ParameterBox is connected and the mains voltage for the inverter is switched on, an automatic **"Bus scan"** is performed. 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 should only be implemented by qualified personnel, strictly in accordance with the warning and safety information.

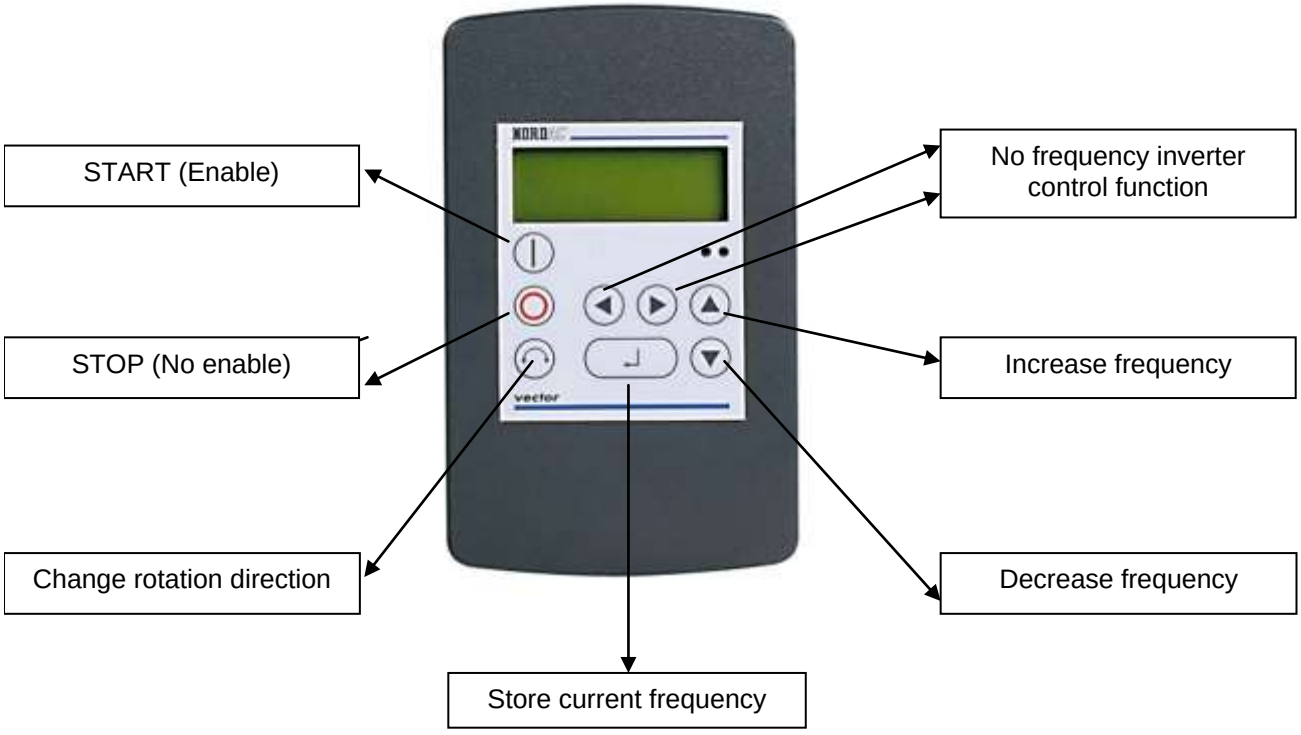
CAUTION: The drive may start immediately after pressing the START key ⏻!

Operation

LCD dsplay	Graphic-capable, backlit LCD display for displaying operational values and parameters for the connected frequency inverter(s) and ParameterBox parameters.	
 	Use the **SELECTION keys** to scroll through the menu levels and within the individual menu items. Press the ◁ and ▷ keys together to go back one level.	
 	The contents of individual parameters can be altered with the **VALUE keys**. Press the ▲ and ▼ keys together to load the default values of the parameter selected. When controlling the frequency inverter using the keyboard, the frequency setpoint is set using the **value keys**.	
	Press the **ENTER key** key to select a menu group or accept the changed menu items or parameter values. **Note:**: If a parameter is to be exited without saving a changed value, the **SELECTION keys** can be used. If the frequency inverter is currently being controlled via the keyboard (not the control terminals), the current setpoint frequency can be saved in the jog frequency parameter (P113).	
	**START key** for switching on the frequency inverter.	**Note:** Can only be used if this function has not been blocked in parameter P509 or P540.
	**STOP key** for switching off the frequency inverter.	
	The direction of rotation of the motor is switched by pressing the **Direction key**. Rotation direction left is indicated by a minus sign. **Attention!** Take care when operating pumps, screw conveyors, fans, etc.	
 ON ERROR	The **LEDs** indicate the actual status of the ParameterBox. **ON** (green) The ParameterBox is connected to the power supply and is ready for operation. **ERROR** (red) An error has occurred when processing data or in the connected frequency inverter.	

Controlling the frequency inverter

The speed and direction of rotation of the frequency inverter can only by completely controlled with the ParameterBox, if the parameter >Interface< (**P509**) is set to the function >Control terminals or keyboard< (= **0**) (Factory setting for NORDAC SK 300E and SK 700E) and the frequency inverter has not previously been enabled via the control terminals.



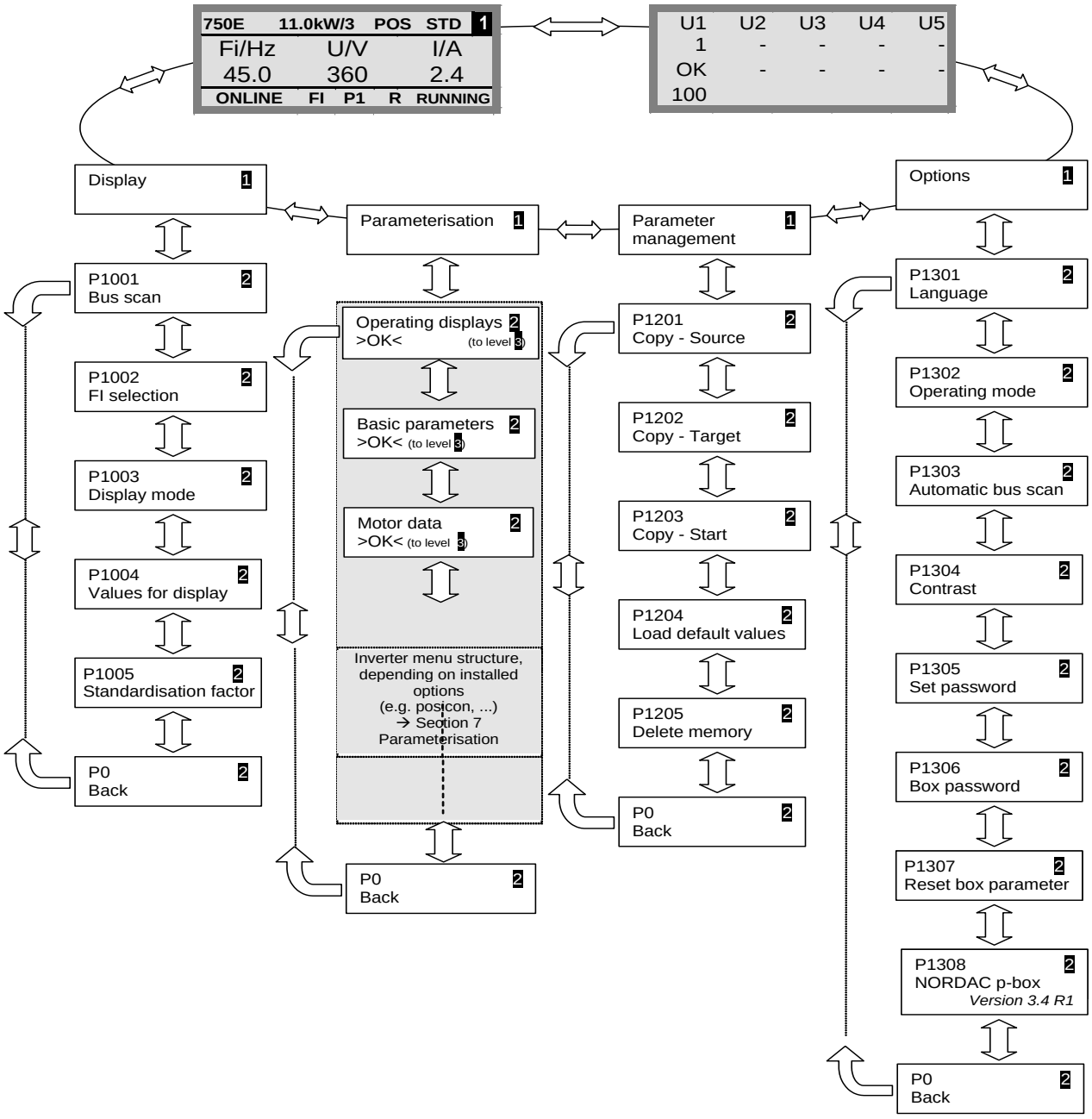
NOTE

If the frequency inverter is enabled in this mode, then the parameter set is used, which was selected for this frequency inverter in the menu >Parameterisation< >Basic parameters< in the >Parameter set< parameter P100. If the parameter set has to be changed during operation, then the new parameter set must be selected in this parameter and activated using the , or keys.

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 which are each arranged in a ring structure. The **ENTER key** (⏎) moves the menu on to the next level. Simultaneous operation of the **SELECTION keys** (◁ and ▷) moves the menu back one level.



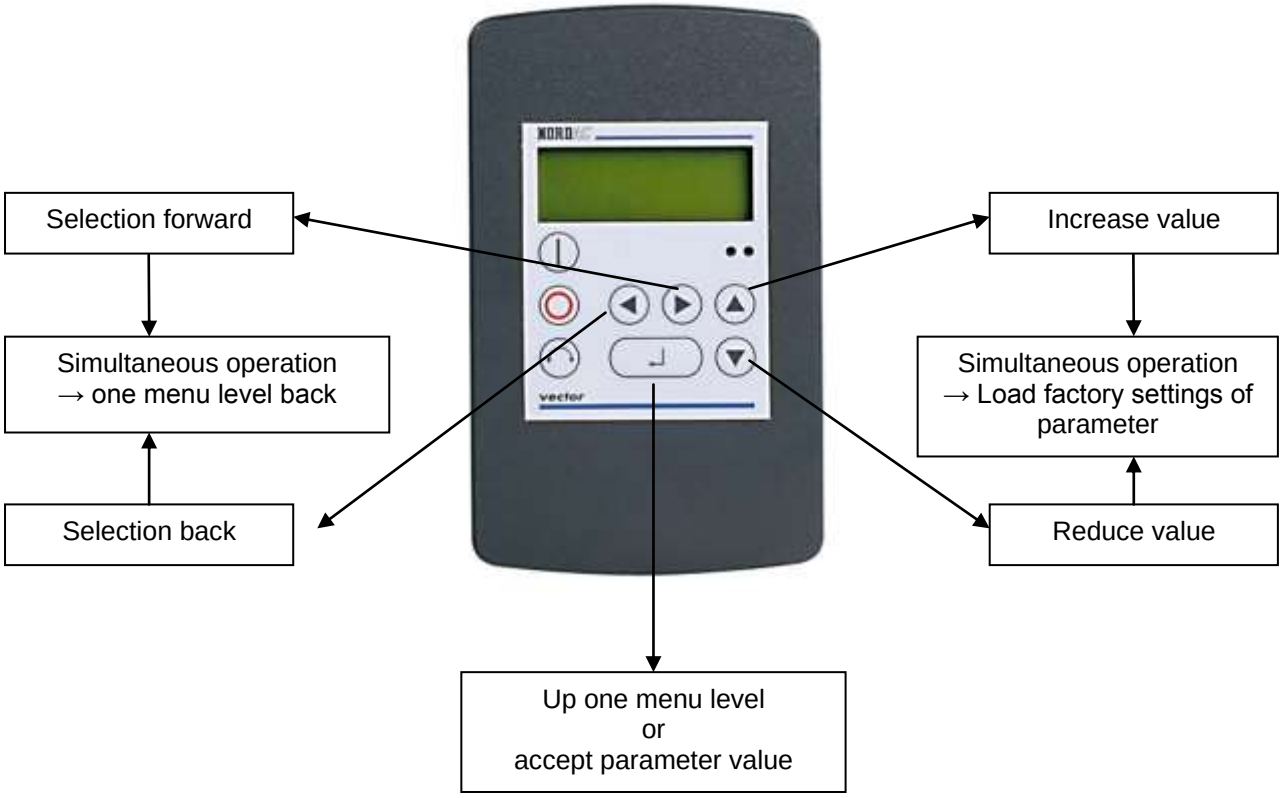
ATTENTION

The parameters of the menu groups **>Display<** (P10xx), **>Parameter Management<** (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 details depend on the customer units (SK CU1-...) and/or special extension units (SK XU1-...) connected to the inverter. The description of parameterisation begins in Section 5 "Parameterisation".

Parameter setup with the ParameterBox

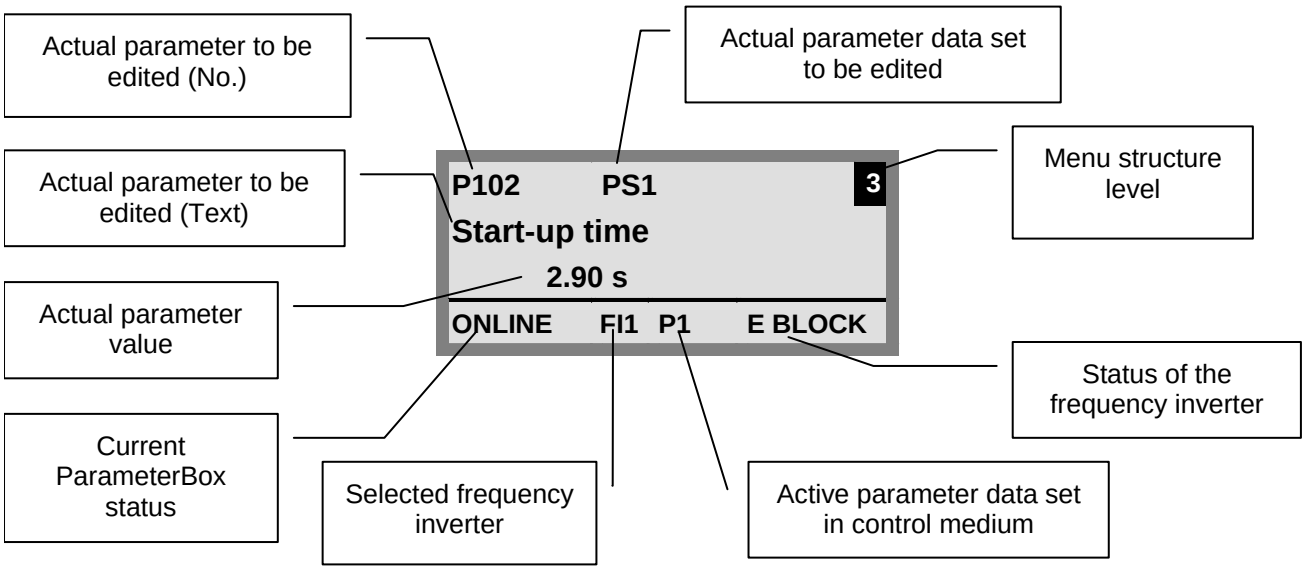
To enter the parameterisation mode, the menu group >Parameterisation< must be selected in the menu level 1. Pressing the **ENTER key** (↵) opens the parameter level of the connected frequency inverter. The following diagram shows how the control elements of the ParameterBox are used for the parameterisation 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 saved, pressing of a **VALUE key** (or) calls up the previously saved value and the parameter is exited by pressing a VALUE key again.



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.	Master function
Display	**(P10xx):**	Selection of operating values and display layout
Parameterisation	**(P11xx):**	Parameterisation of the connected inverter and all storage objects
Parameter Management	**(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
P1001 Bus scan	A bus scan is initiated with this parameter. During this process a progress indicator is shown in the display. After a bus scan, the parameter is "Off". Depending on the result of this process, the ParameterBox goes into the "ONLINE" or "OFFLINE" operating mode.
P1002 FI selection	Selection of the 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. **Note:** If an error has occured in a connected frequency inverter, this can be acknowledged by selecting the frequency inverter. **Value range:** FI 1 - FI 5
P1003 Display mode	Selection of the operating values display for the ParameterBox **Standard** Any 3 values next to each other **Large display** 1 value (any) with unit **List** Any 3 values listed with units
P1004 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 ZK voltage / Bus actual value1 non-stand.
P1005 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
P1101 Object selection	Selection of the object to be parameterised. The ongoing parameterisation process relates to the object selected. Only the devices and storage objects detected during the bus scan are displayed in the selection list. **Note:** This **parameter is not shown** if only one device is recognised and there is no storage object in the ParameterBox. Value range: I1 - I5 and S1 - S5

Menu group < Parameter Management > (P12xx)

Parameter	Setting value / Description / Note
P1201 Copy - Source	Selection of the actual source object to be copied. In the selection list, only the frequency inverters and storage media detected during the bus scan are shown. Value range: I1 - I5 and S1 - S5
P1202 Copy - Target	Selection of actual target object to copy. In the selection list, only the frequency inverters and storage media detected during the bus scan are shown. Value range: I1 - I5 and S1 - S5
P1203 Copy - Start	This parameter triggers a transfer process, whereby all the parameter data sets selected in **>Copy – Source<** are transferred to the object specified in the **>Copy – Target<** parameter. While data is being overwritten, an information window appears with acknowledgement. The transfer starts after acknowledgement.
P1204 Load default values	With this parameter, the parameter data sets of the object selected are described with factory settings. This function is particularly important for editing storage objects. It is only via this parameter that a hypothetical frequency inverter can be loaded and edited with the ParameterBox. Value range: I1 - I5 and S1 - S5
P1205 Delete memory	With this parameter the data in the selected storage medium is deleted. Value range: S1 - S5

Menu group < Options> (P13xx)

Parameter	Setting value / Description / Note
P1301 Language	Selection of languages for operation of the ParameterBox **Available languages**: German English French Spanish Swedish Dutch
P1302 Operating mode	Selection of the operating mode for the ParameterBox • **Offline**: 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. • **Online**: A frequency inverter is located at the interface of the ParameterBox. The frequency inverter can be parameterised and controlled. On changeover to the "**ONLINE**" operating mode, a bus scan is started automatically. • **PC-Slave:** A PC is located at the interface of the ParameterBox. The ParameterBox can be addressed as a slave by the **NORD CON** software. The storage objects log on as separate frequency inverters S1 ⇨ USS address 1 S2 ⇨ USS address 2 S3 ⇨ USS address 3 S4 ⇨ USS address 4 S5 ⇨ USS address 5
P1303 Automatic bus scan	Setting the switch-on characteristics. • **Off** An automatic bus scan is not performed. The frequency inverters connected before switching off must be looked for again after switch-on. • **On** A bus scan is automatically implemented when the ParameterBox is switched on.
P1304 Contrast	Contrast setting of the ParameterBox display Value range: 0% ... 100%; Resolution 1%
P1305 Set password	The user can set up a password in this parameter. If a value other than 0 has been entered in this parameter, then the settings of the ParameterBox or the parameters of the connected frequency inverter cannot be altered.
P1306 Box password	If the password function is to be reset, the password selected in the **>Set password<** parameter must be entered here. If the correct password has been selected, than all functions of the ParameterBox can be used again. **Note:** With the Master-Password ‚65' the currently set password is displayed and can be confirmed with the ENTER key.
P1307 Reset Box parameter	With this parameter, the ParameterBox can be reset to the default setting. All ParameterBox settings and the data in the storage media will be deleted.
P1308 Software version	Displays the software version of the ParameterBox. Please keep available for future use.

4.6 ParameterBox error messages

Display	Fault	Cause • Remedy
Communication error		
200	**Illegal parameter number**	These error messages are due to EMC interference or differing software versions of the participants. • Check the software version of the ParameterBox and that of the connected frequency inverter. • Check the cabling of all components, regarding possible EMC interference
201	**Parameter value cannot be changed**	
202	**Parameter outside of 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**	Communication between frequency inverter and ParameterBox is faulty (EMC), safe operation cannot be guaranteed. • Check the connection to the frequency inverter. Use a shielded cable between the devices. Route the BUS leads separately from the motor cables.
208	**Incorrect status identifier, USS interface**	Communication between frequency inverter and ParameterBox is faulty (EMC), safe operation cannot be guaranteed. • Check the connection to the frequency inverter. Use a shielded cable between the devices. Route the BUS leads separately from the motor cables.
209_1	**Inverter not responding**	The ParameterBox is waiting for a response from the connected frequency inverter. The waiting time has elapsed without a response being received. • Check the connection to the frequency inverter. The settings of the USS parameters for the frequency inverter were changed during operation.
Identification errors		
220	**Unknown device**	Device ID not found. The connected inverter is not listed in the database of the ParameterBox; no communication can be established. • Please contact your Getriebebau Nord Representative.
221	**Software version not recognised**	Software version not found! The software of the connected frequency inverter is not listed in the ParameterBox database, no communication can be set up. • Please contact your Getriebebau Nord Representative.

Display	Fault	Cause • Remedy
222	**Inverter extension level not recognised**	An unknown module has been detected in the frequency inverter (Customer interface). • Please check the components installed in the frequency inverter • If necessary, check the software version of the ParameterBox and the frequency inverter.
223	**Bus configuration has changed**	After restoring the last Bus configuration, a device is reported that is different from the one stored. This error can only occur if the parameter **>Auto Bus Scan<** is set to **OFF** and another device has been connected to the ParameterBox. • Activate the Automatic Bus Scan function.
224	**Device is not supported**	The frequency inverter type connected to the ParameterBox is not supported! • The ParameterBox cannot be used with this frequency inverter.
225	**The connection to the inverter is blocked**	Access to a device that is not **ONLINE** (previously Time Out error). • Carry out a bus scan via the parameter **>Bus Scan<** (P1001).
ParameterBox operating error		
226	**Source and target are different devices**	Copying objects of different types (from / to different inverters) is not possible.
227	**Source is empty**	Copying of data from a deleted (empty) storage medium
228	**This combination is not permitted**	Target and source for the copying function are the same. The command cannot be carried out.
229	**Object selected is empty**	Parameterisation attempt of a deleted storage medium
230	**Different software versions**	**Warning** Copying objects with different software versions can lead to problems when transferring parameters.
231	**Invalid password**	Attempt to alter a parameter without a valid Box password being entered in parameter **>Box password<** P 1306.
232	**Bus scon only during operation: ONLINE**	A bus scan (search for a connected frequency inverter) is only possible when in **ONLINE** mode.

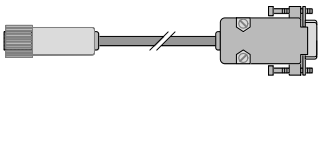
Display	Fault	Cause • Remedy
Warnings		
240	**Overwrite data?** **→YES NO**	These warnings indicate that there is a possibly significant change which needs additional confirmation. Once the next procedure has been selected, it must be confirmed with the "**ENTER**" key.
241	**Delete data?** **→YES NO**	
242	**Move SW version?** **→ CONTINUE CANCEL**	
243	**Move series?** **→ CONTINUE CANCEL**	
244	**Delete all data?** **→ YES NO**	
Inverter control error		
250	**This function is not enabled**	The function requested is not enabled at the frequency inverter parameter interface. • Change the value of the parameter P509 >Interface< of the connected frequency inverter to the required function.
251	**Control command was not successful**	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
252	**Control is not possible OFFLINE**	Call up of a control function in **Offline** mode. • Change the operating mode of the ParameterBox in the parameter **>Operating mode<** P1302 to **Online** and repeat the action.
253	**Error acknowledgement not successful**	The acknowledgement of an error at the frequency inverter was not successful, the error message remains.
Error message from inverter		
"Error No. from inverter"	**Inverter error** **"Inverter error text"**	An error with the displayed number has occurred on the frequency inverter. The frequency inverter error No. and error text is displayed.

4.7 Data transfer with NORD CON

The storage elements S1 to S5 of the NORDAC ParameterBox can be managed and archived with the **NORD CON** control and parameterisation 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 (Part No. 278910220) for this, which is connected to the interface converter via a cinch connector and to the PC/laptop via a USB connector.

The following components are required to connect the ParameterBox → to the PC/Laptop benötigt:



RS232

PC / Laptop

5V-USB-Port Adapter

ParameterBox SK PAR-2H Part No. 278910100	Adapter M12 So/SUB-D for SK PAR-2H → SK IC1 Part No. 278910210	Interface converter SK IC1-232/485 Part No. 276970020	USB/5V adapter for SK IC1-232/485 Part No. 278910220	Software NORD CON Part No. 206099985 (NORD PAC) www.nord.com

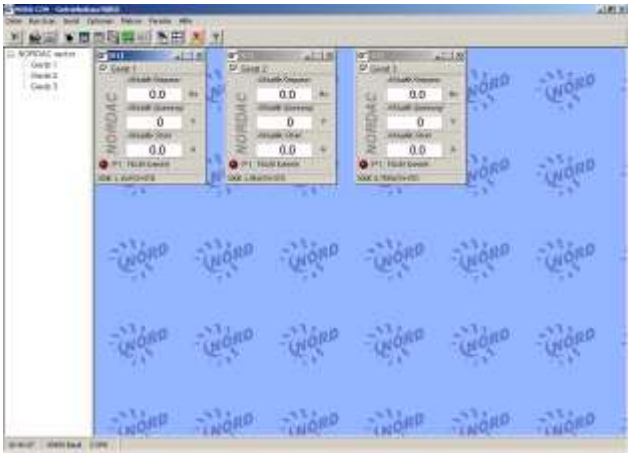
In this configuration, communication is controlled by the PC. For this, the ParameterBox must be set to the value **PC slave**, in the menu group **>Options<** parameter **>Operating mode (P1302)<** . After a bus scan, **NORD CON** program will then detect the filed storage objects S1 to S5 as separate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

NOTE

Only storage objects saved in the frequency inverter parameter data sets can be detected and processed 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 default values (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 programPC-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 install the NORD CON software. The NORD CON software can either be installed from the NORD PAC CD (Part. No.: 206099985) or downloaded from the website >www.nord.com<.

With **NORD CON**, communication can be carried out with up to 31 frequency inverters simultaneously or via the RS485 interface specific to the device.

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 <<<

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 a familiar environment.

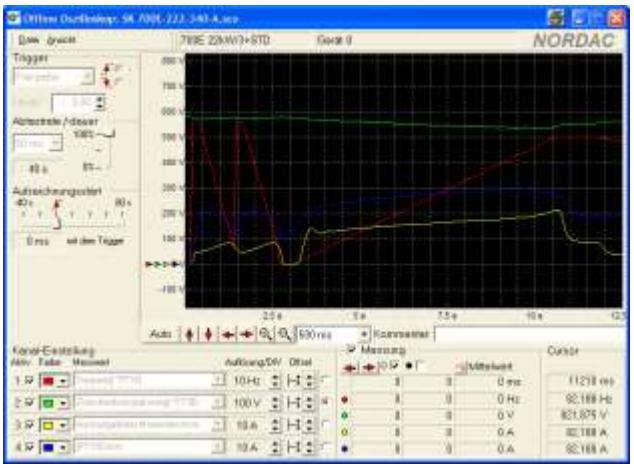
All possible frequency inverter operating unit functions can be carried out.

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 scaleable in both time and value range.

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

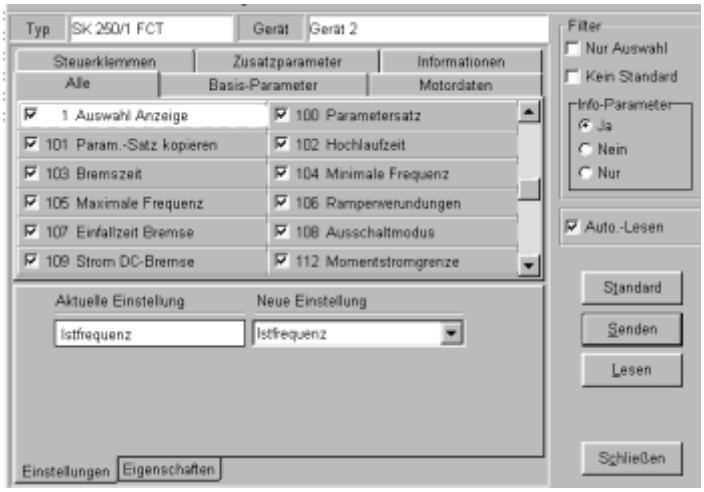


Parameterisation

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

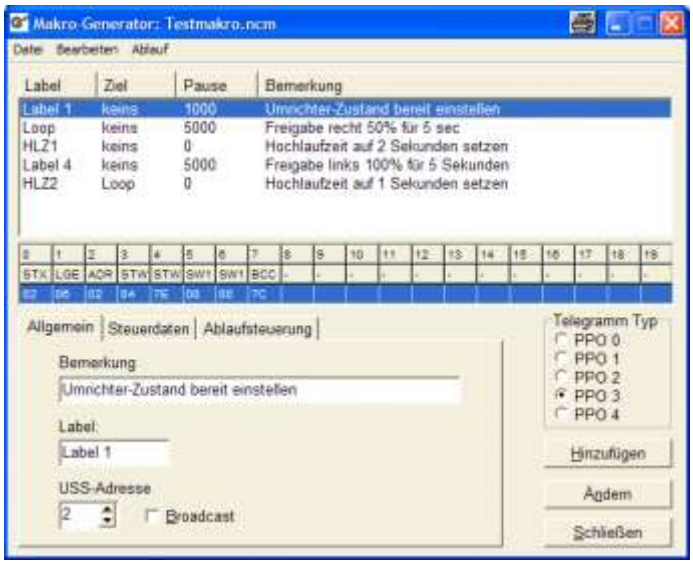
All frequency inverter parameters can be easily accessed via the parameter name and the corresponding parameter number. This means that parameterisation with the PC software **NORD CON** is very transparent and therefore handling is considerably easier.

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



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.



6 Commissioning

General information

Once the power supply has been connected to the frequency inverter, it will be operational within a few moments. In this condition, the frequency inverter can be set up for the application requirements, i.e. parameterised. A complete and comprehensive description of each parameter is set out in the following sections.

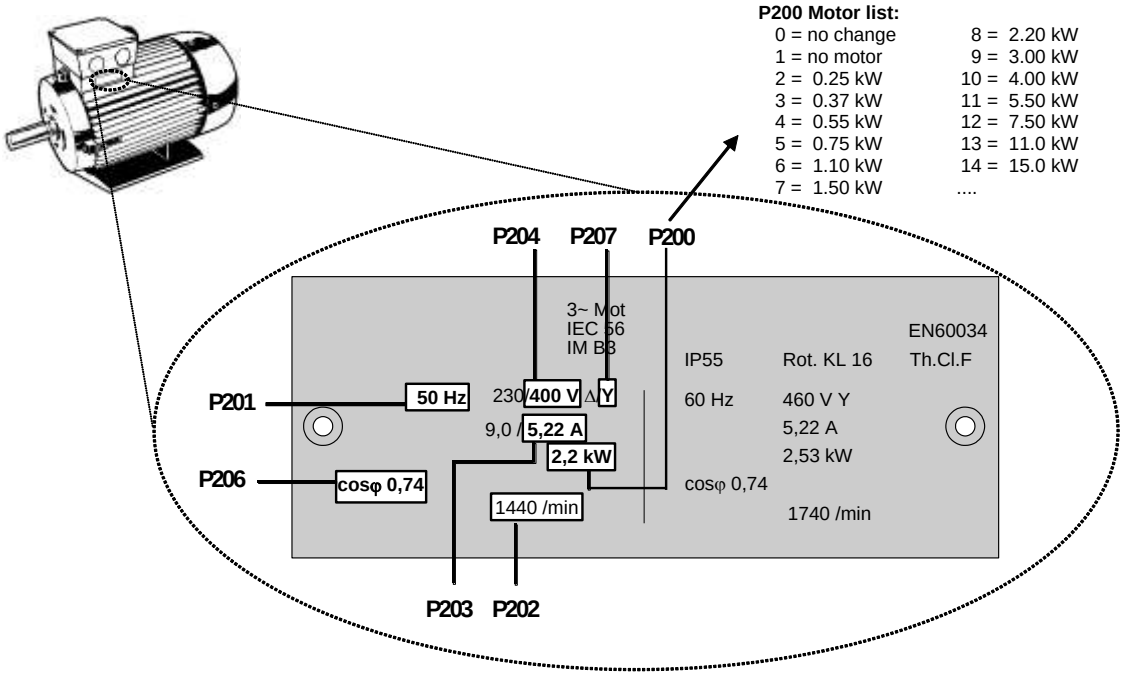
The motor should only be started with the enable signal after the parameters have been successfully set by qualified personnel.

CAUTION: The frequency inverter is not equipped with a line main switch and is therefore always live when connected to the power supply.

6.1 Basic settings

All frequency inverters supplied by Getriebebau NORD are pre-programmed with the factory setting for standard applications with 4-pole standard motors. For use with other motors, the data from the name plate of the motor must be input into the parameters under the menu item >Motor data<.

Recommendation: For correct operation of the drive unit it is necessary to set the motor data as precisely as possible (name plate). In particular, an automatic stator resistance measurement (P208) must be carried out.



Note: In this example, the motor must be "star" wired (400V, P207 = 0).

The frequency inverter is pre-programmed at the factory for standard applications using 4-pole DC standard motors. If another NORD motor is to be used, it can be selected from a motor list in P200. The data is automatically loaded into parameters P201 – P208 and can be compared again with the data from the motor name plate. Then, *0* or *no change* appears in P200.

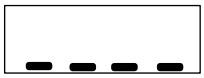
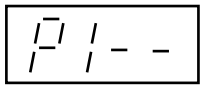
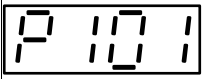
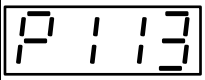
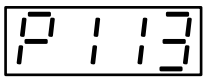
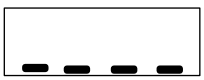
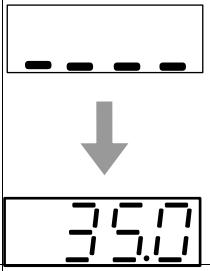
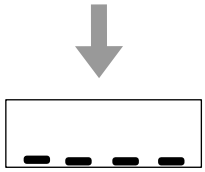
When using other motors, the data from the name plate of the motor must be input into parameters P201 to P208.

In order to automatically determine the stator resistance, set P208 = 0 and confirm by pressing "ENTER". The value adjusted to the line resistance will be saved (dependent upon P207).

6.2 Basic operation - Quick start guide

... with ControlBox (Option: SK TU2-CTR)

The simplest procedure to prepare the frequency inverter for operation is described below. For this operation, jog frequency (P113) is used. Only one parameter needs to be changed in the standard setting.

Measure		Key	Display
1.	Connect the power supply to the frequency inverter. The operating display changes to the "Operational" mode.		
2.	-Keep pressing the ▲ key until menu group P 1 _ _ is displayed.		
3.	-Press the ↵ key to access the Basis Parameter menu group.		
4.	Press the ▲ key. Parameter No. P101 and the following will be displayed.		
5.	Press the ▲ key until parameter P113 >**jog frequency**< is displayed.		
6.	Press the ↵ key to display the actual frequency setpoint (standard factory setting = 0.0Hz).		
7.	Press the ▲ key to set the required frequency setpoint (e.g. 35.0Hz).		
8.	Press the ↵ key to store the setting.		
9.	Keep pressing the ▼ key until the operating display is reached. Or press ▲ and ▼ simultaneously to change directly to the operation display. Use the I key to switch on directly; the frequency inverter then changes directly to the operating display.		
10.	Switch on the frequency inverter using the I key. The motor shaft starts up and indicates that the inverter output frequency is reaching the setpoint of 35Hz. **Note:** The setpoint value is reached after 1.4 seconds (35Hz / 50Hz x 2s). The standard start-up time is 2 seconds to reach 50Hz (as defined by P102 and P105). If necessary, the motor speed (i.e. the frequency) can be adjusted directly using the ▲ ▼ keys. By pressing the ↵ key, the new set value can be saved directly in P113.		
11.	Switch off the frequency inverter using the O key. The motor is braked and is brought to a controlled stop (this takes 1.4 seconds). The standard deceleration time is 2 seconds from 50Hz to standstill (defined by P103, P105). **Note:** The inverter always supplies 0Hz for 0.5 seconds after stopping (P559, >DC-Time lag<). If there is a new enable during this period, then this is interrupted.		

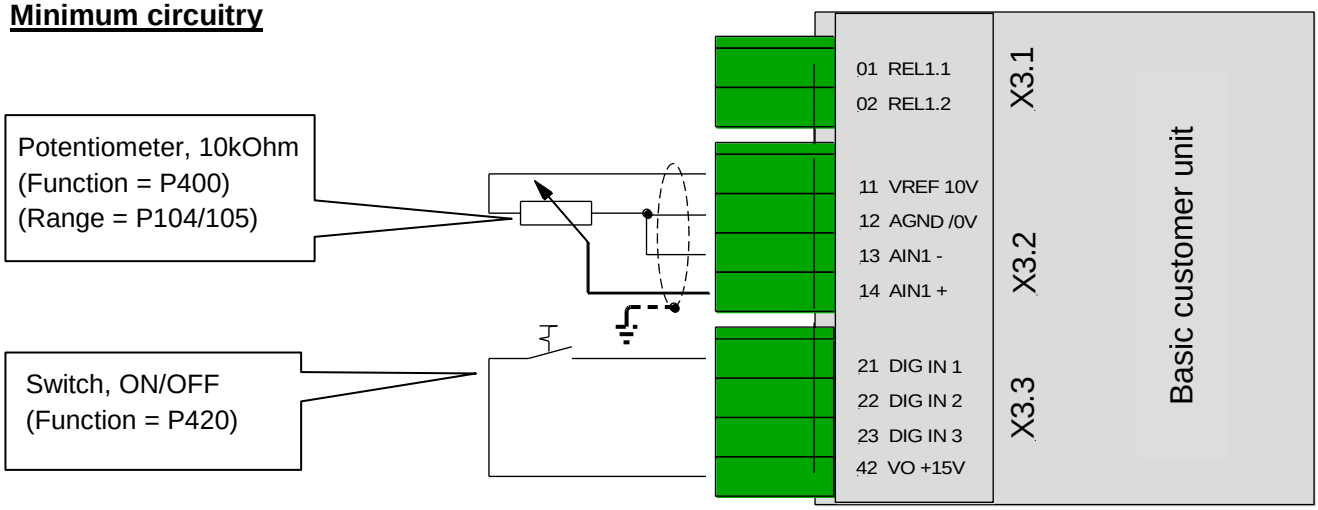
6.3 Minimum configuration of control connections

... with Basic I/O and ControlBox (Option: SK CU1-BSC + SK TU2-CTR)

If the frequency inverter is to be controlled via the digital and analog inputs, this can be implemented immediately in the delivery condition. Settings are not necessary for the moment.

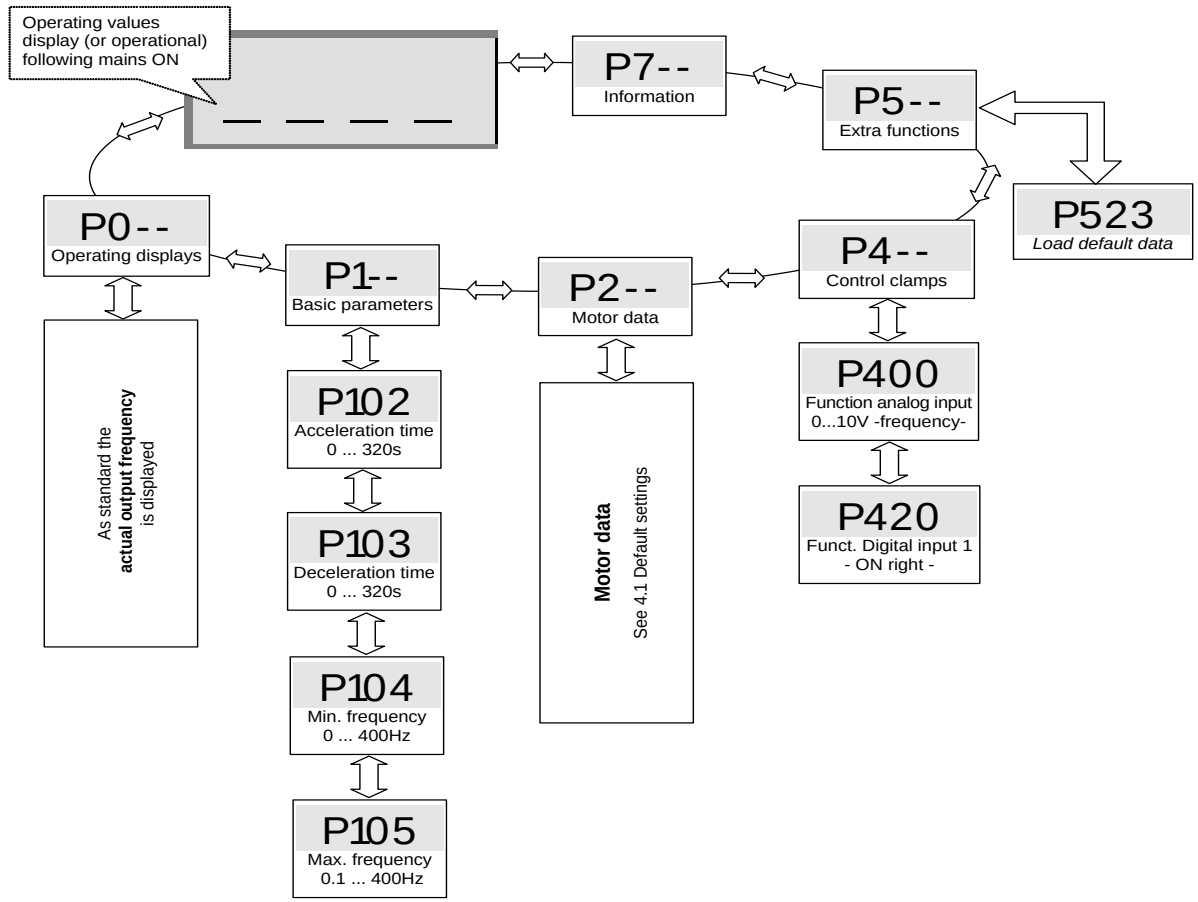
The prerequisite is the installation of a customer unit, e.g. the Basic I/O (as described here).

Minimum circuitry



Basic parameters

If the present setting of the frequency inverter is not known. loading of the default parameters is recommendedd → P523 = 1. In In this configuration the frequency inverter is parameterised for standard applications. If necessary, the following parameters can be modified (with the ControlBox option SK TU2-CTR).



7 Parameterisation

There are four switchable parameter sets available during operation. All parameters are always visible. All parameters can be adjusted "online".

Note:: As there are dependencies between the parameters, it is possible for invalid internal data and operating faults to be generated temporarily. Only inactive parameters should be adjusted during operation.

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

The following main functions are assigned to the menu groups:

Menu group	No.	Master function
Operating displays	**(P0--):**	For the selection of the physical units of the display value.
Basic parameter	**(P1--):**	Contain the basic inverter settings, e.g. switch on and switch off procedures and, along with the motor data, and 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 clamps	**(P4--):**	Analog input and output scaling, specification of digital input and relay output functions, as well as PID controller parameters.
Extra functions	**(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 can also be programmed or read out in several levels (arrays). After selection of the parameter, the array level must also be selected.

NOTE

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

ATTENTION

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

To safeguard the actual parameter settings, these can be transferred to the ControlBox or ParameterBox memories.

Example: Availability of the parameters / parameter description

Example illustration

Parameter		Setting value / Description / Note	Parameter set	Available with option		
P000	**...-01** **...-02** **...**	**Operating display**	**P**	**BSC** **BUS**	**STD** **ENC**	**MLT** **POS**
0.01…9999 [0]		Only with the Option ControlBox according to selection in P001. The operating parameter selected in P001 will be displayed here.				

Parameter text

Array value

Parameter number

Parameter value range

Factory settings of parameter

Parameter set (**P**) dependent on parameter; can be set differently in 4 parameter sets; **Selection in P100**

Customer unit: **BSC** = Basic I / O

BUS = BUS customer units

Customer unit: **STD** = Standard I / O

Special extension unit **ENC =** Incremental encoder module

Customer unit: **MLT** = Multi I/O or Multi I/O 20mA

Special extension unit: **POS** = Positioning module

7.1 Array parameter display

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

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

ParameterBox, SK PAR-2H

Attention

When using the **ControlBox** in combination with an SK 750E, only the first array level of the array parameters is displayed. The other array levels are not displayed with the ControlBox.

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

7.2 Operating displays

In the following, the abbreviation **FI**will be used for a frequency inverter.

Parameter	Setting value / Description / Note	Parameter set	Available with option
P000	**Operating display**		**Always visible**
	Only with the Option ControlBox according to selection in P001. The operating parameter selected in P001 will be displayed here.		
P001	**Selection display**		**Always visible**
0 ... 17 [0]	**0 =** **Actual frequency [Hz]**, is the actual output frequency being supplied by the FI. **1 =** **Speed [rpm]**, the actual speed calculated by the FI. **2 =** **Setpoint frequency [Hz]**, the output frequency equivalent to the actual setpoint. This need not match the actual output frequency. **3 =** **Current [A]**, the actual output current measured by the FI. **4 =** **Torque current [A]**, the torque developing output current of the FI. **5 =** **Voltage [Vac]**, the actual alternating voltage being output by the FI. **6 =** **Link voltage [Vdc]**, the FI-internal DC voltage. Amongst other things, this depends on the level of the mains voltage. **7 =** **cos φ,** the actual calculated value of the power factor. **8 =** **Apparent power [kVA]**, the actual apparent power calculated by the FI. **9 =** **Effective power [kW]**, the actual effective power calculated by the FI. **10 =** **Torque [%]**, the actual torque calculated by the FI. **11 =** **Field [%],** the actual field in the motor calculated by the FI. **12 =** **Operating hours [h],** time that voltage is applied to the FI network. **13 =** **Enabled operating hours [h],** time that the FI is enabled. **14 =** **Analog input 1 [%] *,** actual value present at analog input 1 of the FI. **15 =** **Analog input 2 [%] *,** actual value present at analog input 2 of the FI. **16 =** **Position setpoint **,** desired control position. **17 =** **Actual position **,** actual position of the drive. *) Only advisable if the customer unit has the appropriate inputs. **) Only with special extension *PosiCon*.		
P002	**Factor display**		**Always visible**
0.01 ... 999.99 [1.00]	The operating value in parameter P001 >Selection of operating value display< is scaled with the scaling factor and displayed in P000. It is therefore possible to display system-specific operating values such as bottles per hour.		

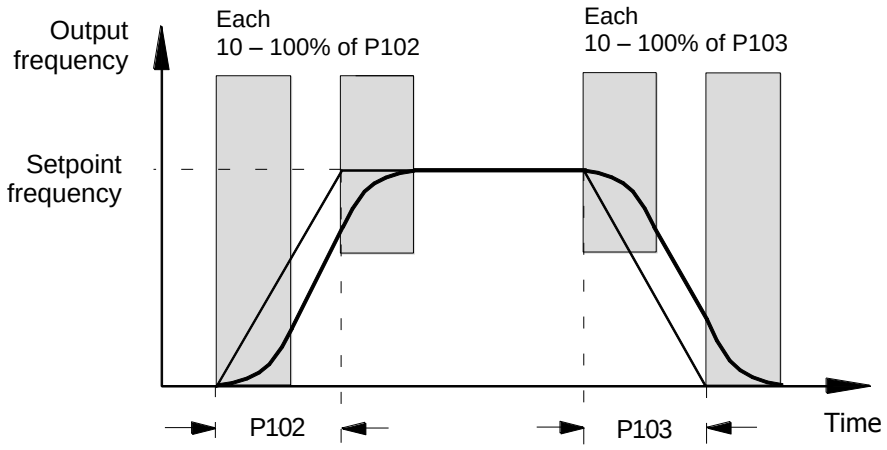
7.3 Basic parameters

Parameter	Setting value / Description / Note	Parameter set	Available in Option
P100	**Parameter set**		**Always visible**
0 ... 3 [0]	Selection of the parameters sets to be parameterised. 4 parameter sets are available. All parameter set-dependent parameters are identified by **P**. The selection of the operating parameter set is performed via a digital input or the Bus control. Switching can take place during operation (online).		

Setting		Digital input function [8]	Digital input function [17]	ControlBox display
0 =	Parameter set 1	LOW	LOW	1 2
1 =	Parameter set 2	HIGH	LOW	1 2
2 =	Parameter set 3	LOW	HIGH	1 2
3 =	Parameter set 4	HIGH	HIGH	1 2

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

P101	**Copy parameter set**		**Always visible**
0 ... 4 [0]	After confirmation with the ENTER key, a copy of the parameter set selected in P100 >Parameter set< is written to the parameter set dependent on the value selected here **0 =** Do not copy **1 =** Copies the active parameter set to parameter set 1 **2 =** Copies the active parameter set to parameter set 2 **3 =** Copies the active parameter set to parameter set 3 **4 =** Copies the active parameter set to parameter set 4		
P102	**Start-up time**	**P**	**Always visible**
0 ... 320.00 s [2.00] or [3.00]	The start-up time is the time corresponding to the linear frequency rise from 0Hz to the set maximum frequency (P105). If an actual setpoint of <100% is being used, the acceleration time is reduced linearly according to the setpoint which is set. The start-up time can be extended by certain circumstances, e.g. FI overload, setpoint lag, rounding or if the current limit is reached.		
P103	**Braking time**	**P**	**Always visible**
0 ... 320.00 s [2.00] or [3.00]	The braking time is the time corresponding to the linear frequency reduction from the set maximum frequency to 0Hz (P105). If an actual setpoint <100% is being used, the braking time reduces accordingly. The braking time can be extended by certain circumstances, e.g. by the selected >Switch-off mode< (P108) or >Ramp smoothing< (P106).		

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

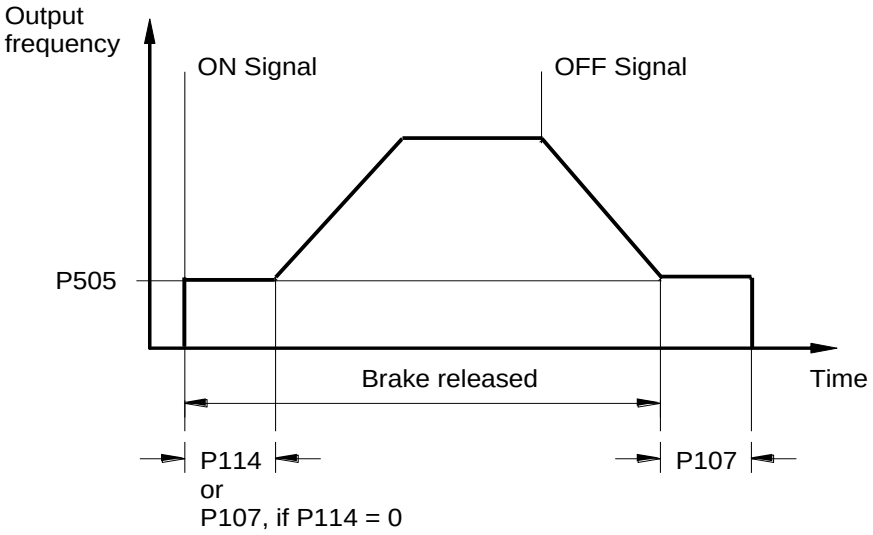
Parameter	Setting value / Description / Note	Parameter set	Available in Option
P107	**Brake reaction time**	**P**	**Always visible**
0 ... 2.50 s [0.00]	Electromagnetic brakes have a physically-dependent delayed reaction time when actuated. This can cause a dropping of the load for lifting applications, as the brake only takes over the load after a delay. This reaction time can be taken into account under parameter P107 (Brake control). Within the adjustable application time, the FI supplies the set absolute minimum frequency (P505) and so prevents movement against the brake and load drop when stopping. See also the parameter >Release time< P114 **Note:** For the control of electromagnetic braking (especially for lifting operations) an internal relay should be used, see → Function 1, external brake (P434/441). The minimum absolute frequency (P505) should never be less than 2.0Hz.		

Recommendation for application:
Lifting equipment with brake, without speed feedback

P114 = 0.2...0.3sec.
P107 = 0.2...0.3sec.
P201…P208 = Motor data
P434 = 1 (ext. brake)
P505 = 2...4Hz

for safe start-up
P112 = 402 (off)
P536 = 2.1 (off)
P537 = 1 (on)
P539 = 2/3 (I_{SD} monitoring)

to prevent load drops
P214 = 50...100%
(precontrol)



Note: If a brake release time is set (P107 / P114) the brake will only be actuated if at least ¼ of the rated magnetisation current (P209) is flowing. The static boost P120 is correspondingly taken into account with values < 100%.

Parameter	Setting value / Description / Note	Parameter set	Available in Option
P108	**Disconnection mode**	**P**	**Always visible**
0 ... 12 [1]	This parameter determines the manner in which the output frequency is reduced after "Blocking" (controller enable → Low). **0 =** **Voltage block:** 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. **1 =** **Ramp:** The actual output frequency is reduced proportionally to the remaining braking time from P103. **2 =** **Ramp with delay:** as with ramp, however for generational operation the brake ramp is extended, or for static operation the output frequency is increased. Under certain conditions, this function can prevent overload switch off or reduce brake resistance power dissipation. **Note:** This function must not be programmed if defined deceleration is required, e.g. with lifting mechanisms. **3 =** **Immediate DC braking:** The FI switches immediately to the preselected DC current (P109). This DC current is supplied for the remaining proportion of the >DC brake time< (P110). Depending on the relationship, actual output frequency to max. frequency (P105), the >Time DC brake on< is shortened. The time taken for the motor to stop depends on the application. The deceleration time depends of the moment of inertial of the load and the DC current which is set (P109). With this type of braking, no energy is fed back to the FI. Heat losses occur, mainly in the rotor of the motor. **4 =** **Constant brake distance**: The brake ramp is delayed in starting if the equipment is not being driven at the maximum output frequency (P105). This leads to an almost constant braking distance from various frequencies. **Note:** This function cannot be used as a positioning function. This function should not be used with ramp rounding (P106). **5 =** **Combined braking:** Depending on the actual link voltage (CLV) a high frequency voltage is applied to the basic mode (linear characteristic curves only, P211 = 0 and P212 = 0). The braking time is retained where possible (P103). → additional motor warming! **6 =** **Quadratic ramp:** The braking ramp does not have a linear course, but rather is quadratic. **7 =** **Quadratic ramp with delay:** Combination of functions 2 and 6 **8 =** **Quadratic combined braking:** Combination of functions 5 and 6 **9 =** **Constant acceleration power:** Only applies in the field weakening range! The drive is accelerated and braked using constant electrical power. The course of the ramps depends on the load. **10 =** **Distance calculator:** Constant distance between actual frequency / speed and the set minimum output frequency (P104). **11 =** **Constant acceleration power with delay:** Combination of functions 2 and 9. **12 =** **Constant acceleration power with delay** (as for 11) **with additional chopper relief**		
P109	**DC brake current**	**P**	**Always visible**
0 ... 250 % [100]	Current setting for the functions of DC current braking (P108 = 3) and combined braking (P108 = 5). The correct setting value depends on the mechanical load and the required deceleration time. A higher setting brings large loads to a standstill more quickly. The 100% setting relates to a current value as stored in the >Nominal current< parameter P203.		
P110	**DC braking time on**	**P**	**Always visible**
0.00 ... 60.00 s [2.00]	The time during which the motor has the current selected in parameter >DC brake current< applied to it during the DC braking functions (P108 = 3). Depending on the relationship, actual output frequency to max. frequency (P105), the >Time DC brake on< is shortened. The time starts running with the removal of the enable and can be interrupted by fresh enabling.		

Parameter	Setting value / Description / Note	Parameter set	Available in Option
P111	**P - torque limit factor**	**P**	**Always visible**
25 ... 400 % [100]	Directly affects the behaviour of the drive at the torque limit. The basic setting of 100 % is sufficient for most drive tasks. If the value is too large, the drive unit will tend to oscillate when the torque limit is reached. If the value is too small, the programmed torque limit may be undershot.		
P112	**Torque current limit**	**P**	**Always visible**
25 ... 400/ 401 % [401]	With this parameter, a limit value for the torque-generating current can be set. This can prevent mechanical overloading of the drive. However, it cannot provide any protection against mechanical blockages (movement to stops). A slipping clutch which acts as a safety device is essential. The torque current limit can also be set over an infinite range of settings using an analog input. The maximum setpoint (compare adjustment 100%, P403/P408) then corresponds to the value set in P112. The limit value 20% of torque current cannot be undershot by a smaller analog setpoint (P400/405 = 2) (with P300 = 1, not below 10%)! 401% = AUS stands for switch-off of the torque current limit off! This is also the basic setting for the FI.		
P113	**Jog frequency**	**P**	**Always visible**
-400.0 ... 400.0 Hz [0.0]	When using the ControlBox or ParameterBox to control the FI, the jog frequency is the starting value following enable. Alternatively, when control is via the control terminals, the jog frequency can be activated via one of the digital inputs. The setting of the jog frequency can be 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. **Note:** Specified setpoints via the control terminals, e.g. jog frequency, fixed frequencies or analog setpoints, are generally added with the correct sign. The set maximum frequency (P105) cannot be exceeded and the minimum frequency (P104) cannot be undershot.		
P114	**Brake release time**	**P**	**Always visible**
0 ... 2.50 s [0.00]	Electromagnetic brakes have a delayed reaction time for their release, which depends on physical factors. This can result in the motor running while the brake is still applied, which will cause the inverter to switch off with an overcurrent message. This release time can be taken into account in parameter P114 (Brake control). During the adjustable ventilation time, the FI supplies the set absolute minimum frequency (P505) thus preventing movement against the brake. See also the parameter >Brake reaction time< P107 (setting example). **Note:** If the brake release time is set to "0", then P107 is the brake release and reaction time.		

7.4 Motor data / characteristic curve parameters

Parameter	Setting value / Description / Note	Parameter set	Available with option
P200	**Motor list**	**P**	**Always visible**
0 ... 32 [0]	The factory settings for the motor data can be edited with this parameter. The factory setting in parameters P201...P209 is a 4-pole DS standard motor with the nominal FI power setting. By selecting one of the possible digits and pressing the ENTER key, all motor parameters (P201…P209) are adjusted to the selected standard power. The basis for the motor data is a 4-pole DS standard motor.		

0 = No change to data

1 = No motor: In this setting, the FI operates without current control, slip compensation and pre-magnetising time, and is therefore not recommended for motor applications. Possible applications are induction furnaces or other applications with coils and transformers. The following motor data is set here: 50.0Hz / 1500rpm / 15.0A / 400V / 0.00kW / cos φ=0.90 / Stern / R_S 0,01Ω / I_{LEER} 6.5A

2 =	0.25kW	**10 =**	4.0kW	**18 =**	0.25hp	**25 =**	5.0hp
3 =	0.37kW	**11 =**	5.5kW	**19 =**	0.50hp	**26 =**	7.5hp
4 =	0.55kW	**12 =**	7.5kW	**20 =**	0.75hp	**27 =**	10hp
5 =	0.75kW	**13 =**	11kW	**21 =**	1.00hp	**28 =**	15hp
6 =	1.10kW	**14 =**	15kW	**22 =**	1.50hp	**29 =**	20hp
7 =	1.50kW	**15 =**	18.5kW	**23 =**	2.00hp	**30 =**	25hp
8 =	2.2kW	**16 =**	22kW	**24 =**	3.00hp	**31 =**	30hp
9 =	3.0kW	**17 =**	30kW			**32 =**	40hp

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

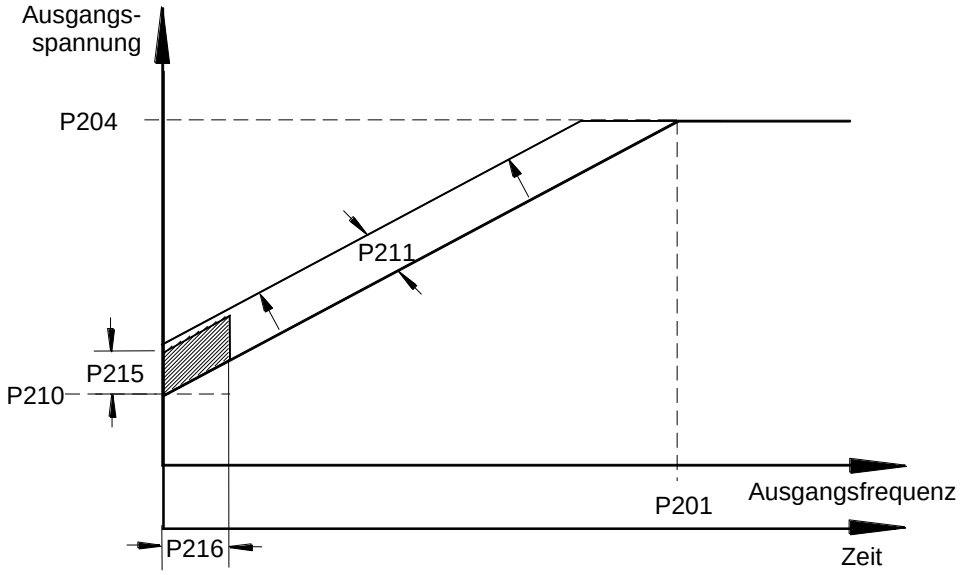
P201	**Nominal frequency**	**P**	**Always visible**
20.0..00.3990.9 Hz [*]	The motor nominal frequency determines the V/f break point at which the FI supplies the nominal voltage (P204) at the output.		
P202	**Nominal speed**	**P**	**Always visible**
300..0.24000 rpm [*]	The nominal motor speed is important for the correct calculation and control of the motor slip and the speed display (P001 = 1).		
P203	**Nominal current**	**P**	**Always visible**
0.1..00.5400.0 A [*]	The nominal motor current is a decisive parameter for the current vector control.		
P204	**Nominal voltage**	**P**	**Always visible**
100..0.800 V [*]	The >Nominal voltage< matches the mains voltage to the motor voltage. In combination with the nominal frequency, this produces the voltage/frequency characteristic curve.		
P205	**Nominal power**	**P**	**Always visible**
0.00... 315.00 kW [*]	The motor nominal power controls the motor set via P200.		
P206	**cos φ**	**P**	**Always visible**
0.50...0.90 [*]	The motor cos φ is a decisive parameter for the current vector control.		

[*] *These setting values depend on the selection in parameter P200.*

Parameter	Setting value / Description / Note	Parameter set	Available with option
P207	**Motor circuit**	**P**	**Always visible**
0 ... 1 [*]	**0 = Star** **1 = Delta** The motor circuit is decisive for stator resistance measurement and therefore for current vector control.		
P208	**Stator resistance**	**P**	**Always visible**
0.00...300.00 Ω [*]	Motor stator resistance ⇒ resistance of one line in the DC motor. Has a direct influence on the current control of the FI. Too high a value will result in a possible overcurrent; too low a value will result in a motor torque which 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. **Note:** For optimum functioning of the current vector control, the stator resistance must be automatically measured by the FI. **The motor must not be disconnected from the FI during the measurement!**		
P209	**No load current**	**P**	**Always visible**
0.1..00.5400.0 A [*]	This value is always calculated automatically from the motor data if there is a change in the parameter >cos φ< P206 and the parameter >Nominal current< P203. **Note:** If the value is to be entered directly, then it must be set as the last motor data. This is the only way to ensure that the value will not be overwritten.		
P210	**Static boost increase**	**P**	**Always visible**
0 ... 400 % [100]	The static boost affects the current which generates the magnetic field. This is equivalent to the no load current of the particular motor and is therefore independent of the load The no load current is calculated using the motor data. The factory setting of 100% is sufficient for normal applications.		
P211	**Dynamic boost increase**	**P**	**Always visible**
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 result in an overcurrent in the FI. Under load therefore, the output voltage will be raised too sharply. Too low a value will result in insufficient torque.		
P212	**Slip compensation**	**P**	**Always visible**
0 ... 150 % [100]	The slip compensation increases the output frequency, dependent on load, to keep the speed of an asynchronous motor approximately constant. The factory setting of 100% is optimal when using DC asynchronous motors and correct motor data has been set. If several motors (different loads or outputs) are operated with one FI, the slip compensation P212 must be set to 0%. This excludes any negative influences. This also applies to synchronous motors which do not have slip due to their design.		
P213	**ISD control loop gain**	**P**	**Always visible**
25 ... 400 % [100]	This parameter influences the control dynamics of the FI current vector control (ISD control). Higher settings make the controller faster, lower settings make it slower. Dependent on application type, this parameter can be altered, e.g. to avoid unstable operation		

[*] *These setting values depend on the selection in parameter P200.*

Parameter	Setting value / Description / Note	Parameter set	Available with option
P214	**Lead torque**	**P**	**Always visible**
-200 ... 200 % [0]	This function allows a value for the expected torque requirement to be set in the controller. This function can be used in lifting applications for a better load transfer during start-up**.** **Note:** With a field of rotation to the right, the motor torques are entered with a positive sign. Generator torques are entered with a negative sign. For rotation field to the left, the reverse applies.		
P215	**Boost precontrol**	**P**	**Always visible**
0 ... 200 % [0]	Only with linear characteristic curve (P211 = 0% and P212 = 0%). For drives that require a high starting torque, this parameter provides an option for switching in an additional current during the start phase. The application time is limited and can be selected in the parameter >Time boost precontrol< P216. All current and torque current limits that may have been set (P112 and P536, P537) are deactivated during the boost lead time. **Note:** With active ISD control (P211 and / or P212 ≠ 0%), parameterisation of P215 ≠ 0 results in incorrect control.		
P216	**Time boost precontrol**	**P**	**Always visible**
0.0 ... 10.0 s [0]	Only with linear characteristic curve (P211 = 0% and P212 = 0%). Application time for increased starting current. **Note:** With active ISD control (P211 and / or P212 ≠ 0%), parameterisation of P216 ≠ 0 results in incorrect control.		
P2xx	**Control/characteristic curve parameters**		



Note:

"Typical" setting for the:

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

7.5 Speed control

Parameter	Setting value / Description / Note	Parameter set	Available with option		
P300	**Servo mode**	**P**		**ENC**	**POS**
0...1 [0]	This parameter activates speed control with speed measurement via an incremental encoder. This results in a very stable speed behaviour untill the motor comes to a standstill. **0 = Off** **1 = On** **Note:** For correct function, an incremental encoder must be connected (see encoder connections, Section 3.6) and the correct pulse number must be entered in parameter P301.				
P301	**Incremental encoder pulse number**			**ENC**	**POS**
0...17 [6]	Input of the pulse-count per rotation of the connected incremental encoder. If the direction of rotation of the encoder is not the same as the FI, (depending on installation and wiring), this can be compensated by selecting the corresponding negative pulse numbers 8...16. **0 =** 500 pulses **1 =** 512 pulses **2 =** 1000 pulses **3 =** 1024 pulses **4 =** 2000 pulses **5 =** 2048 pulses **6 =** 4096 pulses **7 =** 5000 pulses **8 =** 500 pulses **9 =** 512 pulses **10 =** 1000 pulses **11 =** 1024 pulses **12 =** 2000 pulses **13 =** 2048 pulses **14 =** 4096 pulses **15 =** 5000 pulses **16 =** -8192 pulses **17 =** + 8192 pulses				
P310	**Speed controller P**	**P**		**ENC**	**POS**
0...3200 % [100]	P-component of the encoder (proportional amplification). Amplification factor, by which the speed difference between the setpoint and actual frequency is multiplied. A value of 100% means that a speed difference of 10% produces a setpoint of 10%. Values which are too high can cause the output speed to oscillate.				
P311	**Speed controller I**	**P**		**ENC**	**POS**
0...800 % / ms [20]	I-component of the encoder (Integration component). The integration component of the controller enables the complete elimination of any control deviation. The value indicates how large the setpoint change is per ms. Values that are too small cause the controller to slow down (adjustment time is too long).				

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

Parameter	Setting value / Description / Note	Parameter set	Available with option		
P320	**Field weakening controller limit**	**P**			
				ENC	**POS**
0...110 % [100]	The field weakening limit determines at which speed / current the controller will begin to weaken the field. At a set value of 100% the controller will begin to weaken the field at approximately the synchronous speed. If values much larger than the standard values have been set in P314 and/or P317, then the field weakening limit should be correspondingly reduced, so that the control range is actually available to the current controller.				
P321	**Increase speed control I**	**P**			
				ENC	**POS**
0... 4 [0]	During the brake release time (P107/P114), the I-component of the speed control is increased. This results in better load take-up, especially with hanging loads. **0 =** P311 x 1 **1 =** P311 x 2 **2 =** P311 x 4 **3 =** P311 x 8 **4 =** P311 x 16				
P325	**Encoder function**	**P**			
				ENC	**POS**
0...4 [0]	The actual speed list value supplied by an incremental encoder to the FI can be used for various functions in the FI. **0 =** **Speed measurement Servo mode:** The actual motor speed list value is used for the FI servo mode. In this function the ISD control cannot be switched off. **1 =** **PID actual frequency value:** The speed list value of a system is used for speed control. This function can also be used for controlling a motor with a linear characteristic curve. It is also possible to use an incremental encoder for speed control which is not mounted directly onto the motor. P413 – P416 govern the control. **2 =** **Frequency addition:** The determined speed is added to the actual setpoint value. **3 =** **Frequency subtraction:** The determined speed is subtracted from the actual setpoint. **4 =** **Maximum frequency:** The maximum possible output frequency / speed is limited by the speed of the encoder.				
P326	**Encoder transformation ratio**	**P**			
				ENC	**POS**
0.01...200.0 [1.00]	If the incremental encoder is not mounted directly onto the motor shaft, then the respectively correct transformation ratio of motor speed to encoder speed must be set. $P326 = \frac{\text{motor speed}}{\text{encoder speed}}$ Only when P325 = 1, 2, 3 or 4, therefore not in Servo mode (motor speed control)				
P327	**Slip error limit**	**P**			
				ENC	**POS**
0..0.3000 rpm [0]	The limit value for a permitted maximum slip error can be set. If this value is reached, the FI switches off and indicates error E013.1. **0 =** OFF Only when P325 = 0, therefore in Servo mode (motor speed control)				

Parameter	Setting value / Description / Note	Parameter set	Available with option		
P330	**Digital input 13**	**P**			
				ENC	

0 … 3
[0]

0 = **Off:** No function, input is switched off.

1 = **Servo mode On / Off:** Activation and deactivation of the Servo mode using an external signal (High level = active). For this P300 must be set as 1 (Servo mode = On).

2 = **Sense monitoring:** A connected incremental encoder which produces a fault signal and indicates fault functions e.g. break in the supply line or light source failure The FI shows Error 13, Encoder error, if there is an error.

3 = **PTC resistor input:** Analog evaluation of the actual signal switching threshold, approx. 2.5 Volt.

7.6 Control clamps

Parameter	Setting value / Description / Note	Parameter set	Available with option		
			BSC	STD	MLT
P400	**Analog input function 1**				
0...18 [1]	The FI analog input can be used for various functions. It should 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. **0 =** **Off**, the analog input has no function. After the FI has been enabled via the control terminals, it will supply the set minimum frequency (P104). **1 =** **Setpoint 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 altered by means of an analog value. 100% setpoint here corresponds to the set torque current limit P112. 20% cannot be undershot (with P300=1, not below 10%)! **3 =** **Actual PID frequency***, is required to set up a control loop. 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 Control variables P413 – P415) **4 =** **Frequency addition ***, the supplied frequency value is added to the setpoint. **5 =** **Frequency subtraction *,** the supplied frequency value is subtracted from the setpoint. **6 =** **Current limit**, based on the set current limit (P536), this can be altered via the analog input. **7 =** **Maximum frequency,** the maximum frequency of the FI is set in the analog range. 100% corresponds to the setting in parameter P411. 0% corresponds to the setting in parameter P410. The values for the min/max output frequency (P104/P105) cannot be exceeded or undershot. **8 =** **Actual frequency PID limited ***, as for Function 3, Actual frequency PID, however the output frequency cannot fall below the programmed minimum frequency value in Parameter P104. (no change to rotation direction) **9 =** **Actual PID frequency monitored ***, as for Function 3 "Actual frequency PID", however the FI switches the output frequency off when the minimum frequency P104 is reached. **10 =** **Servo mode torque**, in the Servo mode the motor torque can be set using this function. **11 =** **Torque precontrol,** a function that enables a value for the anticipated torque requirement to be entered in the controller (interference factor switching). This function can be used to improve the load take-up of lifting equipment with separate load detection**.** **12 =** Reserved **13 =** **Multiplication,** the setpoint is multiplied with the analog value supplied. The analog value adjusted to 100% then corresponds to a multiplication factor of 1.				

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

14 = **Actual value process controller *,** activates the process controller, analog input 1 is connected to the actual value encoder (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 for Function 14, however, the setpoint is specified (e.g. by a potentiometer). The actual value must be specified via a different input.

16 = **Process controller lead *,** adds an adjustable additional setpoint after the process controller.

Note: Further details regarding the process controller can be found in Section 10.2

17 = Reserved

18 = **Curve travel control,** the slave communicates its actual speed to the master

*) The limits of these values are set by the parameters >Minimum frequency auxiliary setpoints< P410 and >Maximum frequency auxiliary setpoints< P411.

P401	Analog input mode 1		BSC	STD	MLT
0...3 [0]					

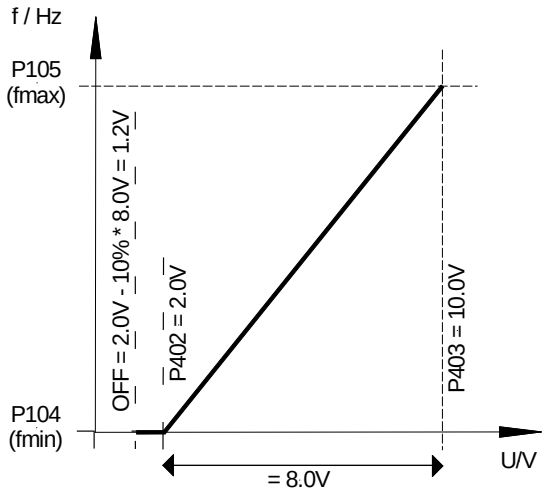
0 = **0 – 10V limited:** An analog setpoint smaller than the programmed adjustment 0% (P402) does not lead to undershooting of the programmed minimum frequency (P104). This therefore does not lead to a reversal of the direction of rotation.

1 = **0 - 10V:** also allows output frequencies which are below the programmed minimum frequency (P104) if a setpoint is present, which is smaller than the programmed matching of 0% (P402). This allows reversal of the direction of rotation using a simple voltage source and potentiometer.

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

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 As soon as the setpoint is greater than [*P402 - (10% * (P403 - P402))*] it delivers an output signal again.

E.g. setpoint 4-20mA:
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.



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

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

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

At the moment of reversal (hysteresis = ± P505), the drive stands still when the minimum frequency (P104) is smaller than the absolute minimum frequency (P505). A brake which is controlled by the FI has not been applied 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 is not applied.

P402	Analog input adjustment 1 0%		BSC	STD	MLT

-50.0..00.500.0 V
[0.0]

This parameter sets the voltage, which is to correspond with the minimum value of the selected function of analog input 1.
In the factory setting (setpoint) this value corresponds to the setpoint which is set by P104 >Minimum frequency<.

Typical setpoints and corresponding settings:

0 – 10V	→	0.0 V
2 – 10 V	→	2.0 V (for function 0-10 V monitored)
0 – 20 mA	→	0.0 V (internal resistance approx. 250Ω)
4 – 20 mA	→	1.0 V (internal resistance approx. 250Ω)

P403	Analog input adjustment 1 100%		BSC	STD	MLT

-50.0..00.500.0 V
[10.0]

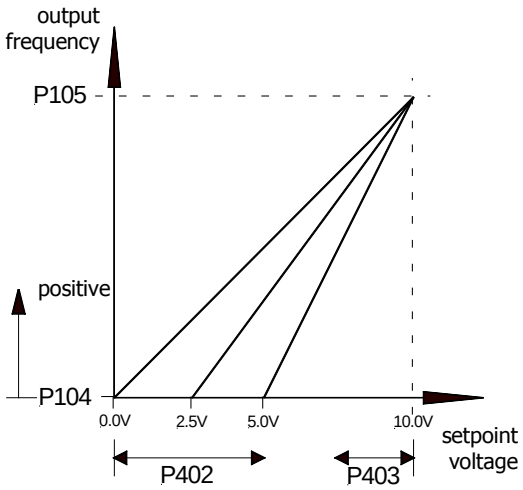
This parameter sets the voltage, which is to correspond with the maximum value of the selected function of analog input 1.
In the factory setting (setpoint) this value corresponds to the setpoint which is set by P105 >Maximum frequency<.

Typical setpoints and corresponding settings:

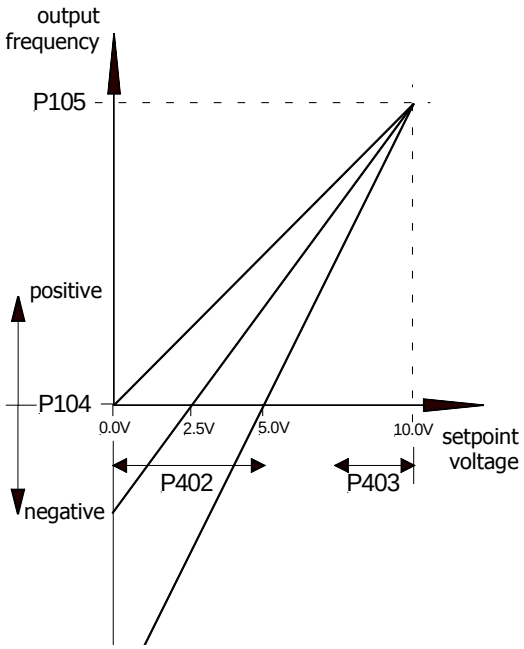
0 – 10 V	→	10.0 V
2 – 10 V	→	10.0 V (for function 0-10 V monitored)
0 – 20 mA	→	5.0 V (internal resistance approx. 250Ω)
4 – 20 mA	→	5.0 V (internal resistance approx. 250Ω)

P400 ... P403

P401 = 0 → 0–10V limited



P401 = 1 → 0–10V not limited



Parameter	Setting value / Description / Note	Parameter set	Available with option		
P404	**Filter analog input 1**		**BSC**	**STD**	**MLT**
10 ... 400 ms [100]	Adjustable digital low-pass filter for the analog signal. Interference peaks are hidden, the reaction time is extended.				
P405	**Analog input function 2**				**MLT**
0...18 [0]	*This parameter is identical to P400.*				
P406	**Analog input mode 2**				**MLT**
0...3 [0]	**0 = 0 – 10V limited** **1 = 0 – 10V** **2 = 0 – 10V monitored** **3 = - 10V – 10V** *This parameter is identical to P401.* P402/403 change to P407/408.				
P407	**Analog input adjustment 2 0%**				**MLT**
-50.0..00.500.0 V [0.0]	*This parameter is identical to P402.*				
P408	**Analog input adjustment 2 100%**				**MLT**
-50.0...50.0 V [10.0]	*This parameter is identical to P403.*				
P409	**Filter analog input 2**				**MLT**
10 ... 400 ms [100]	*This parameter is identical to P404.*				
P410	**Minimum frequency auxiliary setpoints**	**P**	**Always visible**		
-400.0..0.4000.0 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 addition Frequency subtraction — Auxiliary setpoints via BUS Process controller — Min. frequency above analog setpoint (potentiometer)				
P411	**Maximum frequency auxiliary setpoints**	**P**	**Always visible**		
-400.0..0.4000.0 Hz [50.0]	The maximum frequency that can act on the setpoint via the auxiliary setpoints. Auxiliary setpoints are all frequencies that are additionally delivered for further functions in the FI: Actual frequency PID — Frequency addition Frequency subtraction — Auxiliary setpoints via BUS Max. frequency above analog setpoint (potentiometer) Process controller				

Parameter	Setting value / Description / Note	Parameter set	Available with option
P412	**Process controller setpoint**	**P**	**Always visible**
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. 10.2		
P413	**PID control P-component**	**P**	**Always visible**
0 ... 400.0 % [10.0]	Only effective if the function Actual frequency PID is selected. The P-component of the PID controller determines the frequency jump if there is a control deviation based on the control difference. E.g.: At a setting of P413 = 10% and a rcontrol difference of 50%, 5% is added to the actual setpoint.		
P414	**PID control I-component**	**P**	**Always visible**
0 ... 300.0 %/ ms [1.0]	Only effective if the **function actual frequency PID** is selected. The I-component of the PID controller determines the frequency change, dependent on time.		
P415	**PID control D-component**	**P**	**Always visible**
0 ... 400.0 %ms [1.0]	Only effective if the **function actual frequency PID** is selected. If there is a rule deviation, the D-component of the PID controller determines the frequency change multiplied by time (%ms). If one of the analog inputs is set in the **function actual value process controller**, this parameter determines the controller limitation (%) after the PI controller. For further details, see Section 10.2.		
P416	**Ramp PID controller**	**P**	**Always visible**
0 ... 99.99s [2.00]	Only effective if the **function actual frequency PID** is selected. Ramp for PID setpoint		

Note: Further details about the PID and process controller can be found in Section 10.2 and 10.3

P417	Offset analog output 1	P		STD	MLT
-10.0 ... +10.0 V [0.0]	In the analog output function an offset can be entered to simplify the processing of the analog signal in other equipment. If the analog output has been programmed with a digital function, then the difference between the switch-on point and the switch-off point can be set in this parameter (hysteresis).				

Parameter	Setting value / Description / Note	Parameter set	Available with option		
				STD	MLT
P418	**Function analog output 1**	**P**			
0 ... 52 [0]	**analog functions:** An analog voltage (0 ... +10 Volt) can be taken from the control terminals (max. 5mA). Various functions are available, whereby: 0 Volt analog voltage always corresponds to 0% of the selected value. 10 V always corresponds to the motor nominal values (unless otherwise stated) multiplied by the P419 standardisation factor, e.g.: $\Rightarrow 10\text{Volt} = \frac{\text{motor nominal value} \cdot \text{P419}}{100\%}$ **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. If Servo mode is being used, the measured speed will be output via this function. **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 =** **Link voltage**, the DC voltage in the FI. This is not based on the nominal motor data. 10V Volt, standardised at 100%, is equivalent to 450V DC (230V mains) or 850 Volt DC (480V mains)! **7 =** **Value from P542**, the analog output can be set using parameter P542 independently of the actual operating status of the FI. For example, with Bus switching (parameter command) this function can supply an analog value from the FI, which is triggered by the control unit. **8 =** **Apparent power**, the actual apparent power of the motor as calculated by the FI. **9 =** **Effective power**, the actual effective power calculated by the FI. **10 =** **Torque [%]**, the actual torque calculated by the FI. **11 =** **Field [%]**, the actual field in the motor calculated by the FI. **12 =** **Output frequency ±**, the analog voltage is proportional to the output frequency of the FI, whereby the zero point is shifted to 5V. For rotation to the right, values between 5V and 10V are output, and for rotation to the left values between 5V and 0V. **13 =** **Actual speed ±**, is the synchronic rotation speed calculated by the FI, based on the current setpoint, where the null point has been shifted to 5V. For rotation to the right, values from 5V to 10V are output and for rotation to the left, values from 5V to 0V. The measured speed is output via this function if servo mode is used. **14 =** **Torque [%] ±**, is the actual torque calculated by the FI, whereby the zero point is shifted to 5V. For drive torques, values between 5V and 10V are output, and for generator torque, values between 5V and 0V. **30 =** **Setpoint frequency before frequency ramp**, displays the frequency produced by any upstream controllers (ISD, PID, etc.). This is then the setpoint frequency for the power stage after it has been adjusted by the start-up or braking ramp (P102, P103). **31 =** **Value via BUS**, the analog output is controlled via a bus system. The process data is directly transferred (P546, P547, P548).				

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Parameter	Setting value / Description / Note	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. A negation of the function can be set in the parameter >Norm. analog output< P419.

15 =	External brake	**28 =**	... 29 reserved
16 =	Inverter working	**34 =**	... 43 reserved
17 =	Current limit	**44 =**	Bus In Bit 0
18 =	Torque current limit	**45 =**	Bus In Bit 1
19 =	Frequency limit	**46 =**	Bus In Bit 2
20 =	Setpoint reached	**47 =**	Bus In Bit 3
21 =	Fault	**48 =**	Bus In Bit 4
22 =	Warning	**49 =**	Bus In Bit 5
23 =	Overcurrent warning	**50 =**	Bus In Bit 6
24 =	Overtemperature warning motor	**51 =**	Bus In Bit 7
25 =	Torque current limit active	**52 =**	Output via Bus
26 =	Value from P541, external control		
27 =	Drive torque current limit		

P419	Analog output standardisation	P		STD	MLT

-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 working range. The maximum analog output (10V) corresponds to the standardisation value of the corresponding selection.

Therefore, if this parameter is raised from 100% to 200% at a constant working point, the analog output voltage is halved. The 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 ... 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).

Parameter	Setting value / Description / Note	Parameter set	Available with option		
P420	**Function of digital input 1**		**BSC**	**STD**	**MLT**
			BUS		
0 ... 48 [1]	**Enable right** as factory setting Various functions can be programmed. These can be seen in the following table.				
P421	**Function of digital input 2**		**BSC**	**STD**	**MLT**
0 ... 48 [2]	**Enable left** as factory setting Various functions can be programmed. These can be seen in the following table.				
P422	**Function of digital input 3**		**BSC**	**STD**	**MLT**
0 ... 48 [8]	**Parameter set switching** as factory setting Various functions can be programmed. These can be seen in the following table.				
P423	**Function of digital input 4**			**STD**	**MLT**
0 ... 48 [4]	**Fixed frequency 1** as factory setting Various functions can be programmed. These can be seen in the following table.				
P424	**Function of digital input 5**				**MLT**
0 ... 25 [0]	**No function** as factory setting Various functions can be programmed. These can be seen in the following table.				
P425	**Function of digital input 6**				**MLT**
0 ... 25 [0]	**No function** as factory setting Various functions can be programmed. These can be seen in the following table.				

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

Value	Function	Description	Signal
0	No function	Input switched off.	---
1	Enable right	FI supplies output signal, rotation field right (if setpoint positive). 0 → 1 Flank (P428 = 0)	High
2	Enable left	FI supplies output signal, rotation field left (if setpoint positive). 0 → 1 Flank (P428 = 0)	High
	If automatic start is active (P428 = 1), a High level is sufficient. The FI is barred if the functions enable right and enable left are triggered simultaneously.		
3	Change rotation direction	Causes the rotation field to change direction (combined with Enable right or left).	High
4	Fixed frequency 1 [1]	The frequency from P429 is added to the setpoint value.	High
5	Fixed frequency 2 [1]	The frequency from P430 is added to the setpoint value.	High
6	Fixed frequency 3 [1]	The frequency from P431 is added to the setpoint value.	High
7	Fixed frequency 4 [1]	The frequency from P432 is added to the 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 (including minimum frequency) is added.		
8	Parameter set switch Bit 0	Selection of the active Bit 0 parameter set (see P100)	High
9	Hold frequency	During the start-up or braking phase, a Low level will cause the output frequency to be "held". A High level allows the ramp to proceed.	Low
10	Block voltage [2]	The FI output voltage is switched off and the motor runs freely to a stop.	Low
11	Emergency stop [2]	The FI reduces the frequency according to the programmed emergency stop time (P426).	Low
12	Fault acknowledgement [2]	Error acknowledgement with an external signal. If this function is not programmed, an error can also be acknowledged by setting the enable to Low.	0→1 Flank
13	Thermistor input [2]	Analog evaluation of the present signal switching threshold, approx. 2.5 Volt. Switch-off delay = 2sec, warning after 1sec.	Analog
14	Remote control	With Bus system control, low level switches the control to control via control terminals.	High
15	Jog frequency	This frequency fixed value can be set using the HIGHER / LOWER and ENTER keys.	High
16	Maintain frequency "Motorpoti"	As for setting value 09, however, this is not maintained below the minimum frequency and above the maximum frequency.	Low
17	Parameter set switch Bit 1	Selection of the active parameter set Bit 2 (see P100).	High
18	Watchdog [2]	Input must see a High flank cyclically (P460), otherwise error E012 will cause a shutdown. Starting is with the first High flank.	0→1 Flank
19	Setpoint 1 on/off	Analog input switch-on and switch-off 1 (High = ON)	High
20	Setpoint 2 on/off	Analog input switch-on and switch-off 2 (High = ON)	High
21	Fixed frequency 5 [1]	The frequency from P433 is added to the setpoint.	High
22	Reference point run	PosiCon option (see manual BU 0710)	High
23	Reference point	PosiCon option (see manual BU 0710)	High
24	Teach-In	PosiCon option (see manual BU 0710)	High
25	Quit Teach-In	PosiCon option (see manual BU 0710)	High
	These functions are only available with the PosiCon Special Extension Unit!		

continued on the next page

Value	Function	Description	Signal
26	Torque current limit [2 3 5]	Adjustable load limit, the output frequency is reduced when this is reached. → P112	Analog
27	Actual PID frequency [2 3 4 5]	Possible feedback of actual value for the PID controller	Analog
28	Frequency addition [2 3 4 5]	Addition to other frequency setpoint values	Analog
29	Frequency subtraction [2 3 4 5]	Subtraction from other frequency setpoint values	Analog
	Digital inputs can be used for simple analog signals (max. 7 Bit resolution).		
30	PID control on/off [5]	Switches the PID controller / process controller function on and off (High = ON)	High =On
31	Enable right blocked [5]	Blocks the >Enable right/left< via a digital input or Bus control. Does not depend on the actual direction of rotation of the motor (e.g. following negated setpoint). With multi I/O only available in P420...423!	Low
32	Block enable left [5]		Low
33	Current limit (analog) [2 3 5]	Based on the set current limit (P536), this can be changed using the digital/analog input.	Analog
34	Maximum frequency (analog) [2 3 4 5]	The maximum frequency of the FI is set in the analog range. 100% corresponds to the setting in parameter P411. 0% corresponds to the setting in parameter P410. The values for the min/max output frequency (P104/P105) cannot be exceeded or undershot.	Analog
35	Actual frequency PID controller limited (analog) [2 3 4 5]	Needed to set up a control loop. The digital/analog input (actual value) is compared with the setpoint (e.g. other analog input or fixed frequency). The output frequency is adjusted as far as possible until the actual value equals the setpoint. (see control variables P413 – P416) The output frequency cannot fall below the programmed minimum frequency value in parameter P104. (No change of rotation direction!)	Analog
36	Actual frequency PID controller monitored (analog) [2 3 4 5]	As function 35, >Actual frequency PID< but the FI switches the output frequency off when the >Minimum frequency< P104 is reached.	Analog
37	Torque Servo mode (analog) [2 3 5]	The motor torque can be set or limited via this function in Servo mode.	Analog
38	Torque precontrol (analog) [2 3 5]	Function which enables a value for the anticipated torque requirement to be entered in the controller (interference factor switching). This function can be used to improve the load take-up of lifting equipment with separate load detection. → P214	Analog
39	Multiplication [3 5]	This factor multiplies the master setpoint value.	Analog
40	Actual value process controller [3 5]	As for P400 = 14-16 Further details regarding the process controller can be found in Section 10.2	Analog
41	Setpoint value process controller [3 5]		Analog
42	Precontrol process controller [3 5]		Analog
	Digital inputs can be used for simple analog signals (max. 7 Bit).		
47	Increase frequency	Only DI 1-4; in combination with enable R/L the output frequency can be continuously varied. To save a current value in P113, both inputs must be at a High voltage for 0.5s. This value then applies as the next starting value for the same direction of rotation (Enable R/L) otherwise start at f_{MIN}. Values from other setpoint sources (e.g. fixed frequencies) are not taken into account.	High
48	Decrease frequency		High

1 If none 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 (RS485, CANbus, CANopen, DeviceNet, Profibus DP, InterBus, RS232)

3 Functions only available for Basic and Standard I/O, analog setpoints are processed. They are suitable for simple requirements (7 bit resolution).

4 The limits of these values are set by the parameters >Minimum frequency auxiliary setpoints< P410 and >Maximum frequency auxiliary setpoints< P411.

5 Settings are not available with P424 and P425 (Multi I/O).

Parameter	Setting value / Description / Note	Parameter set	Available with option
P426	**Emergency stop time**	**P**	**Always visible**
0 ...100.00 s [0.1] or [1.0]	Braking time setting for the emergency stop function, which can be triggered by digital input, bus control, keyboard or automatically in the case of an error. The emergency 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.		
P427	**Emergency stop on error**		**Always visible**
0 ... 3 [0]	Activation of automatic emergency stop following error **0 = OFF:** Automatic emergency stop following error is deactivated **1 = Mains supply failure:** Automatic emergency stop following mains supply failure **2 = Error:** Automatic emergency stop following fault **3 = Mains supply failure and error:** Automatic emergency stop following mains supply failure and error		
P428	**Automatic start**	**P**	**Always visible**
0 ... 1 [0]	In the standard setting (P428 = **0 → Off**) the inverter requires a flank to enable (signal change from "Low → High") at the relevant digital input. In the setting **On → 1**, the FI reacts to a High level. This function is only possible if the FI is controlled using the digital inputs. (see P509). In some cases, the FI must start up directly when the mains are switched on. For this P428 = **1 → On** can be set. If the enable signal is permanently switched on, or equipped with a cable jumper, the FI starts up immediately.		

Parameter	Setting value / Description / Note	Parameter set	Available with option		
P429	**Fixed frequency 1**	**P**	**BSC**	**STD**	**MLT**
			BUS		
-400 ... 400 Hz [0]	Following actuation via a digital input and enabling of the FI (right or left), the fixed frequency is used as a setpoint. A negative setting value will cause a direction change (based on the *enabled direction of rotation* P420 – P425, P470). If several fixed frequencies are actuated at the same time, then the individual values are added with the correct sign. This also applies to combinations with the jog frequency (P113), analog setpoint (if P400 = 1) or minimum frequency (P104). The frequency limits (P104 = f_{min}, P105 = f_{max}) cannot be over or undershot. If none of the digital inputs are programmed for enable (right or left), the simple fixed frequency signal results in an enable. A positive fixed frequency corresponds to a right enable, a negative to a left enable.				
P430	**Fixed frequency 2**	**P**	**BSC**	**STD**	**MLT**
			BUS		
-400 ... 400 Hz [0]	For a description of the function of the parameter, see **P429** >**Fixed frequency 1**<				
P431	**Fixed frequency 3**	**P**	**BSC**	**STD**	**MLT**
			BUS		
-400 ... 400 Hz [0]	For a description of the function of the parameter, see **P429** >**Fixed frequency 1**<				
P432	**Fixed frequency 4**	**P**	**BSC**	**STD**	**MLT**
			BUS		
-400 ... 400 Hz [0]	For a description of the function of the parameter, see **P429** >**Fixed frequency 1**<				
P433	**Fixed frequency 5**	**P**	**BSC**	**STD**	**MLT**
			BUS		
-400 ... 400 Hz [0]	For a description of the function of the parameter, see **P429** >**Fixed frequency 1**<				

Parameter	Setting value / Description / Note	Parameter set	Available with option		
P434	**Function relay 1**	**P**	**BSC**	**STD**	**MLT**
			BUS		

0 ... 38
[1]

Control terminals 1/2: Settings 3 to 5 and 11 work with a 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		Digital Output ... for limit value or function (see also P435)
0 =	**No function**	open
1 =	**External brake**, to control a mechanical brake on the motor. The relay switches at a programmed absolute minimum frequency (P505). For typical brakes a setpoint delay of 0.2 … 0.3 seconds (see also P107) should be programmed. A mechanical brake can be directly AC switched. (Please note the technical specifications of the relay contacts)	Closes
2 =	**Inverter operating**, the closed relay contact indicates voltage FI output (U - V - W).	Closes
3 =	**Current limit**, based on the setting of the motor rated current in P203. This value can be adjusted with the standardisation (P435).	Closes
4 =	**Torque current limit**, based on motor data settings in P203 and P206. Signals a corresponding torque load on the motor. This value can be adjusted with the standardisation (P435).	Closes
5 =	**Frequency limit**, based on motor nominal frequency setting in P201. This value can be adjusted with the standardisation (P435).	Closes
6 =	**Setpoint reached**, indicates that the FI has completed the frequency increase or decrease. Setpoint frequency = actual frequency! From a difference of 1 Hz → *Setpoint not reached - contact opens.*	Closes
7 =	**Error**, general error message, error is active or not yet acknowledged. → *Operational - closes*	Opens
8 =	**Warning**, general warning, a limit value was reached which could lead to a later shutdown of the FI.	Opens
9 =	**Overcurrent warning**: At least 130% of the nominal FI current was supplied for 30 seconds.	Opens
10 =	**Motor overtemperature (warning)**: The motor temperature is evaluated via a digital input. →Motor is too hot. The warning is given immediately, overheating switch-off after 2 seconds.	Opens
11 =	**Torque current limit/Current limit active (warning):** The limiting value in P112 or P536 has been reached. A negative value in P435 inverts the reaction. Hysteresis = 10%.	Opens
12 =	**Relay via P541 – external control**, the relay can be controlled with parameter P541 (Bit 0) independently of the actual operating status of the FI.	Closes
13 =	**Torque limit gen. active:** Limit value in P112 was reached in the generator range. Hysteresis = 10%.	Closes

Parameter	Setting value / Description / Note	Parameter set	Available with option
	14 = ... 29 reserved		---
	30 = Bus IO In Bit 0 / Bus In Bit 0 *	Further details in the BUS manuals	Closes
	31 = Bus IO In Bit 1 / Bus In Bit 1 *		Closes
	32 = Bus IO In Bit 2 / Bus In Bit 2 *		Closes
	33 = Bus IO In Bit 3 / Bus In Bit 3 *		Closes
	34 = Bus IO In Bit 4 / Bus In Bit 4 *		Closes
	35 = Bus IO In Bit 5 / Bus In Bit 5 *		Closes
	36 = Bus IO In Bit 6 / Bus In Bit 6 *		Closes
	37 = Bus IO In Bit 7 / Bus In Bit 7 *		Closes
	38 = Value from BUS setpoint *		Closes

*) P546...P548 = 17 or 19

P435	**Standardisation relay 1**	**P**	**BSC** / **BUS**	**STD**	**MLT**
-400 ... 400 % [100]	Adjustment of the limit values of the relay functions. For a negative value, the output function will be output negative. Current limit = x [%] · P203 >Motor nominal current < Torque current limit = x [%] · P203 · P206 (calculated motor nominal torque) Frequency limit= x [%] · P201 >Motor nominal frequency< Values in the +/-20% range are limited internally to 20%.				

P436	**Hysteresis relay 1**	**P**	**BSC** / **BUS**	**STD**	**MLT**
1 ... 100 % [10]	Difference between switch-on and switch-off point to prevent oscillation of the output signal.				

P441	**Function relay 2**	**P**		**STD**	**MLT**
0 ... 38 [7]	**Control terminals 3/4:** Functions are identical to P434.				

P442	**Standardisation relay 2**	**P**		**STD**	**MLT**
-400 ... 400 % [100]	Functions are identical to P435.				

P443	**Hysteresis relay 2**	**P**		**STD**	**MLT**
0 ... 100 % [10]	Functions are identical to P436.				

P447	**Offset analog output 2**	**P**			**MLT**
-10.0 ... 10.0 V [0.0]	The parameter has an identical function to parameter P417 >Offset analog output 1<, except that it acts on analog output 2.				

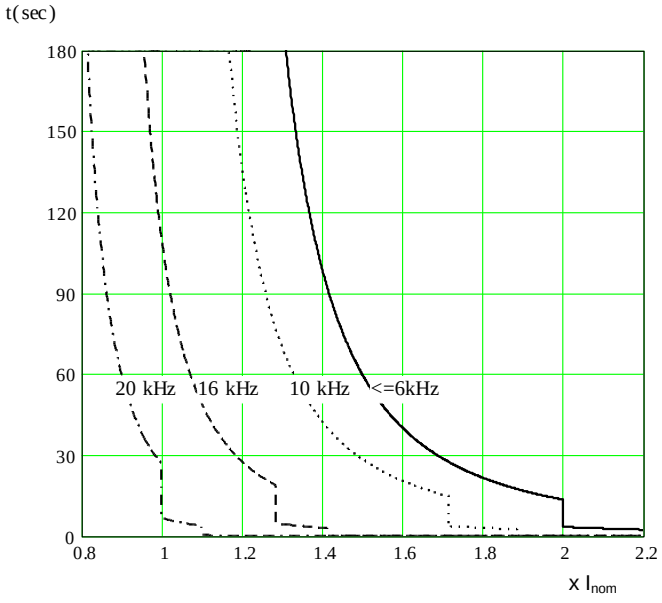
P448	**Function analog output 2**	**P**			**MLT**
0 ... 52 [0]	The scope of the function is identical to that of analog output 1. The precise description can be read under parameter P418, >Function analog output 1<.				

P449	**Standardisation analog output 2**	**P**			**MLT**
-500 ... 500 % [100]	Functions are identical to P419.				

Parameter	Setting value / Description / Note	Parameter set	Available with option		
					MLT
P458	**Analog output mode**	**P**			
0 ... 1 [0]	The mode of the analog output of the Multi I/O (SK CU1-MLT, SK CU1-MLT 20mA, optional) is adjustable. **0 =** 0...20mA / 0...10V **1 =** 4...20mA / 2...10V				
P460	**Time watchdog**	**P**	**Always visible**		
0.0 / 0.1 ... 250.0 s [10.0]	**0.1 ... 250.0** = The time interval between the expected Watchdog signals (programmable function of the digital inputs P420 – P425). If this time interval elapses without an impulse being registered, a switch-off and error message E012 are actuated. **0.0 = Customer error:** As soon as a high-low flank or a low signal is detected at a digital input (function 18) the FI switches off with error message E012.				
P480 **.. - 01 ... .. - 08**	**Function Bus I/O In Bits**		**Always visible**		
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] =** Bus I/O In Bit 1 **[05] =** Bus I/O Initiator 1 **[02] =** Bus I/O In Bit 2 **[06] =** Bus I/O Initiator 2 **[03] =** Bus I/O In Bit 3 **[07] =** Bus I/O Initiator 3 **[04] =** Bus I/O In Bit 4 **[08] =** Bus I/O Initiator 4 The possible functions for the Bus In Bits can be found in the table of functions for the digital inputs P420...425. Further details can be found in the manuals for each Bus system.				
P481 **.. - 01 ... .. - 08**	**Function Bus I/O Out Bits**		**Always visible**		
0 ... 38 [0]	The bus I/O Out bits are perceived as multi-function relay outputs. They can be set to the same functions (P434...443). **[01] =** Bus I/O Out Bit 1 **[05] =** Bus I/O Actuator 1 **[02] =** Bus I/O Out Bit 2 **[06] =** Bus I/O Actuator 2 **[03] =** Bus I/O Out Bit 3 **[07] =** Flag 1 **[04] =** Bus I/O Out Bit 4 **[08] =** Flag 2 The possible functions for the Bus Out Bits can be found in the table of functions for the relay P434. Further details can be found in the manuals for each Bus system.				
P482 **.. - 01 ... .. - 08**	**Standardisation of bus I/O Out bits**		**Always visible**		
-400 … 400 % [100]	Adjustment of the limit values of the relay functions/Bus Out Bits. For a negative value, the output function will be output negative. When the limit value is reached and the setting values are positive, the relay contact closes, with negative setting values the relay contact opens.				
P483 **.. - 01 ... .. - 08**	**Hysteresis of bus I/O Out bits**		**Always visible**		
1 … 100 % [10]	Difference between switch-on and switch-off point to prevent oscillation of the output signal.				

7.7 Extra functions

Parameter	Setting value / Description / Note	Parameter set	Available with option
P503	**Master function output**		**Always visible**
0 ... 8 [0]	To use the Master function output, the inverter controller source must be selected in P509. Only the master frequency (setpoint 1 and control word) is transferred with **Mode 1**, while the actual values selected in P543, P544 and P545 are transferred in **Mode 2**. In **Mode 3** a 32Bit actual position and a 16Bit setpoint speed (after ramp) is output. Mode 3 is required for synchronous control with the POSICON option. **Mode 4** = Curve control. Please refer to the detailed supplementary documentation. The first word which is transmitted: status word, 2nd word: actual setpoint frequency before the speed ramp, 3rd word: actual torque current standardised to the torque limit, 4th word: present actual frequency (with slip frequency removed) **0 = Off** **1 = USS Mode 1** (Freq.) **2 = CAN Mode 1** (Freq.) up to 250kBaud **3 = USS Mode 2** (IW 1-3) **4 = CAN Mode 2** (IW 1-3) up to 250kBaud **5 = USS Mode 3** (GL) **6 = CAN Mode 3** (GL) **7 = USS Mode 4** (KS) **8 = CAN Mode 4** (KS)		
P504	**Pulse frequency**		**Always visible**
3.0 ... 16.0 kHz [6.0]	The internal pulse frequency for controlling the power component can be changed with this parameter. A high set value results in less noise from the motor, but also to higher EMC radiation. **Note:** The degree of interference suppression for limit curve A as per EN 55011 is complied with using a setting of 6kHz, on condition that the wiring guidelines are complied with. I^2t FI characteristic curve, an increase of the pulse frequency results in a reduction of the output current depending on time.		



Parameter	Setting value / Description / Note	Parameter set	Available with option
P505	**Absolute minimum frequency**	**P**	**Always visible**
0.0 ... 10.0 Hz [2.0]	States 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. 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. When controlling lifting equipment, this value should be set at a minimum of 2Hz. From 2Hz and higher, the current control of the FI operates and a connected motor can supply sufficient torque.		
P506	**Automatic error acknowledgement**		**Always visible**
0 ... 7 [0]	In addition to the manual error acknowledgement, an automatic one can also be selected. **0 =** **No automatic** error acknowledgement. **1 ... 5 =** **Number**of permissible automatic malfunction acknowledgments within one mains-on cycle. After mains off and switch on again, the full number is available again. **6 =** **Always**, an error message will always be acknowledged automatically if the cause of the error is no longer present. **7 =** **ENTER key**, acknowledgement is only possible using the ENTER key or by mains switch-off. No acknowledgement is implemented by removing the enable!		
P507	**PPO type**		**Always visible**
1 ... 4 [1]	Only with the technology unit Profibus, DeviceNet or InterBus See also additional descriptions BU 0020, BU 0080, BU 0070		
P508	**Profibus address**		**Always visible**
1 ... 126 [1]	Profibus address, only with the Profibus technology unit See also the additional description for the Profibus control		

Parameter	Setting value / Description / Note	Parameter set	Available with option
P509	**Interface**	**Always visible**	

0 ... 21
[0]

Selection of the interface via which the FI is controlled. (if necessary, P503 master function output must be taken into account)

0 = **Control terminal or keyboard control** **/*** with the ControlBox (option), PotentiometerBox (option) or via BUS I/O Bits (option).

1 = **Control terminals only */*****, the FI can only be controlled via the digital and analog inputs (a customer unit is necessary!) or via the **BUS I/O Bits** (option).

2 = **USS setpoint */*****, the frequency setpoint is transferred via the RS485 interface.
Control via the digital I/Os remains active.

3 = **USS control word ***, the control signals (enable, rotation direction, etc.) are transferred via the RS485 interface, the setpoint via the analog input or the fixed frequencies.

4 = **USS ***, all control data is transferred via the RS485 interface. The analog and digital inputs have no function. The setting is required for the external **ParameterBox / *p-box***!

5 = **CAN** setpoint */*** (option)

6 = **CAN** control word * (option)

7 = **CAN *** (Option)

8 = **Profibus** setpoint */*** (option)

9 = **Profibus** control word * (option)

10 = **Profibus** * (option)

11 = CAN Broadcast * (Option)

12 = **InterBus** setpoint */*** (option)

13 = **InterBus** control word * (option)

14 = **InterBus** * (option)

15 = **CANopen** setpoint */*** (option)

16 = **CANopen** control word * (option)

17 = **CANopen** * (option)

18 = **DeviceNet** setpoint */*** (option)

19 = **DeviceNet** control word * (option)

20 = **DeviceNet** * (option)

21 = in preparation

Note:
For details about the respective Bus systems: please refer to the respective Options descriptions.
BU 0020 = Profibus
BU 0050 = USS
BU 0060 = CAN/CANopen
BU 0070 = InterBus
BU 0080 = DeviceNet
BU 0090 = AS-Interface

***)** Keyboard control (ControlBox, ParameterBox, PotentiometerBox) is blocked, parameterisation is still possible.

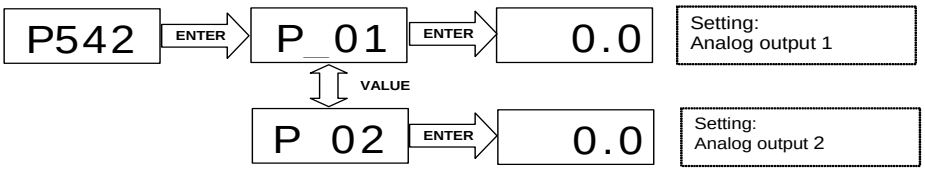
****)** If the communication during keyboard control is interrupted (time out 0.5 sec), the FI will block without error message.

*****)** Permissible settings for use of the AS interface.

Parameter	Setting value / Description / Note	Parameter set	Available with option
P510	**Auxiliary setpoint interface**		**Always visible**
0 ... 8 [0]	Selection of the interface via which the FI receives the setpoint. **0 =** **Auto:** the source of the auxiliary setpoint is automatically derived from the setting in the parameter P509 >Interface< **1 =** **Control terminals**, digital and analog inputs control the frequency, including fixed frequencies **2 =** **USS** **3 =** **CAN** **4 =** **Profibus** **5 =** **InterBus** **6 =** **CANopen** **7 =** **DeviceNet** **8 =** Reserved		
P511	**USS baud rate**		**Always visible**
0 ... 3 [3]	Setting of the transfer rate (transfer speed) via the RS485 interface. All bus participants must have the same baud rate setting. **0 =** 4800 Baud **1 =** 9600 Baud **2 =** 19200 Baud **3 =** 38400 Baud		
P512	**USS address**		**Always visible**
0 ... 30 [0]	Setting of the FI Bus address.		
P513	**Telegram downtime**		**Always visible**
-0.1 / 0.0 ... 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 error and switches off with the error message E010 >Bus Time Out<. **-0.1** = 10.8 / 10.2 inactive, monitoring switched off, no error is generated. **0.0 … 100.00 s** = = Response time for telegram failure		
P514	**CANbus baud rate**		**Always visible**
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 BU 0060 CANbus. **0 =** 10kBaud **1 =** 20kBaud **2 =** 50kBaud **3 =** 100kBaud **4 =** 125kBaud **5 =** 250kBaud **6 =** 500kBaud **7 =** 1MBaud * (test purposes only) *) Reliable operation cannot be guaranteed		
P515	**CANbus address**		**Always visible**
0 ... 255 [50]	Setting for the CANbus address.		
P516	**Skip frequency 1**	**P**	**Always visible**
0.0 ... 400.0 Hz [0.0]	The output frequency around the frequency value (P517) set here is not shown. This range is transmitted with the set brake and acceleration ramp; it cannot be continuously supplied to the output. Frequencies below the absolute minimum frequency should not be set. **0 =** Skip frequency inactive		
P517	**Skip frequency range 1**	**P**	**Always visible**
0.0 ... 50.0 Hz [2.0]	Skip range for the >Skip frequency 1< P516. This frequency value is added and subtracted from the skip frequency. Skip frequency range 1: P516 - P517 ... P516 + P517		
P518	**Skip frequency 2**	**P**	**Always visible**
0.0 ... 400.0 Hz [0.0]	The output frequency around the set frequency value (P519) is skipped. This range is transmitted with the set brake and acceleration ramp; it cannot be continuously supplied to the output. Frequencies below the absolute minimum frequency should not be set. **0 =** Skip frequency inactive		

Parameter	Setting value / Description / Note	Parameter set	Available with option
P519	**Skip frequency range 2**	**P**	**Always visible**
0.0 ... 50.0 Hz [2.0]	Skip range for the >Skip frequency 2< P518. This frequency value is added and subtracted from the skip frequency. Skip frequency range 2: P518 - P519 ... P518 + P519		
P520	**Flying start**	**P**	**Always visible**
0 ... 4 [0]	This function is required to connect the FI to already rotating motors, e.g. in fan drives. Motor frequencies >100Hz are only picked up in speed controlled mode (Servo mode P300 = ON). **0 =** **Switched off**, no flying start. **1 =** **Beoth directions**, the FI looks for a speed in both directions. **2 =** **Setpoint value direction**, searches only in the direction of the setpoint value which is present. **3 =** **Both directions**, only following mains supply failure and error **4 =** **In setpoint direction**, only following mains supply failure and error		
P521	**Flying start resolution**	**P**	**Always visible**
0.02... 2.50 Hz [0.05]	The flying start increment size can be adjusted with this parameter. Values that are too large affect accuracy and causes the FI to cut out with an overcurrent message. If the values are too small, the search time is greatly extended.		
P522	**Flying start offset**	**P**	**Always visible**
-10.0 ... 10.0 Hz [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.		
P523	**Factory setting**		**Always visible**
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. **0 =** **No change:** Does not change the parameterisation. **1 =** **Load factory settings:** The complete parameterisation of the FI reverts to the factory setting. All originally parameterised data are lost. **2 =** **Factory settings without bus:** All parameters of the FI, however not the bus parameters are reset to the factory setting.		
P535	**I^2t motor**		**Always visible**
0 ... 1 [0]	The motor temperature is calculated according to the output current, time and the output frequency (cooling). If the temperature limit value is reached then switch off occurs and error message E002 (motor overheating) is output. Possible positive or negative effects of ambient conditions cannot be taken into account. **0 =** **Switched off** **1 =** **Switched on**		
P536	**Current limit**		**Always visible**
0.1...2.0 / 2.1 (x nominal current of FI) [1.5]	The inverter output current is limited to the set value. (as before = "Increase delay") If this limit value is reached, the inverter reduces the actual output frequency. **0.1 - 2.0 =** **Multiplier** with the inverter nominal current, gives the limit value **2.1 =** **OFF** indicates that this limit value is switched off. This is also the basic setting of this parameter.		
P537	**Pulse switch-off**		**Always visible**
0 ... 1 [1]	This function prevents immediate switch-off of the inverter in case of a heavy overload (>200% inverter current). With the current limit switched on, the output current is limited to approximately 150% of the FI nominal current. This limit is implemented by briefly switching off the end stage. **0 =** Switched off **1 =** Switched on **Note:** For devices **above 30kW** the Pulse switch-off function **can not** be switched off.		

Parameter	Setting value / Description / Note	Parameter set	Available with option
P538	**Mains monitoring**		**Always visible**
0 ... 4 [3]	For reliable operation of the inverter the power supply must meet a certain 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. Under certain operating conditions, it may be necessary to suppress this error message. In this case, the input monitoring can be modified. **0 =** **Switched off**: No monitoring of the supply voltage. **1 =** **Only phase errors**: an error message is only produced by phase errors. **2 =** **Only low voltage**: an error message is only produced by a low voltage. **3 =** **Phase error and low voltage**: Phase errors and low voltage produce error messages. **4 =** **DC supply**: The input voltage is fixed at 480V with direct supply of direct current. Phase error and low mains voltage monitoring are deactivated. **NOTE:** Operation with an impermissible mains voltage can destroy the frequency inverter!		
P539	**Output monitoring**	**P**	**Always visible**
0 ... 1 [0]	The output current is measured and checked for symmetry. If an asymmetrical load is detected, the error message E016 >Motor phase error< is output. **0 =** Switched off **1 =** Switched on		
P540	**Block rotation direction**	**P**	**Always visible**
0 ... 7 [0]	For safety reasons this parameter can be used to prevent a rotation direction reversal and therefore the incorrect rotation direction. **0 =** **No rotation direction limitation** **1 =** **Direct key blocked**, the direction of rotation key via the VontrolBox (SK TU2-CTR) is blocked. With this parameter, the direction key in the ParameterBox is not blocked. **2 =** **Right rotation only***, only a field of rotation to the right is possible. The selection of the "incorrect" rotation leads to an enable with the minimum frequency (P104) in the "correct" direction. **Note:** When using a PotentiometerBox (SK TU2-POT), function 5 is active here! **3 =** **Left rotation only***, only a field of rotation to the left is possible. The selection of the "incorrect" rotation leads to an enable with the minimum frequency (P104) in the "correct" direction. **Note:** When using a PotentiometerBox (SK TU2-POT), function 6 is active here! **4 =** **Enable direction only**, 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. **Note:** When using a PotentiometerBox (SK TU2-POT), function 7 is active here! **5 =** **Right rotation monitored***, only a field of rotation to the right is possible. The selection of the "incorrect" rotation direction results in the FI switching off. **6 =** **Left rotation monitored***, only a field of rotation to the left is possible. The selection of the "incorrect" rotation direction results in the FI switching off. **7 =** **Only enabled direction monitored**, rotation direction is only possible according to the enable signal, otherwise the FI is switched off. *) Applies to keyboard (SK TU2-) and control terminal control, in addition, the direction key on the ControlBox is blocked.		

Parameter	Setting value / Description / Note	Parameter set	Available with option		
P541	**External control relay**		**BSC**	**STD**	**MLT**
			BUS		
000000 ... 111111 [000000]	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**. This function is binary coded: Setting range [000000-111111 (Binary)] Bit 0 = Relay 1 Bit 1 = Relay 2 Bit 2 = Analog output 1 (Digital function) Bit 3 = Analog output 2 (Digital function) Bit 4 = Relay 3 Bit 5 = Relay 4 This function can either be used manually or in combination with Bus control with this parameter (Function test). **BUS:** The corresponding value is written into the parameter, thereby setting the relay and digital outputs. **ControlBox:** The ControlBox enables the selection of all output combinations. If only Bits 0 - 3 are to be activated, the selection is displayed in binary code. If the *PosiCon* option is installed (Bit 4 + 5), the display is coded in hexadecimal. **ParameterBox:** Each individual output can be separately accessed and activated.				
P542	**External Control of analog outputs 1...2**			**STD**	**MLT**
0.0 ... 10.0 V [0.0]	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 output (P418/P448) must be set to the function **External control** (=7). This function can either be used manually or in combination with a Bus control with this parameter. The value set here will, once confirmed, be output at the analog output . When programming with the ControlBox: 				

Parameter	Setting value / Description / Note	Parameter set	Available with option
P543	**Actual bus value 1**	**P**	**Always visible**
0 ... 12 [1]	The return value 1 can be selected for bus actuation in this parameter. **Note:** Further details can be found in the respective BUS instruction manuals. **0 =** Off **1 =** Actual frequency **2 =** Actual speed **3 =** Current **4 =** Torque current (100% = P112) **5 =** Status of digital inputs and outputs [2] **6 =** Actual position (only with PosiCon, SK 700E) **7 =** Actual position (only with PosiCon, SK 750E) **8 =** Setpoint frequency **9 =** Error number **10 =** Actual position increment [3] (only with PosiCon, SK 750E) **11 =** Setpoint position increment [3] (only with PosiCon, SK 750E) **12 =** Bus I/O Out Bits 0 … 7		
P544	**Actual bus value 2**	**P**	**Always visible**
0 ... 12 [0]	In this parameter zhe return value 2 can be selected for bus control. **Note:** Further details can be found in the respective BUS instruction manuals. This parameter is identical to P543.		
P545	**Actual bus value 3**	**P**	**Always visible**
0 ... 12 [0]	In this parameter zhe return value 3 can be selected for bus control. This is only available if P546 ≠ 3. **Note:** Further details can be found in the respective BUS instruction manuals. This parameter is identical to P543.		

[3] Assignment of the digital inputs in P543/ 544/ 545 = 5 for SK 750E

Bit 0 = DigIn 1	Bit 1 = DigIn 2	Bit 2 = DigIn 3	Bit 3 = DigIn 4
Bit 4 = DigIn 5	Bit 5 = DigIn 6	Bit 6 = DigIn 7 (POS or ENC)	Bit 7 = DigIn 8
Bit 8 = DigIn 9 (POS)	Bit 9 = DigIn 9 (POS)	Bit 10 = DigIn 10 (POS)	Bit 11 = DigIn 12 (POS)
Bit 12 = Rel 1	Bit 13 = Rel 2	Bit 14 = Rel 3 (POS)	Bit 15 = Rel 4 (POS)

[2] The setpoint/actual position corresponding to an 8192 increment encoder.

Parameter	Setting value / Description / Note	Parameter set	Available with option
P546	**Bus setpoint 1**	**P**	**Always visible**
0 ... 7 [1]	In this parameter, a function is allocated to the output setpoint 1 during bus actuation. **Note:** Further details can be found in the respective BUS instruction manuals. **0 =** Off **1 =** Setpoint frequency (16 Bit) **2 =** 16 Bit setpoint position (only with option PosiCon, SK 750E) **3 =** 32 Bit setpoint position (only with Option PosiCon, SK 750E and if PPO type 2 or 4 has been selected) **4 =** Control terminals PosiCon [3](only with Option PosiCon, SK 750E, 16Bit) **5 =** Setpoint position (16 Bit) increment [2](only with PosiCon, SK 750E) **6 =** Setpoint position (32Bit) increment [2] (only with PosiCon, SK 750E) **7 =** Bus I/O In Bits 0 … 7		

P547	Bus setpoint 2	P	Always visible
0 ... 20 [0]	In this parameter, a function is allocated to the output setpoint 2 during bus actuation. **Note:** Further details can be found in the respective BUS instruction manuals. **0 =** Off **1 =** Setpoint frequency **2 =** Torque current limit **3 =** Actual frequency PID **4 =** Frequency addition **5 =** Frequency subtraction **6 =** Current limit **7 =** Maximum frequency **8 =** Actual PID frequency limited **9 =** Actual PID frequency monitored **10 =** Torque **11 =** Lead torque **12 =** Control terminals *PosiCon* [3] (only with *PosiCon* option) **13 =** Multiplication **14 =** Process controller actual value **15 =** Process controller setpoint **16 =** Process controller lead **17 =** Bus IO In Bits 0-7 **18 =** Curve travel calculator **19 =** Set relay (P541) **20 =** Set analog output (P542)		

P548	Bus setpoint 3	P	Always visible
0 ... 20 [0]	In this parameter, a function is allocated to the output setpoint 3 during bus actuation. It is only present when P546 ≠ 3. **Note:** Further details can be found in the respective BUS instruction manuals. This parameter is identical to P547.		

[3] The "reference run", "teach-in" and "reset position" can be controlled via the other Bits:

[2] Bit 0: Position array / Position increment array
Bit 1: Position array / Position increment array
Bit 2: Position array / Position increment array
Bit 3: Position array / Position increment array
Bit 4: Position array / Position increment array
Bit 5: Position array / Position increment array
Bit 6: Reference point run
Bit 7: Reference point
Bit 8: Teach-In
Bit 9: Quit Teach-In
Bit 10: Reset position

Parameter	Setting value / Description / Note	Parameter set	Available with option
P549	**Function PotentiometerBox**		**Always visible**

0 ... 13
[1]

In this parameter, a function is assigned to the potentiometer value output when control is via the potentiometer option. (An explanation can be found in the description of P400)

0 =	Off	**7 =**	Maximum frequency
1 =	Setpoint frequency	**8 =**	Actual PID frequency limited
2 =	Torque current limit	**9 =**	Actual PID frequency monitored
3 =	Actual frequency PID	**10 =**	Torque
4 =	Frequency addition	**11 =**	Lead torque
5 =	Frequency subtraction	**12 =**	No function
6 =	Current limit	**13 =**	Multiplication

P550	**Save dataset**		**Always visible**

0 ... 3
[0]

It is possible to save a dataset (parameter set 1 to 4) of the connected FI in the optional **ControlBox**. This is saved inside the Box in a non-volatile memory and can therefore be transferred to other NORDAC *750E* devices with the same databank version (compare P743).

Caution: In deviation from the statement in Section 3.2, Overview of technology units, this function can only be used in the **rright hand slot**. If no BUS module is used, the ControlBox can also be used in the right hand slot with the full range of functions.

0 = No function

1 = FI → ControlBox, the dataset is written from the connected FI to the ControlBox.

2 = ControlBox → FI, the dataset is written from the ControlBox to the connected FI.

3 = FI ←→ ControlBox, the FI dataset is exchanged with the ControlBox dataset. With this variant, no data is lost. It is continuously exchangeable.

Note: If parameterisation from old FI's must be loaded into new FI's, then the ControlBox must previously be written to by the new FI (=1). The dataset to be copied from the old FI can then be read out and copied to the new FI.

P551	**Drive profile**		**Always visible**

0 / 1

According to the option the relevant process data profiles can be activated with this parameter.
This parameter is only effective for plug-in technology modules (SK TU1-…)

System	CANopen *	DeviceNet	InterBus
Technology module	SK TU1-CAO	SK TU1-DEV	SK TU1-IBS
Setting			
0 =	USS protocol (Profile "Nord")		
1 =	DS402 profile	AC Drives profile	Drivecom profile

Note: With the use of the internal CANbus (CANnord) via the integrated customer interface (SK CU1-…), the settings in this parameter have no effect. The DS402 profile cannot be activated.

Parameter	Setting value / Description / Note	Parameter set	Available with option
P554	**Min. chopper trigger point**		**Always visible**
65 … 100 %	With this parameter it is possible to program a manual (peak) power limit for the brake resistor. The switch-on delay (modulation level) for the chopper can only rise to a certain maximum specified limit. Once this value has been reached, the inverter switches off the current to the resistor, irrespective of the level of the link voltage. The result would be an overvoltage switch-off of the FI.		
P555	**Chopper power limit**		**Always visible**
5 ... 100 % [100]	With this parameter it is possible to program a manual (peak) power limit for the brake resistor. The switch-on delay (modulation level) for the chopper can only rise to a certain maximum specified limit. Once this value has been reached, the inverter switches off the current to the resistor, irrespective of the level of the link voltage. The result would be an overvoltage switch-off of the FI.		
P556	**Brake resistor**		**Always visible**
3 ... 400 Ω [120]	Value of the brake resistance for the calculation of the maximum brake power to protect the resistor. IOnce the maximum continuous output (P557) has been reached, then an I^2t limit error (E003) is triggered.		
P557	**Brake resistor power**		**Always visible**
0.00... 100.00 kW [^{0}.00]	Continuous resistor output (nominal power) for the calculation of the maximum braking power. **0.00** = Monitoring disabled		
P558	**Magnetizing time**	**P**	**Always visible**
0/ 1/ 2...500 ms [1]	The ISD control can only function correctly if there is a magnetic field in the motor. For this reason, a DC current is applied before starting the motor. The duration depends on the size of the motor and is automatically set in the factory setting of the FI. For time-critical applications, the magnetizing time can be set or deactivated. **0 = Switched off** **1 = Automatic calculation** **2...500 = corresponding to set value** **Note:** Values that are too low can reduce the dynamics and torque development during start-up.		
P559	**DC run-on time**	**P**	**Always visible**
0.00 ... 5.0 s [0.50]	Following a stop signal and the braking ramp, a direct current is briefly applied to the motor to fully bring the drive to a stop. Depending on the inertia, the time for which the current is applied can be set in this parameter. The current level depends on the previous braking procedure (current vector control) or the static boost (linear characteristic).		
P560	**EEPROM storage**		**Always visible**
0 ... 1 [1]	**0 =** Changes to the parameter settings will be lost if the FI is disconnected from the mains supply. **1 =** All parameter changes are automatically written to the EEPROM and remain stored there even if the FI is disconnected from the mains supply. **NOTE:** If USS communication is used to implement parameter changes, it must be ensured that the maximum number of write cycles (100,000 x) in the EEPROM is not exceeded.		

7.8 PosiCon

For the description of parameter **P6xx** please refer to the instruction manual **BU 0710**.
These parameters are only visible if the option **SK XU1-POS** PosiCon positioning is used.

7.9 Information

Parameter	Setting value / Description / Note	Parameter set	Available with option
P700	**Actual error**		**Always visible**
0.0 ... 20.9	Actual error present. Further details in Section 8 Error messages. **ControlBox:** Descriptions of the individual error numbers can be found under Error Messages. **ParameterBox:** Errors are displayed in plain text, further information can be found under Error Messages.		
P701 .. - 01 ... .. - 05	**Last fault 1...5**		**Always visible**
0.0 ... 20.9	This parameter stores the last 5 faults. Further details in Section 8 Error messages. The ControlBox must be used to select the corresponding memory location 1-5 (Array), and confirmed using the ENTER key to read the stored error code.		
P702 .. - 01 ... .. - 05	**Freq. previous fault 1...5**		**Always visible**
-400.0 ... 400.0 Hz	This parameter stores the output frequency that was being delivered at the time the fault occurred. The values of the last 5 errors are stored. The ControlBox must be used to select the corresponding memory location 1-5 (Array), and confirmed using the ENTER key to read the stored error code.		
P703 .. - 01 ... .. - 05	**Current, previous fault 1...5**		**Always visible**
0.0 ... 500.0 A	This parameter stores the output current that was being delivered at the time the fault occurred. The values of the last 5 errors are stored. The ControlBox must be used to select the corresponding memory location 1-5 (Array), and confirmed using the ENTER key to read the stored error code.		
P704 .. - 01 ... .. - 05	**Voltage, previous fault 1...5**		**Always visible**
0 ... 500 V AC	This parameter stores the output voltage that was being delivered at the time the fault occurred. The values of the last 5 errors are stored. The ControlBox must be used to select the corresponding memory location 1-5 (Array), and confirmed using the ENTER key to read the stored error code.		
P705 .. - 01 ... .. - 05	**UZW, previous fault 1...5**		**Always visible**
0 ... 1000 V DC	This parameter stores the link voltage that was being delivered at the time the error occurred. The values of the last 5 errors are stored. The ControlBox must be used to select the corresponding memory location 1-5 (Array), and confirmed using the ENTER key to read the stored error code.		

Parameter	Setting value / Description / Note	Parameter set	Available with option
P706 **.. - 01** ... **.. - 05**	**Parameter set, last error 1...5**		**Always visible**
0 ... 3	This parameter stores the parameter set code that was active when the error occurred. Data for the previous 5 faults are stored. The ControlBox must be used to select the corresponding memory location 1-5 (Array), and confirmed using the ENTER key to read the stored error code.		
P707 **.. - 01** **.. - 02**	**Software version**		**Always visible**
0 ... 9999	This parameter shows the software and revision numbers in the FI. This can be significant when different FIs are assigned the same settings.	**... - 01** = Version number (3.1) **... - 02** = Revision number (1.0)	
P708	**Status of digital inputs**		**Always visible**
00 ... 3F (hexadecimal)	Displays the status of the digital inputs in hexadecimal code. This display can be used to check the input signals. Bit 0 = Digital input 1 *[far right]* Bit 1 = Digital input 2 Bit 2 = Digital input 3 Bit 3 = Digital input 4 Bit 4 = Digital input 5 Bit 5 = Digital input 6 Bit 6 = Digital input 7 (only with PosiCon) Bit 7 = Digital input 8 (only with PosiCon) Bit 8 = Digital input 9 (only with PosiCon) Bit 9 = Digital input 10 (only with PosiCon) Bit 10 = Digital input 11 (only with PosiCon) Bit 11 = Digital input 12 (only with PosiCon) Bit 12 = Digital input 13 (only with encoder) **ControlBox:** If there are only four digital inputs, the status is indicated in binary code. If the Customer Unit Multi I/O, Encoder or *PosiCon* is installed (Bit 4, 5 ...), the display is coded in hexadecimal.		

P709	**Voltage analog input 1**		**BSC**	**STD**	**MLT**
-10.0 ... 10.0 V	Displays the measured analog input value 1. (-10.0 ... 10.0V)				

P710	**Voltage analog output 1**			**STD**	**MLT**
0.0 ... 10.0V	Displays the value which is output from analog output 1. (0.0 ... 10.0V)				

P711	**Status multifunction relay**		**Always visible**
00 ... 11 (binary)	Displays the actual status of the signal relays. **Bit 0** = Relay 1 **Bit 1** = Relay 2 **Bit 2** = Relay 3 (only with PosiCon option) **Bit 3** = Relay 4 (only with PosiCon option)		

P712	**Voltage analog input 2**				**MLT**
-10.0 ... 10.0 V	Displays the measured analog input value 2. (-10.0 ... 10.0V)				

P713	**Voltage analog output 2**				**MLT**
0.0 ... 10.0V	Displays the value which is output from analog output 2. (0.0 ... 10.0V)				

P714	**Operating time**		**Always visible**
0.0 ... 9999 h	This parameter shows the time for which the FI was connected to the mains and was ready for operation.		

Parameter	Setting value / Description / Note	Parameter set	Available with option
P715	**Enablement time**		**Always visible**
0.0 ... 9999 h	This parameter shows the time for which the FI was enabled and supplied current to the output.		
P716	**Actual frequency**		**Always visible**
-400.0 ... 400.0 Hz	Displays the actual output frequency.		
P717	**Actual rotation speed**		**Always visible**
-9999...9999 rpm	Displays the actual motor speed calculated by the FI.		
P718 **... - 01** **... - 02** **... - 03**	**Actual setpoint frequency**		**Always visible**
-400.0 ... 400.0 Hz	Displays the frequency specified by the setpoint. (see also 10.1 Setpoint processing) **... - 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		
P719	**Actual current**		**Always visible**
0.0 ... 500.0 A	Displays the actual output current.		
P720	**Actual torque current**		**Always visible**
-500.0 ... 500.0 A	Displays the actual calculated torque-developing output current. The basis for calculation are the motor data P201 ... P209. -500.0 ... 500.0 A → negative values = generator, positive values = motor.		
P721	**Actual field current**		**Always visible**
-500.0 ... 500.0 A	Displays the actual calculated field current. The basis for calculation are the motor data P201 ... P209.		
P722	**Actual voltage**		**Always visible**
0 ... 500 V	Displays the actual AC voltage supplied by the FI output.		
P723	**Actual voltage component U_d**		**Always visible**
-500 ... 500 V	Displays the actual field voltage component.		
P724	**Actual voltage component U_q**		**Always visible**
-500 ... 500 V	Displays the actual torque voltage component.		
P725	**Actual cosφ**		**Always visible**
0.00 ... 1.00	Displays the actual calculated power factor of the drive.		
P726	**Apparent power**		**Always visible**
0.00 ... 300.00 kVA	Displays the actual calculated apparent power. The basis for calculation are the motor data P201 ... P209.		
P727	**Effective power**		**Always visible**
0.00... 300.00 kW	Displays the actual calculated effective power. The basis for calculation are the motor data P201 …P209.		
P728	**Mains voltage**		**Always visible**
0 ... 1000 V	Displays the actual mains voltage at the FI input.		
P729	**Torque**		**Always visible**
-400 ... 400 %	Displays the actual calculated torque. The basis for calculation are the motor data P201 ... P209.		

Parameter	Setting value / Description / Note	Parameter set	Available with option
P730	**Field**		**Always visible**
0 ... 100 %	Displays the actual field in the motor calculated by the inverter. The basis for calculation are the motor data P201 ... P209.		
P731	**Actual parameter set**		**Always visible**
0 ... 3	Displays the actual parameter set. **0 =** Parameter set 1 **1 =** Parameter set 2 **2 =** Parameter set 3 **3 =** Parameter set 4		
P732	**U phase current**		**Always visible**
0.0 ... 500.0 A	Displays the actual U phase current. **Note:** This value can, due to the measurement procedure used even with symmetrical output currents, deviate somewhat from the value in P719.		
P733	**V phase current**		**Always visible**
0.0 ... 500.0 A	Displays the actual V phase current. **Note:** This value can, due to the measurement procedure used even with symmetrical output currents, deviate somewhat from the value in P719.		
P734	**W phase current**		**Always visible**
0.0 ... 500.0 A	Displays the actual W phase current. **Note:** This value can, due to the measurement procedure used even with symmetrical output currents, deviate somewhat from the value in P719.		
P735	**Encoder speed**		**ENC** **POS**
-9999 ... +9999 rpm	Displays the actual speed supplied by the encoder.		
P736	**DC link current**		**Always visible**
0 ... 1000 V DC	Displays the actual link voltage.		
P740 ... - 01 **...** **... - 06**	**Process data bus In**		**Always visible**
0 ... FFFF hex	This parameter informs about the actual control word and the setpoints that are transferred via the bus systems.	**... - 01** = Control word **... - 02** = Setpoint 1 (P546) **... - 03** = Setpoint 1 High byte **... - 04** = Setpoint 2 (P547) **... - 05** = Setpoint 3 (P548) **... - 06** = Bus-In-Bit (P546-P548)	
P741 ... - 01 **...** **... - 06**	**Process data Bus Out**		**Always visible**
0 ... FFFF hex	This parameter provides information about the actual status word and the actual values that are transferred via the bus systems.	**... - 01** = Status word **... - 02** = Actual value 1 (P543) **... - 03** = Actual value 1 High byte **... - 04** = Actual value 2 (P544) **... - 05** = Actual value 3 (P545) **... - 06** = Bus-Out-Bit (P543-P545)	
P742	**Database version**		**Always visible**
0 ... 9999	Displays the internal database version of the FI.		
P743	**Inverter type**		**Always visible**
0.00 ... 250.00	Displays the inverter power in kW, e.g.**15**“ ⇒ FI with 15 kW nominal power.		

Parameter	Setting value / Description / Note	Parameter set	Available with option
P744	**Configuration**		**Always visible**
0 ... 9999	The option modules recognised by the frequency inverter are displayed in this parameter. The display with the ParameterBox is in plain text. The possible combinations are displayed in code in the ControlBox. The Customer Units in use are displayed on the right. If another Encoder module is installed, this is indicated in the second digit with a 1, the option *PosiCon* is indicated with a 2. No I/O **XX00** USS I/O **XX04** Encoder **01XX** Basic I/O **XX01** CAN I/O **XX05** *PosiCon* **02XX** Standard I/O **XX02** Profibus I/O **XX06** Multi I/O **XX03**		
P745 **... - 01** **... - 02** **... - 03**	**Module version**		**Always visible**
0 ... 32767	Software version of the integrated modules (only when own processor is present). Array level: [01] Technology unit [02] Customer Unit [03] Special Extension Unit		
P746 **... - 01** **... - 02** **... - 03**	**Module status**		**Always visible**
0000 ... FFFF hex	Status of the installed modules (if active) Array level: [01] Technology unit [02] Customer Unit [03] Special Extension Unit		
P747	**Inverter voltage range**		**Always visible**
1 / 2	Indicates the mains voltage range for which this device is specified. **1** = 200 … 240V **2** = 380 … 480V		
P750	**Overcurrent statistic**		**Always visible**
0 ... 9999	Number of overcurrent messages during the operating period.		
P751	**Overvoltage statistic**		**Always visible**
0 ... 9999	Number of overvoltage messages during the operating period.		

Parameter	Setting value / Description / Note	Parameter set	Available with option
P752	**Mains supply faults**		**Always visible**
0 ... 9999	Number of mains faults during the operating period.		
P753	**Overheating statistics**		**Always visible**
0 ... 9999	Number of overtemperature faults during the operating period.		
P754	**Parameter loss statistic**		**Always visible**
0 ... 9999	Number of parameters lost during the operating period.		
P755	**System faults statistic**		**Always visible**
0 ... 9999	Number of system errors during the operating period.		
P756	**Time out statistics**		**Always visible**
0 ... 9999	Number of Time out errors during the operating period.		
P757	**Customer faults statistic**		**Always visible**
0 ... 9999	Number of Customer Watchdog errors during the operating period.		
P758	**Statistic, *PosiCon* Error 1**		**Always visible**
0 ... 9999	Number of *PosiCon* errors during the operating period. See error E014		
P759	**Statistic, *PosiCon* Error 2**		**Always visible**
0 ... 9999	Number of *PosiCon* errors during the operating period. See error E015		

7.10 Parameter overview, User settings

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

Parameter No.		Name	Factory setting	Setting after commissioning			
				P 1	P 2	P 3	P 4
OPERATING DISPLAYS (7.2)							
P000		Operating display					
P001		Selection display	0				
P002		Factor display	1.00				
BASIC PARAMETERS (7.3)							
P100		Parameter set	0				
P101		Copy parameter set	0				
P102	(P)	Start-up time [s]	2.0 or 3.0				
P103	(P)	Braking time [s]	2.0 or 3.0				
P104	(P)	Minimum frequency [Hz]	0.0				
P105	(P)	Maximum frequency [Hz]	50.0				
P106	(P)	Ramp rounding [%]	0				
P107	(P)	Brake reaction time [s]	0.00				
P108	(P)	Disconnection mode	1				
P109	(P)	DC brake current [%]	100				
P110	(P)	DC braking time on	2.0				
P111	(P)	P factor torque limit [%]	100				
P112	(P)	Torque current limit [%]	401 (OFF)				
P113	(P)	Jog frequency [Hz]	0.0				
P114	(P)	Brake reaction time [s]	0.00				
MOTOR DATA / CHARACTERISTIC CURVE PARAMETERS (7.4)							
P200	(P)	Motor list	0				
P201	(P)	Nominal motor frequency [Hz]	*50.0 **				
P202	(P)	Nominal speed [rpm]	*1460 **				
P203	(P)	Nominal motor current [A]	*21.5 **				
P204	(P)	Nominal motor voltage [V]	*400 **				
P205	(P)	Nominal power [kW]	*11.00 **				
P206	(P)	Motor cos phi	*0.84 **				
P207	(P)	Motor circuit [star=0/delta=1]	*1 **				
P208	(P)	Stator resistance [Ω]	*1.08**				
P209	(P)	No load current [A]	*11.6 **				
P210	(P)	Static boost [%]	100				
P211	(P)	Dynamic boost [%]	100				
P212	(P)	Slip compensation [%]	100				
P213	(P)	Amplification ISD control [%]	100				
P214	(P)	Torque precontrol [%]	0				
P215	(P)	Boost precontrol [%]	0				
P216	(P)	Boost time precontrol [s]	0.0				

*) dependent on inverter power or P200

Parameter No.		Name	Factory setting	Setting after commissioning			
				P 1	P 2	P 3	P 4
CONTROL PARAMETERS (7.5) Encoder option							
P300	(P)	Servo Mode [Off / On]	0				
P301		Incremental encoder pulse number	6				
P310	(P)	Speed controller P [%]	100				
P311	(P)	Speed controller I [%/ms]	20				
P312	(P)	Torque current controller P [%]	200				
P313	(P)	Torque current controller I [%/ms]	125				
P314	(P)	Limit, torque current controller [V]	400				
P315	(P)	Field current controller P [%]	200				
P316	(P)	Field current controller I [%/ms]	125				
P317	(P)	Limit, field current controller [V]	400				
P318	(P)	Field weakening controller P [%]	150				
P319	(P)	Field weakening controller I [%/ms]	20				
P320	(P)	Field weakening limit [%]	100				
P321	(P)	Increase speed control I	0				
P325		Encoder function	0				
P326		Encoder conversion	1.00				
P327		Slip error limit	0				
P330		Digital input 13	0				
CONTROL TERMINALS (7.6)							
P400		Function Analog input 1	1				
P401		Analog On mode 1	0				
P402		Adjustment 1: 0% [V]	0.0				
P403		Adjustment 1: 100% [V]	10.0				
P404		Filter analog input 1 [ms]	100				
P405		Function Analog input 2	0				
P406		Analog On mode 2	0				
P407		Adjustment 2: 0% [V]	0.0				
P408		Adjustment 2: 100% [V]	10.0				
P409		Filter analog input 2 [ms]	100				
P410	(P)	Min. freq. aux. setpoint [Hz]	0.0				
P411	(P)	Max. freq. aux. setpoint [Hz]	50.0				
P412	(P)	PID process controller setpoint [V]	5.0				
P413	(P)	P-component PID control [%]	10.0				
P414	(P)	I-component PID control [%/ms]	1.0				
P415	(P)	D-component PID control [%ms]	1.0				
P416	(P)	Ramp time PI setpoint. [s]	2.0				
P417	(P)	Analog output offset 1 [V]	0.0				
P418	(P)	Function analog output 1	0				
P419	(P)	Standardisation analog output 1 [%]	100				
P420		Function of digital input 1	0 or 1				
P421		Function of digital input 2	0 or 2				
P422		Function of digital input 3	8				
P423		Function of digital input 4	4				
P424		Function of digital input 5	0				
P425		Function of digital input 6	0				

Parameter No.		Name	Factory setting	Setting after commissioning			
				P 1	P 2	P 3	P 4
P426	(P)	Emergency stop time [s]	0.1 or 1				
P427		Emerg. stop Fault	0				
P428	(P)	Automatic start-up [Off / On]	0				
P429	(P)	Fixed frequency 1 [Hz]	0.0				
P430	(P)	Fixed frequency 2 [Hz]	0.0				
P431	(P)	Fixed frequency 3 [Hz]	0.0				
P432	(P)	Fixed frequency 4 [Hz]	0.0				
P433	(P)	Fixed frequency 5 [Hz]	0.0				
P434	(P)	Relay 1 function	1				
P435	(P)	Stand. relay 1 [%]	100				
P436	(P)	Relay 1 hysteresis [%]	10				
P441	(P)	Relay 2 function	7				
P442	(P)	Relay 2 standardisation [%]	100				
P443	(P)	Relay 2 hysteresis [%]	10				
P447	(P)	Analog output offset 2	0.0				
P448	(P)	Function analog output 2	0				
P449	(P)	Standardisation analog output 2 [%]	100				
P458		Analog output mode	0				
P460		Watchdog time [s]	10.0				
P480		Function Bus I/O In Bits	0				
P481		Function Bus I/O Out Bits	0				
P482		Standardisation of Bus IO Out Bits	100				
P483		Hysteresis, Bus Out Bits [%]	10				

Parameter No.		Name	Factory setting	Setting after commissioning			
				P 1	P 2	P 3	P 4
EXTRA FUNCTIONS (7.7)							
P503		Master function output	0				
P504		Pulse frequency [kHz]	6.0				
P505	(P)	Abs. minimum frequency [Hz]	2.0				
P506		Automatic acknowledgement	0				
P507		PPO type	1				
P508		Profibus address	1				
P509		Interface	0				
P510		Aux. setpoint bus aux. setpoint	0 (auto)				
P511		USS baud rate	3				
P512		USS address	0				
P513		Telegram time-out [s]	0.0				
P514		CAN baud rate	4				
P515		CAN address	50				
P516	(P)	Skip frequency 1 [Hz]	0.0				
P517	(P)	Skip frequency range 1 [Hz]	2.0				
P518	(P)	Skip frequency 2 [Hz]	0.0				
P519	(P)	Skip frequency range 2 [Hz]	2.0				
P520	(P)	Flying start	0				
P521	(P)	Flying start resolution [Hz]	0.05				
P522	(P)	Flying start offset [Hz]	0.0				
P523		Factory setting	0				
P535		I^2t motor	0				
P536		Current limit	1.5				
P537		Pulse switch-off	1				
P538		Mains voltage Monitoring	3				
P539	(P)	Output monitoring	0				
P540		Rotation direction mode	0				
P541		Set relay	000000				
P542		Set analog output 1 … 2	0				
P543	(P)	Actual bus value 1	1				
P544	(P)	Actual bus value 2	0				
P545	(P)	Actual bus value 3	0				
P546	(P)	Bus setpoint 1	1				
P547	(P)	Bus setpoint 2	0				
P548	(P)	Bus setpoint 3	0				
P549		PotentiometerBox function	1				
P550		ParameterBox orders	0				
P551		Drive profile	0				
P554		Min. chopper trigger point [%]	65				
P555		P - chopper limit [%]	100				
P556		Brake resistance [Ω]	120				
P557		Brake resistance power [kW]	0				
P558	(P)	Magnetisation time [ms]	1				
P559	(P)	DC overshoot [s]	0.50				
P560		EEPROM storage	1				

Parameter No.		Name	Factory setting	Setting after commissioning			
				P 1	P 2	P 3	P 4
POSITIONING PARAMETERS (7.8) *PosiCon* option *(Details in BU 0710 EN)*							
P600	(P)	Position control [On / Off]	0				
P601		Actual position [rev]	-				
P602		Actual position setpoint [rev]	-				
P603		Actual position. diff. [rev]	-				
P604		Distance measurement system	1				
P605		Absolute encoder	15				
P606		Incremental encoder	6				
P607		Conversion 1..2	1				
P608		Reduction 1..2	1				
P609		Offset abs. Pos 1..2	0.000				
P610		Setpoint Mode	0				
P611	(P)	Position controller P	5.0				
P612	(P)	Pos. window	0.0				
P613	(P)	Position 1 ... 63	0.000				
P614	(P)	Position incr. 1 ... 6	0.000				
P615	(P)	Maximum pos.	0.000				
P616	(P)	Minimum pos.	0.000				
P617		Act. pos. check	0				
P618		Digital input 7	1				
P619		Digital input 8	2				
P620		Digital input 9	3				
P621		Digital input 10	4				
P622		Digital input 11	7				
P623		Digital input 12	8				
P624	(P)	Relay 3 function	2				
P625	(P)	Relay 3 hyst.	1.00				
P626	(P)	Rel. 3 comparison position	0				
P627	(P)	Relay 4 function	0				
P628	(P)	Relay 4 hyst.	1.00				
P629	(P)	Rel. 4 comparison position	0.000				
P630	(P)	Position slip error	0.00				
P631	(P)	Slip error. abs./inc.	0.00				

Parameter No.	Name	Actual status and displayed values				
INFORMATION (7.9), read only						
P700 (P)	Actual error					
P701	Last fault 1...5					
P702	Freq. previous fault 1...5 [Hz]					
P703	Current, last error 1...5 [A]					
P704	Voltage, previous fault 1...5 [V]					
P705	Link voltage, previous fault 1...5 [V]					
P706	P-set last error 1...5					
P707	Software version					
P708	Digital input status (hex)					
P709	Voltage, analog input 1 [V]					
P710	Voltage, analog output [V]					
P711	Relay status [binary]					
P712	Voltage, analog input 2 [V]					
P713	Voltage analog output 2 [V]					
P714	Operating period [h]					
P715	Enable period [h]					
P716	Actual frequency [Hz]					
P717	Actual speed [rpm]					
P718	Actual setpoint frequency 1..3 [Hz]					
P719	Actual current [A]					
P720	Actual torque current [A]					
P721	Actual field current [A]					
P722	Actual voltage [V]					
P723	Voltage-d [V]					
P724	Voltage-q [V]					
P725	Actual cos phi					
P726	Apparent power [kVA]					
P727	Effective power [kW]					
P728	Input voltage [V]					
P729	Torque [%]					
P730	Field [%]					
P731	Parameter set					
P732	U phase current [A]					
P733	V phase current [A]					
P734	W phase current [A]					
P735	Speed encoder [rpm]					
P736	Link voltage [V]					
P740	Process data bus In					
P741	Process data bus Out					
P742	Database version					
P743	Inverter type					
P744	Configuration					
P745	Module version 1...3					
P746	Module status 1...3					
P747	Inverter voltage range					

Parameter No.	Name	Actual status and displayed values
INFORMATION (7.9), read only		
P750	Stat. overcurrent	
P751	Stat. overvoltage	
P752	Stat. mains failure	
P753	Stat. overtemperature	
P754	Stat. parameter loss	
P755	Stat. system error	
P756	Stat. Time-out	
P757	Stat. customer error	
P758	Stat. pos. error 1	
P759	Stat. pos. error 2	

8 Error messages

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

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

1. By switching mains off and on again,
2. By an appropriately programmed digital input (P420 ... P425 = 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 error acknowledgement.

8.1 ControlBox display

The **ControlBox** (optional) 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. Further information on inverter status when errors occur can be found in parameters P702 to P706.

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

Table of possible error messages

Display		Fault	Cause ➢ Remedy
Group	Details in P700 / P701		
E001	**1.0**	**Inverter overtemperature**	Error signal from output stage module (static) ➢ Reduce ambient temperature (<50°C or <40°C , see also Section 10 Technical data) ➢ Check control cabinet ventilation
E002	**2.0**	**Motor overtemperature (PTC)** Only if a digital input is programmed (Function 13)	Motor temperature sensor has triggered ➢ Reduce motor load ➢ Increase motor speed ➢ Use external motor fan
	2.1	**Motor overtemperature (I^2t)** Only if I^2t motor (P535) is programmed.)	I^2t motor has triggered ➢ Reduce motor load ➢ Increase motor speed

Display		Fault	Cause ➢ Remedy
Group	Details in P700 / P701		
E003	**3.0**	Inverter overcurrent	I^2t limit has triggered e.g.. > 1.5 x I_n for 60s (see also P504) ➢ Continuous overload at inverter output
	3.1	**Overcurrent,** chopper	I^2t limit for braking resistance has triggered (please also note P555, P556, P557) ➢ Avoid overcurrent in brake resistance
	3.2	**Overcurrent derating** Monitoring 125%	Derating (power reduction) at f < 2 Hz ➢ 125% overcurrent for 50ms ➢ for fan drives: enable flying start (P520)
E004	**4.0**	**Overcurrent module**	Error signal from module (short duration) ➢ Short circuit or earthing at FI output ➢ Use external output choke (motor cable is too long)
E005	**5.0**	**Link circuit overvoltage**	DC link voltage is too high ➢ Reduce energy return by means of a braking resistance ➢ Extend braking time (P103) ➢ If necessary, set switch-off mode (P108) with delay (not for lifting equipment) ➢ Extend emergency stop time (P426)
	5.1	Mains overvoltage	Mains voltage is too high ➢ Please check (380V-20% ... 480V+10%), or 200/240V ± 10%
E006	**6.0**	**Link circuit undervoltage** (Charging error)	Inverter mains/link voltage too low ➢ Check mains voltage (380V-20% ... 480V+10%), or 200/240V ± 10%
	6.1	Mains undervoltage	
E007	**7.0**	**Mains phase error**	One of the three mains input phases was or is interrupted. ➢ Check mains phases (380V-20% ... 480V+10%), or 200/240V ± 10% ➢ All three mains phases must be symmetrical.
OFF		**Note:** 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		Fault	Cause ➢ Remedy
Group	Details in P700 / P701		
E008	**8.0**	**EEPROM parameter loss**	Error in EEPROM data ➢ Software version of the stored data set not compatible with the software version of the FI. **Note:** Faulty parameters are automatically reloaded (default data). ➢ EMC interferences (see also E020)
	8.1	Invalid inverter type	➢ EEPROM faulty
	8.2	External EEPROM copy error (ControlBox)	➢ Check ControlBox for correct position. ➢ ControlBox EEPROM faulty (P550 = 1).
	8.3	Customer unit type incorrect	
	8.4	Database number incorrect	
	8.7	Original and reflection are not identical	
E009	**---**	ControlBox error	SPI Bus faulty, no communication with ControlBox. ➢ Check ControlBox for correct position. ➢ Switch mains voltage off and on again.

Display		Fault	Cause ➢ Remedy
Group	Details in P700 / P701		
E010	**10.0**	**Telegram downtime** (P513)	Data transfer is faulty. Check P513. ➢ Check external Bus connection. ➢ Check bus protocol program process. ➢ Check Bus Master. ➢ Check 24V supply of internal CAN/CANopen Bus. ➢ Nodeguarding error (internal CANopen) ➢ *Bus Off* error (internal CAN Bus)
	10.2	External bus module telegram timeout	Telegram transfer is faulty. ➢ Check external connection. ➢ Check bus protocol program process. ➢ Check Bus Master.
	10.4	External bus module initialisation failure	➢ Check P746. ➢ Bus module not correctly plugged in. ➢ Check Bus module current supply.
	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 error	➢ Connection fault / error in the external component
E011	**11.0**	Reference voltage (SK CU1-...)	Reference voltage of customer unit faulty (10V / 15V). Only displayed if control is via the control terminals (P509 = 0/1). ➢ Check control terminals connection for short-circuit. ➢ I/O module may not be correctly engaged.
E012	**12.0**	Customer Watchdog	The Watchdog function is selected at a digital input and the impulse at the corresponding digital input is not present for longer than the time set in parameter P460 >Watchdog time<.

Display		Fault	Cause ➢ Remedy
Group	Details in P700 / P701		
E013	**13.0**	Encoder error	Encoder error (only for special extension unit Encoder/*PosiCon*) ➢ 5V Sense signal not present at encoder input
	13.1	Speed slip error	➢ The slip speed error limit was reached. ➢ Increase setting in P327.
	13.2	Slip error switch-off monitoring	The slip error monitoring was triggered; the motor could not follow the setpoint. ➢ Increase setting value for torque limit in P112.
E014	**14.0**	Slave check	*PosiCon* – Error 1 Further details can be found in the description **BU 0710**
	14.1	Host check	
	14.2	Reference point travel error	
	14.3	Absolute encoder voltage monitoring bit	
	14.4	Incremental encoder error	
	14.5	Position change and speed do not match	
	14.6	Slip error between absolute and incremental encoders	
	14.7	**Maximum position** exceeded	
	14.8	**Minimum position** undershot	
E015	**15.0**	Incorrect software version	*PosiCon* – Error 2 Further details can be found in the description **BU 0710**
	15.1	**Watchdog** PosiCon	
	15.2	Stack overflow PosiCon	
	15.3	Stack underflow PosiCon	
	15.4	Undefined opcode PosiCon	
	15.5	Protected instruction PosiCon	
	15.6	Illegal word access PosiCon	
	15.7	Illegal instruction access PosiCon	
	15.8	EPROM error PosiCon	
E016	**16.0**	Motor phase error	A motor phase is not connected. ➢ Check P539 ➢ Check motor connection
	16.1	Motor current monitoring for braking mode	Required exciting current not achieved at moment of switch-on. ➢ Check P539 ➢ Check motor connection

Display		Fault	Cause ➢ Remedy
Group	Details in P700 / P701		
E017	**17.0**	Customer unit change	New or missing customer unit. ➢ Switch mains voltage *off* and *on* again
E020	**20.0**	**External RAM error**	System error in program execution, triggered by EMC interference. Please comply with wiring guidelines in Section 2.6. Use additional external line filter. (Section 10.3 / 10.4 EMC) FI must be very well "earthed".
	20.1	Watchdog	
	20.2	Stack overflow	
	20.3	Stack underflow	
	20.4	Undefined opcode	
	20.5	Protected Instruction	
	20.6	Illegal word access	
	20.7	Illegal instruction access	
	20.8	EPROM error	
	20.9	Error Dual-Port-Memory	
	21.0	**NMI** error (not used by hardware)	
	21.1	**PLL** error	
	21.2	**ADU** Overrun	
	21.3	**PMI** Access Error	

9 Technical data

9.1 General Data

Function	Specification
Output frequency	0.0 ... 400.0Hz
Pulse frequency	3.0 ... 16.0kHz (Standard = 6kHz)
Typical overload capacity	150% for 60s, peak value 200% for 3.5s
Protective measures against	Overtemperature of the frequency inverter Over and under-voltage Short-circuit, earth fault Overload, idle running
Regulation and control	Sensorless current vector control (ISD) Field-orientated control Linear V/f characteristic curve
Setpoint input analog / PID input (optional)	0 ... 10V, ± 10V, 0/4 ... 20mA
Analog setpoint resolution	10 bit based on measurement range
Analog output	0 ... 10V scaleable (optional)
Setpoint consistency	analog < 1% digital < 0.02% (optional)
Motor temperature monitoring	I^2t-motor (UL/CUL certified), PTC / Bimetal switch (optional, not UL/CUL)
Ramp times	0 ... 320s
Control outputs (optional)	1 or 2 relays 28V DC / 230V AC, 2A
Interface (optional)	According to option: CANbus, CANopen, DeviceNet, Profibus DP, InterBus, AS interface RS 485 (standard)
Efficiency of frequency inverter	approx. 95%
Ambient temperature	0°C ... +50°C (S1 mode), 0°C ... +60°C (S3 mode) without condensation
Storage and transport temperature	-25°C ... +60/70°C
Long-term storage	See Section 10.6.1
Protection class	IP54 air cooled version / IP65 water cooled version
Electrical isolation	Control terminals (digital and analog inputs)
Max. installation altitude above sea level	Up to 1000m: No power reduction 1000...4000m: 1%/ 100m power reduction (up to 2000m overvoltage cat. 3) 2000...4000m: Only overvoltage category 2 is complied with, external overvoltage protection at the mains input is necessary
Waiting time between two mains switching cycles	60 sec for all devices in normal operating cycle
Ambient conditions	Transport (IEC 60721-3-2): Vibration: 2M2 Operation (IEC 60721-3-3): Vibration: 3M7; Climate: 3K3
Certifications	CE, UL, cUL

9.2 Electrical Data 230V

Size:		1		2	
Device type:	**SK 750E ...**	**-551-323-A**	**-751-323-A**	**-921-323-A**	**-112-323-A**
Nominal motor power (4-pole standard motor)	200V [kW]	5.5	7.5	9.2	11.0
	240V [hp]	7½	10	12.5	15
Mains voltage		3 AC 200 - 240V, ±10%, 47...63 Hz			
Output voltage		3 AC 0 - Mains voltage			
Nominal output current (rms)	[A]	23.0	30.0	35.0	45.0
Recommended brake resistance	(Accessories)	30 Ω	30 Ω	22 Ω	22 Ω
Minimum brake resistance		28 Ω	28 Ω	22 Ω	14 Ω
Typ. input current (rms)	[A]	30	40	50	60
Rec. mains fuse	slow-blowing	35 A	50 A	63 A	63 A
Type of ventilation		Fan cooling (temperature-controlled) Water cooled version			
Weight	Approx. [kg]	18		23	

9.3 Electrical data 400V

Size:		1				2	
Device type:	**SK 750E ...**	**-551-340-A**	**751-340-A**	**-112-340-A**	**-152-340-A**	**-182-340-A**	**-222-340-A**
Nominal motor power (4-pole standard motor)	400V [kW]	5.5	7.5	11.0	15.0	18.5	22.0
	460...480V [hp]	7½	10	15	20	25	30
Mains voltage		3 AC 380 - 480V, -20% / +10%, 47...63 Hz					
Output voltage		3 AC 0 - Mains voltage					
Nominal output current (rms)	[A]	11.5	15.5	23.0	30.0	35.0	45.0
Recommended brake resistance	(Accessories)	60 Ω	60 Ω	30 Ω	30 Ω	22 Ω	22 Ω
Minimum brake resistance		40 Ω	32 Ω	28 Ω	28 Ω	22 Ω	14 Ω
Typ. input current (rms)	[A]	17	21	30	40	50	60
Rec. mains fuse	slow-blowing	20 A	25 A	35 A	50 A	63 A	63 A
Type of ventilation		Fan cooling (temperature-controlled) Water cooled version					
Weight	Approx. [kg]	18				23	

9.4 Electrical data for UL/cUL certification

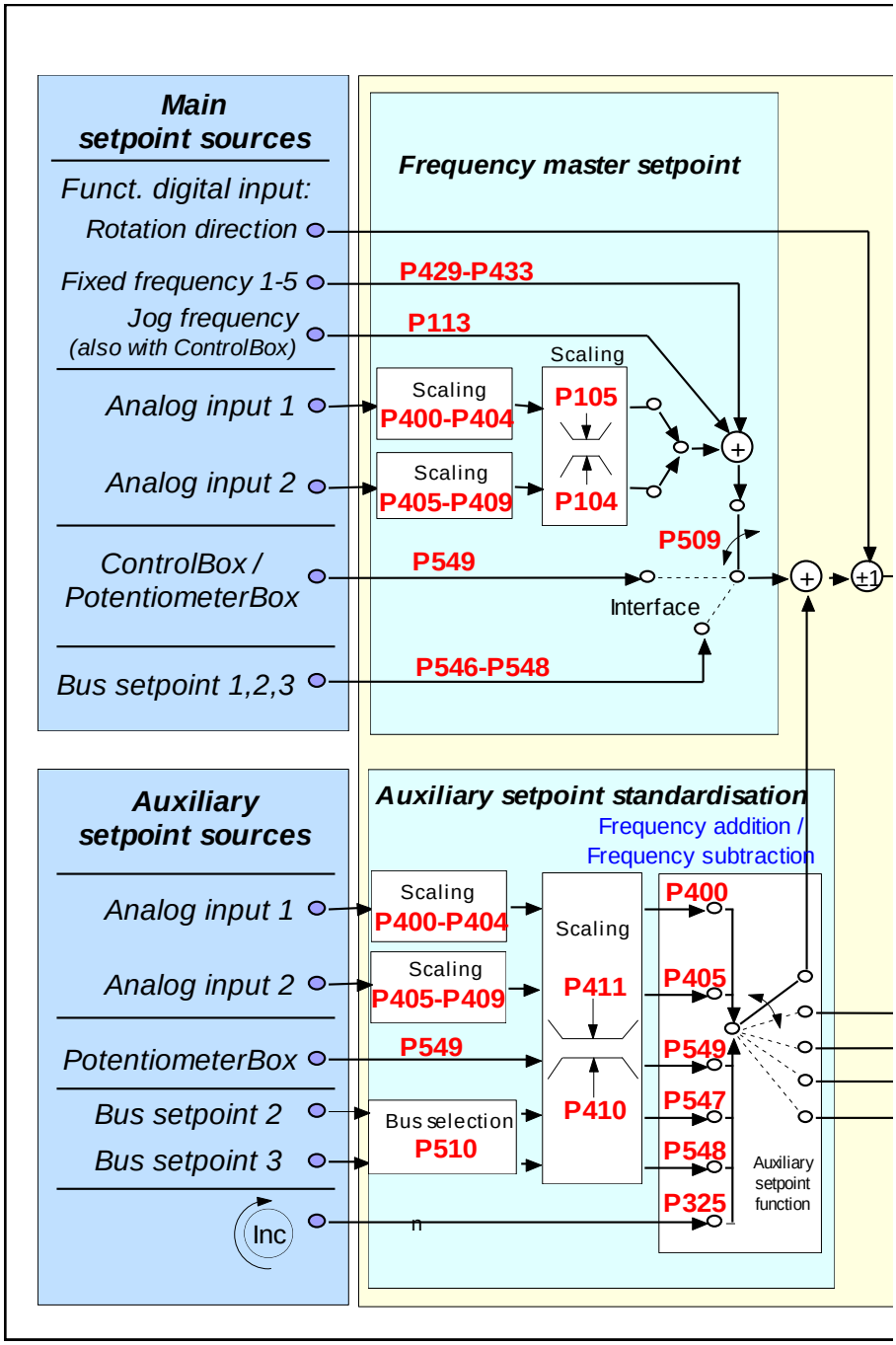
The data given in this section must be taken into account to comply with UL/cUL certification.

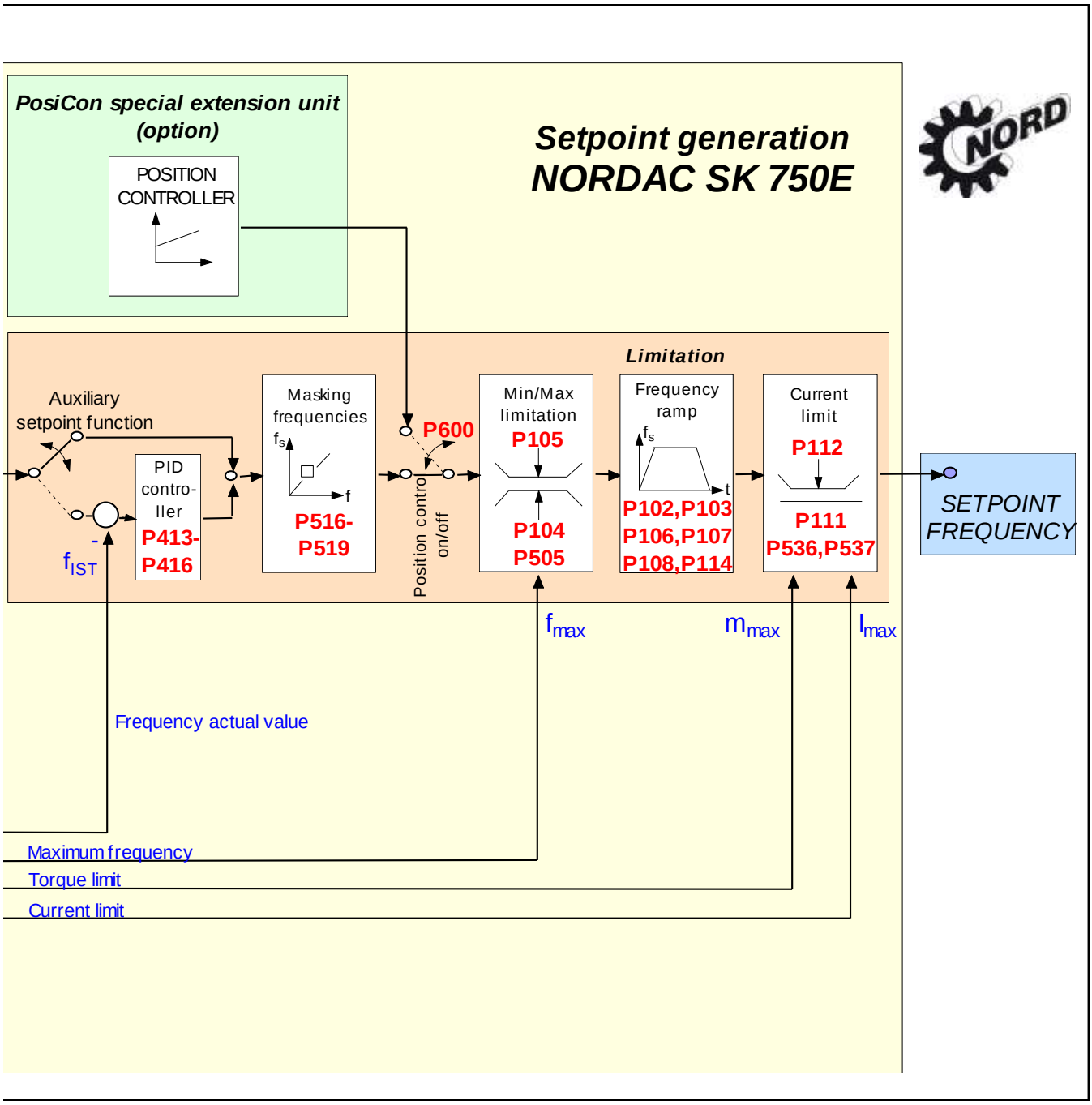
Size:	230V mains	1		2	
Device type:	**SK 750E ...**	**-551-323-A**	**-751-323-A**	**-921-323-A**	**-112-323-A**
Nominal motor power (4-pole standard motor)	200V [kW]	5.5	7.5	9.2	11
	240V [hp]	7½	10	12.5	15
FLA [A]	[A]	22	28	35	42
Rec. mains fuse	J Class Fuse	30A	40A	50A	60A

Size:	400V mains	1				2	
Device type:	**SK 750E ...**	**-551-340-A**	**-751-340-A**	**-112-340-A**	**-152-340-A**	**-182-340-A**	**-222-340-A**
Nominal motor power	380V [kW]	5.5	7.5	11	15	18.5	22
(4-pole standard motor)	460 … 480V [hp]	7½ hp	10 hp	15 hp	20 hp	25 hp	30 hp
FLA [A]	[A]	11	14	21	27	34	40
Rec. mains fuse	J Class Fuse	20A	25A	35A	50A	50A	60A

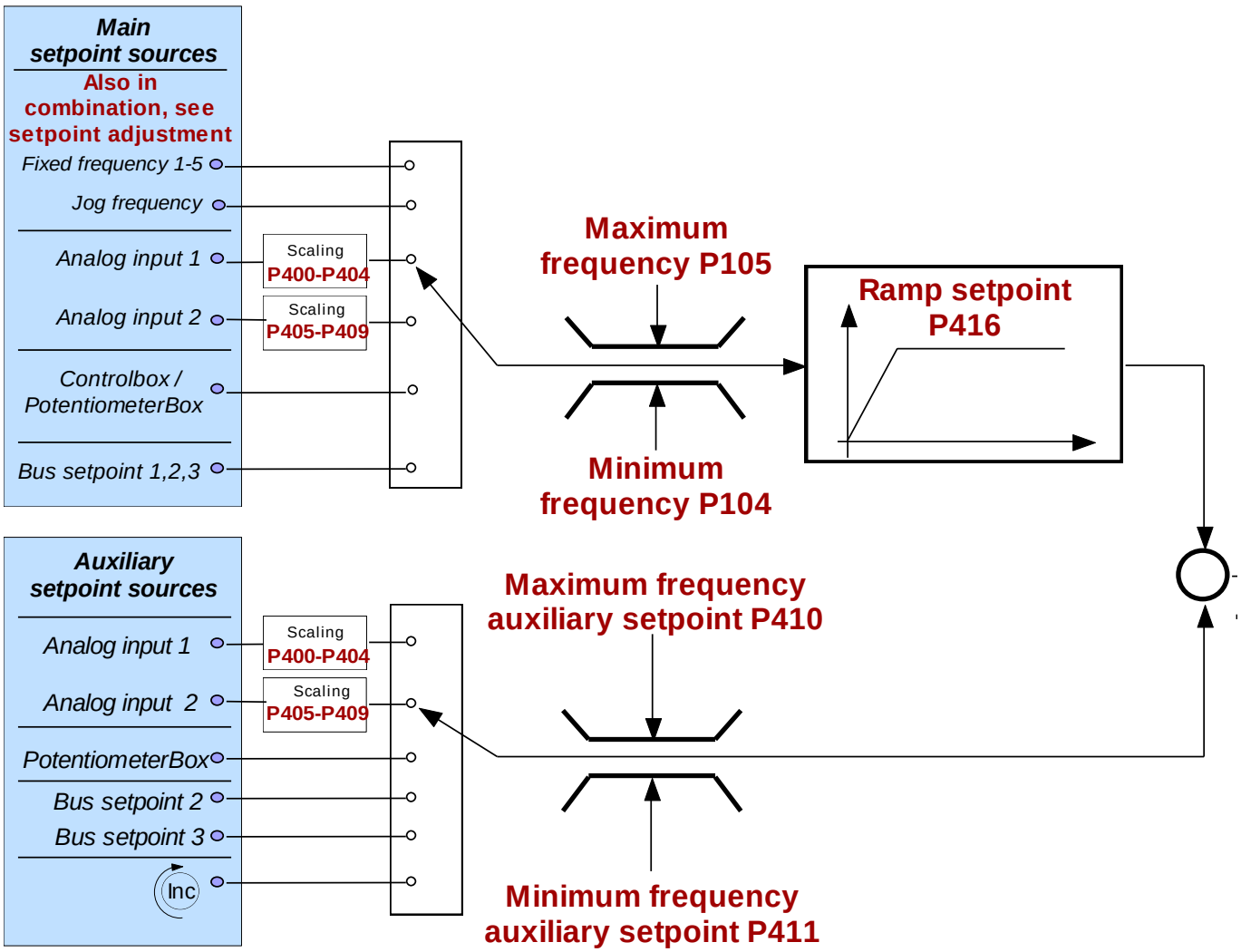
10 Additional information

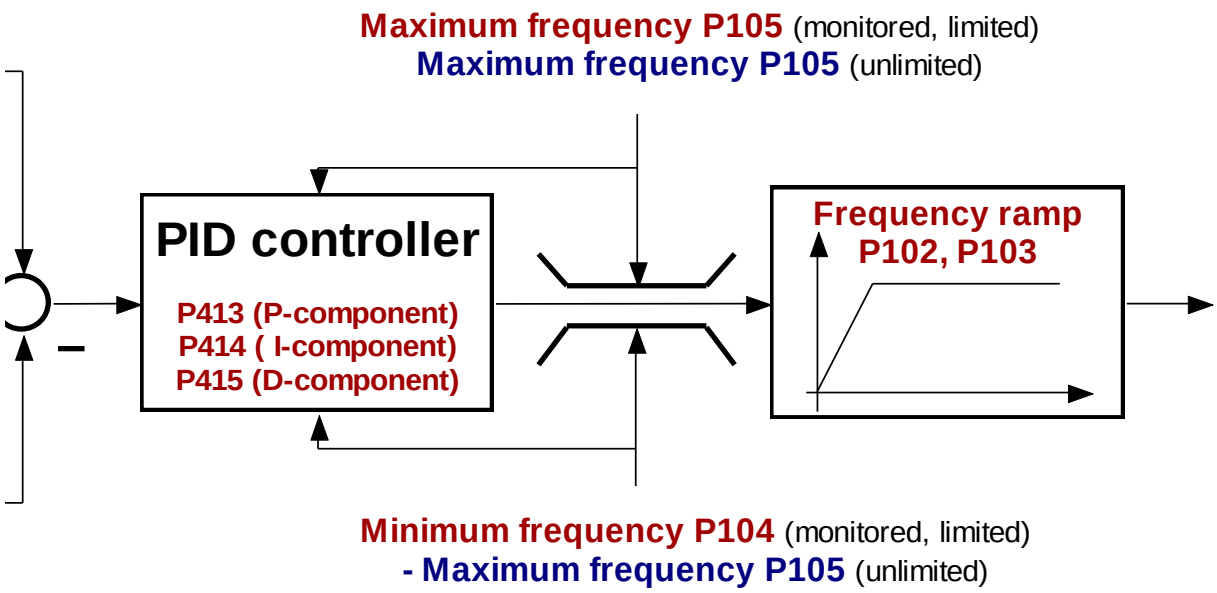
10.1 Setpoint processing in the SK 750E




PosiCon special extension unit (option)
POSITION CONTROLLER
Setpoint generation
NORDAC SK 750E
Limitation
Auxiliary setpoint function
PID contro-ller
P413-P416
Masking frequencies
P516-P519
P600
Position control on/off
Min/Max limitation
P105
P104
P505
Frequency ramp
P102,P103
P106,P107
P108,P114
Current limit
P112
P111
P536,P537
SETPOINT FREQUENCY
f_{IST}
f_{max}
m_{max}
I_{max}
Frequency actual value
Maximum frequency
Torque limit
Current limit

10.2 PID controller for the SK 750E




Maximum frequency P105 (monitored, limited)
Maximum frequency P105 (unlimited)
PID controller
P413 (P-component)
P414 (I-component)
P415 (D-component)
Frequency ramp
P102, P103
Minimum frequency P104 (monitored, limited)
- Maximum frequency P105 (unlimited)

10.3 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 provides the option of controlling any downstream drives with the master setpoint and readjusting using the PI controller.

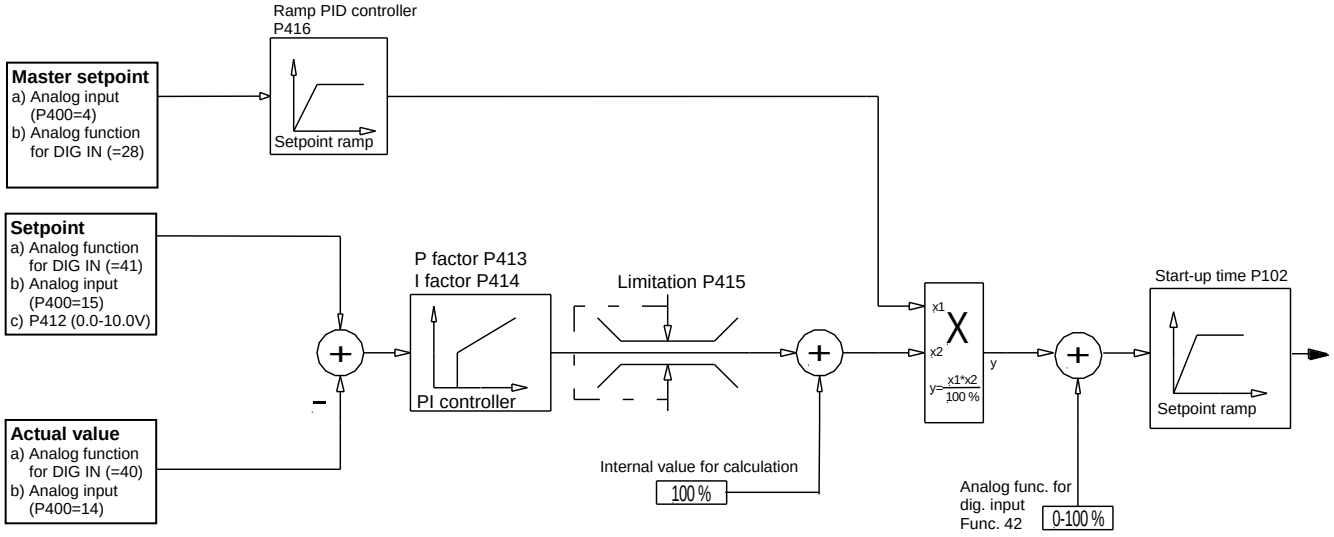
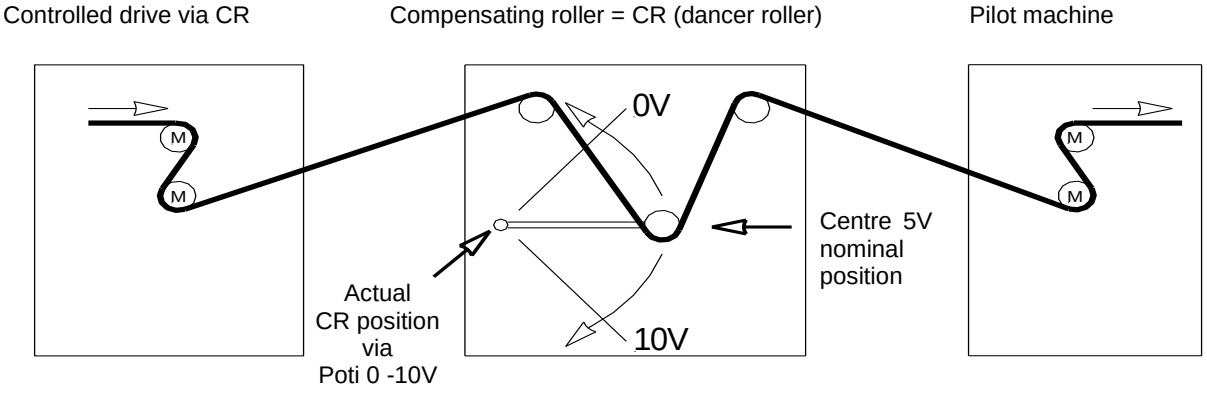
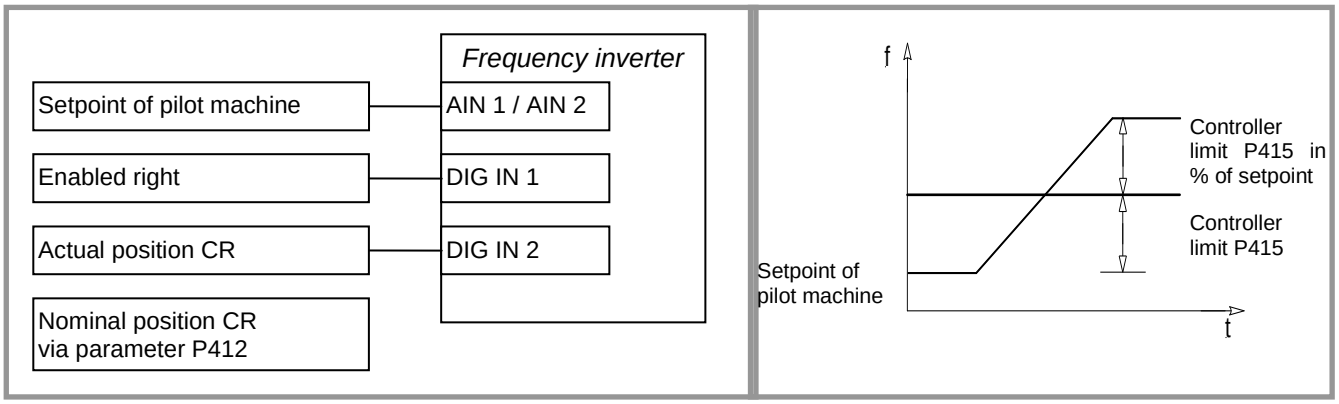


Fig.: Process controller flow diagram

10.3.1 Process controller application example





10.3.2 Process controller parameter settings

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

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

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

P400 (Funct. analog input) : **„4“** (frequency addition)

P411 (setpoint frequency) [Hz] : Setpoint frequency with 10 V at analog input 1
: Example **50 Hz**

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

P413 (P controller) [%] : Factory setting **10%** (adjust 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 match controller behaviour)

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

P421 (Funct. Digital input 2) : **„40“** actual value PID process controller

Alternatively, the 2nd analog input (P405=14) of the multi I/O can be used.

10.4 Electromagnetic compatibility (EMC)

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

1. *EC declaration of conformity*

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

2. *Technical documentation*

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

3. *EC Type test certificate* This method only applies to radio transmitter equipment.

   SK 750E frequency inverters only have an intrinsic function when they are connected to other equipment (e.g. with a motor). The basic units cannot therefore carry the CE mark which would confirm compliance with the EMC directive. Precise details are therefore given below about the EMC behaviour of this product, based on the proviso that it is installed according to the guidelines and instructions described in this documentation.

Class A, Group 2: General, for industrial environments

Complies with the EMC standard EMC standard for power drives EN 61800-3, for use in **secondary environments (industrial)** and if **not generaaly available**.

Class A, Group1: 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 50081-2 and EN 50082-2 for radiation and interference resistance in industrial environments.

Class B, Group1: 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 50081-1 and EN 50082-1 for radiation and interference resistance.

ATTENTION

NORDAC SK 700E Frequency inverters are **exclusively intended for commercial use**. They are therefore not subject to the requirements of the standard EN 61000-3-2 for radiation of harmonics.

10.5 EMC limit value classes

NOTE

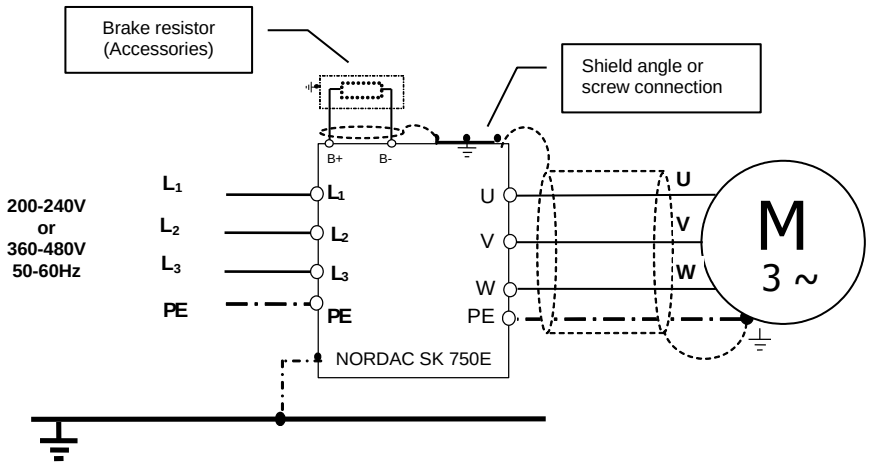
Please note that these limit value classes are only reached if the standard switching frequency (**4/6kHz**) is used and the length of the shielded motor cable does not exceed the limits. In addition, it is essential to use wiring suitable for EMC. (Cable gland)

The motor cable shielding must be applied on both sides (inverter shield angle and the metal motor terminal box). To comply with Class 3, cable shielding must also be applied at the entry to the housing of the device (EMC screw connection).

Device type **max. cable length, shielded**	**without** aux. line filter
SK 750E-551-323-A … SK 750E-112-323-A	Class A
	25m
SK 750E-551-340-A … SK 750E-222-340-A	Class A
	25m

Overview of standards that, as per EN 61800-3 (product standard for frequency inverters) are based on EN 50081; 510082 and must be complied with			
	Standard	**Limit value class**	
Emission of interference			
Cable-related emission	EN55011	"A"	"B" with filter
Radiated emission	EN55011	"A"	"B" with filter, built into control cabinet
Immunity from interference			
ESD, discharge of static electricity	EN61000-4-2	6kV (CD), 8kV (AD)	
EMF, high frequency electro-magnetic fields	EN61000-4-3	10V/m; 26-1000MHz	
Burst on control cables	EN61000-4-4	1kV	
Burst on mains and motor cables	EN61000-4-4	2kV	
Surge (phase-phase / phase-ground)	EN61000-4-5	1kV / 2kV	
Cable-led interference due to high frequency fields	EN 61000-4-6	10V, 0.15 – 80MHz	
Voltage fluctuations and drops	EN61000-2-1	+10%, -15%; 90%	
Voltage asymmetries and frequency changes	EN61000-2-4	3%; 2%	

Wiring recommendations



10.6 Maintenance and servicing information

10.6.1 Maintenance Instructions

In normal use, NORDAC SK 750E frequency inverters are maintenance free. Please note the "general data" in Section 9.1.

Dusty environments

If the frequency converter is being used in a dusty environment, the cooling surfaces should be regularly cleaned with compressed air. If air intake filters have been built into the control cabinet, then these should also be regularly cleaned or replaced.

Long-term storage

The frequency inverter must be connected to the supply network for at least 60 min at regular intervals.

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

If a device is to be stored for longer than one year, it must be recomissioned with the aid of an adjustable transformer before normal connection to the mains.

Long-term storage for 1 - 3 years

30 min with 25% mains voltage

30 min with 50% mains voltage

30 min with 75% mains voltage

30 min with 100% mains voltage

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

120 min with 25% mains voltage

120 min with 50% mains voltage

120 min with 75% mains voltage

120 min with 100% mains voltage

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

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

10.6.2 Repair information

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

Repairs

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

NORD Electronic DRIVESYSTEMS GmbH

Tjüchkampstraße 37
26605 Aurich, Germany

For queries about repairs, please contact:

Getriebebau NORD GmbH & Co. KG

Tel.: 04532 / 401-515
Fax: 04532 / 401-555

If a frequency inverter is sent in for repair, no liability can be accepted for any added components, e.g. such as mains cables, potentiometer, external displays, etc.!

Please remove all non-original parts from the frequency inverter.

NOTE

If possible, the reason for returning the component/device should be stated. If necessary, at least one contact for queries should be stated.
This is important in order to keep repair times as short and efficient as possible.
On request you can also obtain a suitable return goods voucher from Getriebebau NORD.
Unless otherwise agreed, the device is reset to the factory settings after inspection or repair.

Internet information

You can also find the comprehensive manual in German and in English on our Internet site.
www.nord.com

11 Keyword index

NORD Drivesystems | Global vor Ort

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NORD
DRIVESYSTEMS

Part No. 607 7502 / 3311