

INTELLIGENT DRIVESYSTEMS, WORLDWIDE SERVICES



BU 0135 – en

NORDAC® START (SK 135E / SK 175E)

Users Manual for Motor Starters



Documentation

Title: BU 0135
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Series: SK 1x5E
Device series: SK 135E, SK 175E
Device types: SK 1x5E-301-340-A
 SK 1x5E-751-340-A

Version list

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Table 1: Version list

Copyright notice

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1 General

The SK 1x5E series is based on the tried and tested NORD platform. The devices are characterised by their compact design and their optimum operational characteristics, and have uniform parametrisation.

Due to dual phase control, not only a pure motor start, but also a soft start is possible. The phase control process was selected so that the resulting harmonic torques are kept as low as possible. A comprehensive spectrum of monitoring functions rounds off the range.

Due to the numerous setting options, any three-phase synchronous motor can be controlled.

The motor starter is basically intended for a three-phase mains connection. The power range is from 0.25 kW to 7.5 kW.

This series of devices can be adapted to individual requirements by means of modular assemblies.

This manual is based on the device software specified in the version list (see P707). If the motor starter uses a different software version, this may cause differences. If necessary, the current manual can be downloaded from the Internet (<http://www.nord.com/>).

Additional descriptions exist for optional functions and bus systems (<http://www.nord.com/>).

Information

Accessories

Changes may also be made to the accessories that are mentioned in the manual. Current details of these are included in separate data sheets, which are listed under www.nord.com under the heading *Documentation* → *Manuals* → *Electronic drive technology* → *Techn. Info / Data sheet*. The data sheets available at the date of publication of this manual are listed by name in the relevant sections (TI ...).

The different versions of the device series also result in different functionality (e.g.: with integrated AS Interface or with integrated PROFIBUS DP interface).

In the simplest configuration, all of the most important parameters can be set using up to four potentiometers and four DIP switches, even without a PC or a control unit. LEDs are provided for the diagnostics of the operating status. The use of a control module is therefore not absolutely necessary.

Installation directly on a motor is typical of this device series. Alternatively, optional accessories are also available for mounting the devices close to the motor, e.g. on the wall or on a machine frame.

In order to have access to all parameters, the internal RS232 interface (access via RJ12 connection) can be used. Access to the parameters takes place via an optional SimpleBox or ParameterBox, for example.

The parameter settings modified by the owner/operator must be saved in the Flash memory of the device (**P550**). Otherwise the changed parameter settings would be lost when the device was switched off.

1.1 Overview

This manual describes all of the possible functions and equipment. The equipment and functionality are limited depending on the type of device. Type SK 175E devices have the maximum configuration level.

Basic characteristics

- 2 digital inputs
- 2 digital outputs
- Separate temperature sensor input (TF+/TF-)
- Actuation and connection of an electromechanical brake

- Motor overload protection (I^2t triggering characteristic in accordance with EN 60947) → This means that a motor protection switch is not needed, merely a pre-fuse!
- Mains and motor phase failure monitoring
- Flux monitoring (minimum current monitoring)
- Automatic phase sequence detection
- Can be installed directly on, or close to the motor.
- Permissible ambient temperature -25°C to 50°C (please refer to technical data)
- Integrated EMC line filter for limit curve B
- 4x DIP switches and four potentiometers for configuration
- LEDs for diagnostics
- RS232 interface via RJ12 plug

Additional features

The devices are available without an integrated field bus and alternatively in both versions (-ASI) with *integrated AS Interface* and (-PBR) with *integrated PROFIBUS DP*.

Differences between the individual versions (SK 135E / SK 175E) are summarised in the following table and will be described in this manual.

Feature	135E	175E-ASI	175E-PBR
Soft start function	x	x	x
Reversing function	x	x	x
Two additional digital inputs		x	x
AS interface (4I / 4O)		ASI	
PROFIBUS-DP (4I / 4O)			PBR

Table 2: Additional features

Option modules

Option modules are used to extend the functionality of the device.

These options are available as an installation variant, the so-called SK CU4-... customer unit, and also as an attachment variant, the so-called SK TU4-... technology unit. As well as the mechanical differences, the installation and attachment variants also have some functional differences.

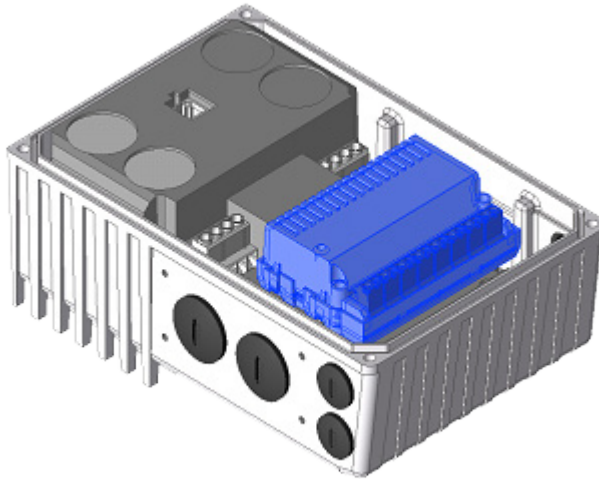


Figure 1: Device with internal SK CU4-...



Figure 2: Device with external SK CU4-...

Attachment variant

The **external technology unit (Technology Unit SK TU4-...)** is externally attached to the device and is therefore easy to access.

A technology unit basically requires the use of a suitable SK TI4-TU-... connection unit.

The power supply and signal lines are connected using the screw clamps of the connection unit. Depending on the version, additional connections for connectors (e.g. M12 or RJ45) may be available.

The optional wall mounting kit SK TIE4-WMK-TU also allows the technology units to be mounted away from the starter.

Built-in variant

The **internal customer unit (Customer Unit, SK CU4-...)** is integrated in the device. The power supply and signal lines are connected using screw clamps.

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 delivery

NOTICE


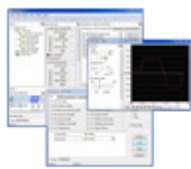

Defect in the device









Use of unapproved accessories and options (e.g. options from other device series (SK CSX-0)) may result in defects of the interconnected components.


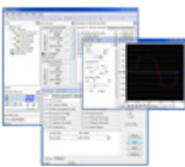

Only use options and accessories which are explicitly intended for use with this device and are stated accordingly in this manual.

- Standard version:*
- IP55 version of device (optionally IP66, IP69K)
 - Operating instructions as PDF file on CD ROM including NORD CON, (PC parametrisation software)

Available accessories:

	Designation	Example	Description
Control and parametrisation options	Parametrisation units for temporary connection to the device, handheld Plus connection extension SK TIE4-RS485-RS232 (Material number 275274603)		For commissioning, parametrisation and control of the device. Model SK PAR-3H, SK CSX-3H (📖 Paragraph 3.1 "Control and parametrisation options ")
	NORD CON MS Windows® - based software		For commissioning, parametrisation and control of the device. Refer to www.nord.com NORD CON (Free download)
IO extension	Internal signal converter		Customer unit for installation in the device for converting bipolar analogue signals to unipolar analogue signals, e.g. digital signals on relays Model SK CU4-REL- ... 📖 Section 3.2.1 "Internal customer interfaces SK CU4-... (installation of modules)"

Power supply	Internal power supplies		Power supply for installation in the device for generating the low control voltage (24 V DC). Model SK CU4-24V- ... 📖 Section 3.2.1 "Internal customer interfaces SK CU4-... (installation of modules)"
	External power supplies		Technology unit for attaching to the device or alternatively for wall mounting (wall mounting kit required) for generating the low control voltage (24 V DC). Model SK TU4-24V- ... 📖 Section 3.2.2 "External technology units SK TU4-... (module attachment)"
Switch	Switch (L – OFF – R)		Switch for attaching to the device for ease of controlling the device Model SK TIE4-SWT 📖 Section 3.1 "Control and parametrisation options "
	Maintenance switch (0 – I)		Technology unit for attaching to the device or alternatively for wall mounting (wall mounting kit required) for reliably disconnecting the device from the power supply. Model SK TU4-MSW- ... 📖 Section 3.2.2 "External technology units SK TU4-... (module attachment)"
Plug connector	Power connection (for power input, power output, motor output)		AC Power connector for attaching to the device for making a detachable connection for supply lines (e.g. mains supply line) Model SK TIE4-... 📖 Section 3.2.3.1 "Plug connectors for power connections"
	Control line connection		System connector (M12) for attaching to the device, for making a detachable connection for control lines Model SK TIE4-... 📖 Section 3.2.3.2 "Plug connectors for control connection"
Adapter	Adapter cable		Different adapter cables (Link)
	Mounting Adapter		Various adapter kits for attaching the device to different motor sizes 📖 Section 2.1.1.1 "Adapters for different motors"

Miscellaneous	Internal fuse module		<p>Customer unit for installation in the device, for protecting the individual device in the event of "Daisy Chain" cabling (looping through of mains voltage from one device to the next).</p> <p>Model SK CU4-FUSE- ...</p> <p>📖 Section 3.2.1 "Internal customer interfaces SK CU4-... (installation of modules)"</p>
Software (Free download)	<p>NORD CON MS Windows® - based software</p>		<p>For commissioning, parametrisation and control of the device.</p> <p>Refer to www.nord.com NORD CON</p>
Software (Free download)	ePlan macros		<p>Macros for producing electrical circuit diagrams</p> <p>Refer to www.nord.com ePlan</p>

1.4 Safety, installation and operating instructions

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

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

These safety instructions must be kept in a safe place!

1. General

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

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

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

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

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

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

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

The device and any power plug connectors must not be disconnected while a voltage is applied to the device. Failure to comply with this may cause arcing, which in addition to the risk of injury, also results in a risk of damage or destruction of the device.

The fact that the status LED or other indicators are not illuminated does not indicate that the device has been disconnected from the mains and is without voltage.

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

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

All work on the device, e.g. transportation, installation, commissioning and maintenance work must be carried out by qualified experts (observe IEC 364 or CENELEC HD 384 or DIN VDE 0100 and IEC 664 or DIN VDE 0110 and national accident prevention regulations). In particular, the general and regional installation and safety regulations for work on high voltage systems (e.g. VDE) must be complied with as must the regulations concerning correct use of tools and the use of personal protection equipment.

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

Further information can be found in this documentation.

2. Qualified experts

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

Furthermore, the device and the associated accessories may only be installed and started up by qualified electricians. An electrician is a person who, because of their technical training and experience, has sufficient knowledge with regard to

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

3. Correct purpose of use – general

The Motor starters are devices for industrial and commercial plants for operating three-phase asynchronous motors with squirrel-cage rotors.

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

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

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

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

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

When installed in machines, the devices must not be commissioned (i.e. commencement of proper use) until it has been ensured that the machine fulfils the provisions of EC Directive 2006/42/EC (Machinery Directive); EN 60204-1 must also be complied with.

Commissioning (i.e. start-up of proper use) is only permitted if the EMC directive (2014/30/EU) has been complied with.

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

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

4. Phases of life

Transport, storage

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

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

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

Installation and assembly

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

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

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

Electrical Connection

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

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

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

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

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

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

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

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

Set-up, troubleshooting and commissioning

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

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

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

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

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

Operation

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

All covers must be kept closed during operation.

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

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

Maintenance, repair and decommissioning

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

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

Disposal

The product and its parts and accessories must not be disposed of as domestic waste. At the end of its life, the product must be properly disposed of according to the local regulations for industrial waste. In particular, this product contains integrated semiconductor circuits (PCBs and various electronic components, including high power capacitors). In case of incorrect disposal there is a risk of formation of toxic gases, which may cause contamination of the environment and direct or indirect injuries (e.g. chemical burns). In the case of high power capacitors, there is also a risk of explosion, with the associated risk of injury.

5. Potentially explosive environment (ATEX, EAC Ex)

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

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

- Only persons who are qualified, i.e. trained and authorised for all assembly, service, commissioning and operation work on association with explosion hazard environments may work with the devices described here (including the motors, geared motors, any accessories and all connection technology).
- Explosive concentrations of dust may cause explosions if ignited by hot or sparking objects. Such explosions may cause serious or fatal injuries to persons or severe material damage.






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

1.5 Warning and hazard information

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

1.5.1 Warning and hazard information on the product

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

Symbol	Supplement to symbol ¹⁾	Meaning
	DANGER Device is live > 5min after removing mains voltage	<p>⚠ Danger Electric shock</p> <p>The device contains powerful capacitors. Because of this, there may be a hazardous voltage for more than 5 minutes after disconnection from the mains.</p> <p>Before starting work, check that the device is free of voltage at all power contacts by means of suitable measuring equipment.</p>
		It is essential to read the manual in order to prevent hazards!
		<p>⚠ CAUTION Hot surfaces</p> <p>The heat sink and all other metal components as well as the surfaces of plug connectors may heat up to temperatures in excess of 70°C.</p> <ul style="list-style-type: none"> • Danger of injury due to local burns on contact. • Heat damage to adjacent objects <p>Allow sufficient cooling time before starting work on the device. Check the surface temperatures with suitable measuring equipment. Maintain an adequate distance to adjacent components or provide protection against contact.</p>
		<p>NOTICE EDS</p> <p>The device contains electrostatically sensitive components, which can be easily damaged by incorrect handling.</p> <p>Avoid all contact (indirect contact by tools or similar, or direct contact) with PCBs and their components.</p>




1) Texts are written in English.

Table 3: Warning and hazard information on the product

1.5.2 Warning and hazard information in the document

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

The warning and hazard information is classified as follows according to the risk and the severity of the resulting injuries.

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

1.6 Standards and approvals

All devices of the entire SK 200E series comply with the standards and directives listed below.





Approval	Directive	Applied standards	Certificates	Code
CE (European Union)	Low Voltage Directive 2014/35/EU	EN 60947-1 EN 60529	C310800	
	EMC 2014/30/EU	EN 60947-4-2		
	RoHS 2011/65/EU	EN 50581		
UL (USA)		UL 60947-1 UL 60947-4-2	E365221	
CSA (Canada)		C22.2 No.UL 60947-1-13 C22.2 No.UL 60947-4-2-14	E365221	
C-Tick (Australia)			N 23134	
EAC (Eurasia)	TR CU 004/2011, TR CU 020/2011	IEC 60947-1 IEC 60947-4-2	TC RU C- DE.A132.B.01859	

Table 4: Standards and approvals

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

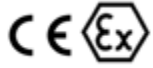

Approval	Directive	Applied standards	Certificates	Code
ATEX <i>(European Union)</i>	ATEX 2014/34/EU	EN 60079-0 EN 60079-31	C432810	
	EMC 2014/30/EU	EN 61800-5-1 EN 60529		
	RoHS 2011/65/EU	EN 61800-3 EN 50581		
EAC Ex <i>(Eurasia)</i>	TR CU 012/2011	IEC 60079-0 IEC 60079-31	TC RU C-DE.AA87.B.01108	

Table 5: Standards and approvals for explosion hazard environments

1.6.1 UL and CSA approval

File No. E365221

Categorisation of protective devices approved by the UL according to United States Standards for the inverters described in this manual is listed below with essentially the original wording. The categorisation of individually relevant fuses or circuit breakers can be found in this manual under the heading "Electrical Data". All devices include motor overload protection.

(📖 section 7.2 "Electrical data")

i Information

Group fuse protection

The devices can basically be protected as a group via a common fuse (details in the following). The adherence of the total currents and the use of the correct cables and cable cross-sections must be taken into account when doing this. If the device or devices is/are being installed close to the motor, this also applies to the motor cable.

UL / CSA conditions according to the report

i Information

"Use 60/75°C copper field wiring conductors."

„These products are intended for use in a pollution degree 2 environment“

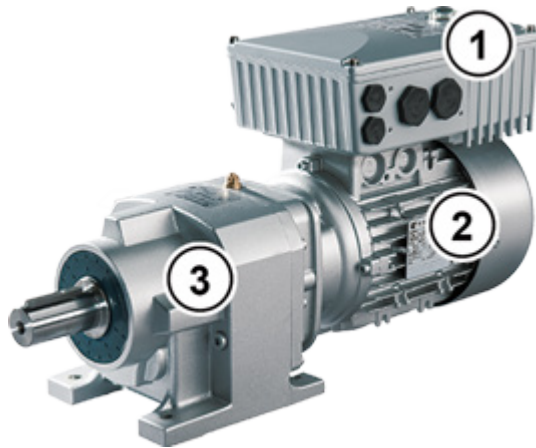
"The device has to be mounted according to the manufacturer instructions."

Size	valid	description
1 - 2	generally valid	<p>“Suitable For Use On A Circuit Capable Of Delivering Not More Than 100 000 rms Symmetrical Amperes, 500 Volts Maximum” “When Protected by class RK5 Fuses or faster, rated _____ Amperes, and 500 Volts”, as listed in ¹⁾.</p> <p>“Suitable For Use On A Circuit Capable Of Delivering Not More Than 100 000 rms Symmetrical Amperes, 500 Volts Maximum” “When Protected by High-Interrupting Capacity, Current Limiting Class CC, G, J, L, R, T, etc., as listed in ¹⁾.</p> <p>“Suitable For Use On A Circuit Capable Of Delivering Not More Than 65 000 rms Symmetrical Amperes, 480 Volt maximum”, “When Protected by Circuit Breaker (inverse time trip type) in accordance with UL 489, rated _____ Amperes, and 480 Volts”, as listed in ¹⁾, Rated short circuit current min. 65 kA</p> <p>“Suitable For Use On A Circuit Capable Of Delivering Not More Than 100 000 rms Symmetrical Amperes, 500 Volts Max., When Protected by internal device SK CU4-FUSE”</p>
	Motor group installation (Group fusing):	<p>“Suitable for motor group installation on a circuit capable of delivering not more than 100 000 rms symmetrical amperes, 500 V max” “When Protected by class RK5 Fuses or faster, rated 30_Ampere and 500 Volts.”</p> <p>“Suitable for motor group installation on a circuit capable of delivering not more than 100 000 rms symmetrical amperes, 500 V max” “When Protected by High-Interrupting Capacity, Current Limiting Class CC, G, J, L, R, T, etc. Fuses rated 30 Amperes”</p> <p>“Suitable for motor group installation on a circuit capable of delivering not more than 65 000 rms symmetrical amperes, 480 V max” “When Protected by Circuit Breaker (inverse time trip type) in accordance with UL 489, rated 30 Amperes and 500 Volts, 480 V min”</p>
	differing data CSA:	None differing data → equal to UL

¹⁾ (☞ 7.2)

1.7 Type code / nomenclature

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

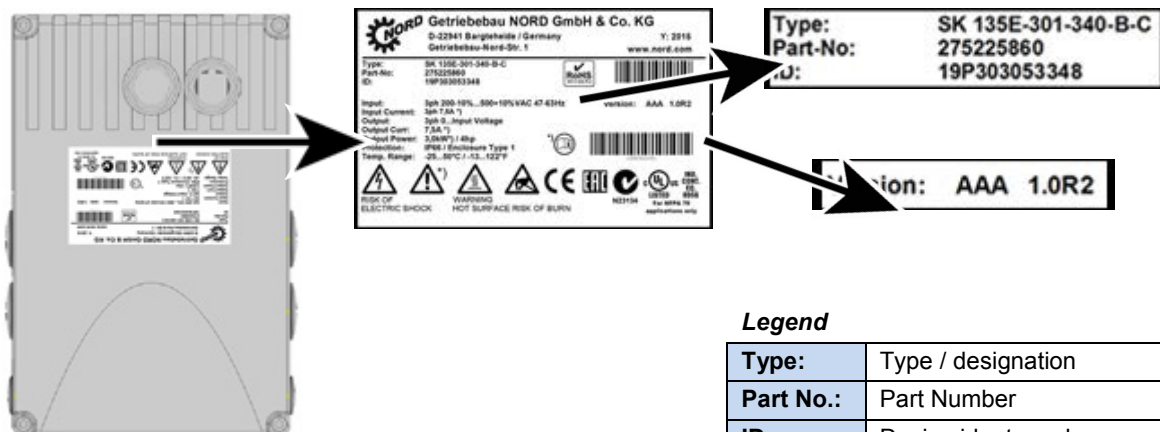


1	Motor starters
2	Motor
3	Gear units

5	Optional module
6	Connection unit
7	Wall-mounting kit

1.7.1 Name plate

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



Type:	SK 135E-301-340-B-C
Part-No.:	275225860
ID:	19P303053348

Version:	AAA 1.0R2
-----------------	-----------

Legend

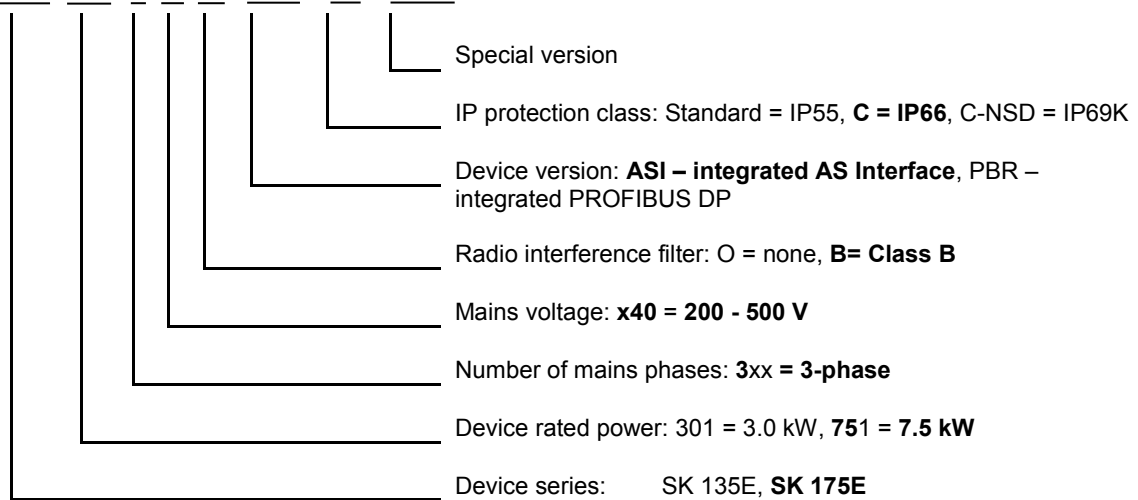
Type:	Type / designation
Part No.:	Part Number
ID:	Device ident number

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

Figure 3: Name plate

1.7.2 Type code Motor starter

SK 175E-751-340-B (-ASI) (-C) (-xxx)

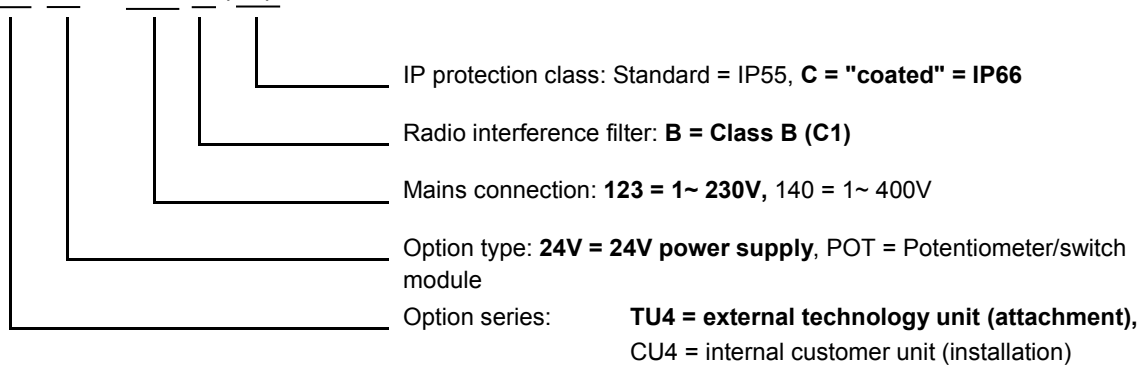


(...) Options, only implemented if required.

1.7.3 Type code for option modules

For "PotiBox" power supply or potentiometer modules

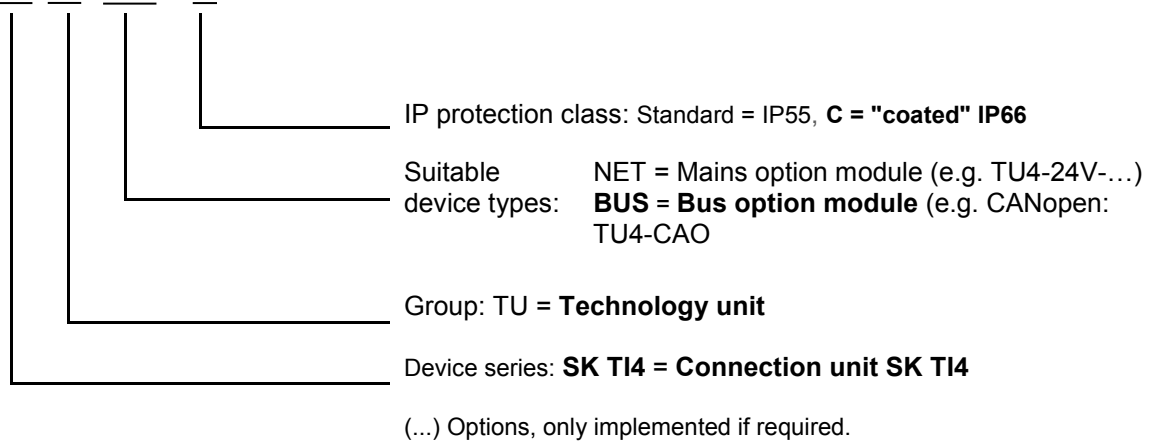
SK TU4-24V-123-B (-C)



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

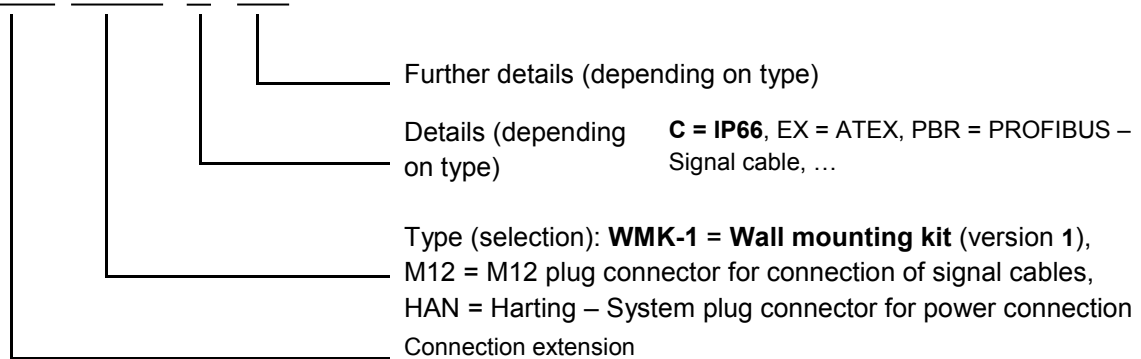
1.7.4 Type code, connection unit for technology unit

SK TI4-TU-BUS (-C)



1.7.5 Adapter Unit type code

SK TIE4-WMK-1 (-C- ...)



1.8 Power rating / Motor size

Size ¹⁾	Mains / power assignment	
	3~ 200 – 240 V	3~ 380 – 500 V
Size 1	0.12 ... 1.5 kW	0.25 ... 3.0 kW
Size 2	2.2 ... 4.0 kW	4.0 ... 7.5 kW

1) The sizes that have been mentioned differ from each other in terms of the envelope dimensions. The difference is restricted to the version of the opening for fitting the terminal box to a motor.

1.9 Version in protection class IP55, IP66, IP69K

The SK 1x5E is available in IP55 (standard) or IP66, IP69K (optional). The additional modules are available in protection classes IP55 (standard) or IP66 (optional).

A protection class that differs from the standard (IP66, IP69K) must always be specified in the order when ordering!

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

e.g. SK 1x5E-221-340-A-C



Information

Cable laying

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

IP55 version:

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

IP66 version:

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



Information

IP66 special measures

The modules for the IP66 version are identified by an additional "-C" in the type key, and are modified with the following special measures:

- impregnated PCBs,
 - Powder coating RAL 9006 (white aluminium) for housing,
 - modified blank screw caps (UV-resistant),
 - Low pressure test.
-

IP69K version:

The IP69K version is a modified **option** of the IP66 version. In device with protection class IP69K, the housing is made from **nsd-tupH**. Both installation types (*motor-integrated*, *close coupled*) are also available for this version.

Additional attachments (technology units etc.) to the device are not permitted.

2 Assembly and installation

2.1 Installation SK 1x5E

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

Motor-mounted version



Wall-mounted version



When a complete drive unit (gear unit + motor + SK 1x5E) is delivered, the device is always fully installed and tested.

i Information

Device version IP6x

IP6x-compliant devices must be installed by NORD, since special measures have to be implemented. IP6x components that are retrofitted on site cannot ensure that this protection class is provided.

When delivered separately, the device includes the following components:

- SK 1x5E
- Screws and contact washers for mounting the motor terminal box
- Pre-fabricated cable for motor and PTC connections

The sizes of the device series only differ with regard to their possibilities for adapting to the matching motors. For example, size 1 is coordinated with motor sizes 80 – 100, and size 2 is coordinated with motor size 132. The external dimensions (envelope dimensions) of the devices are identical.

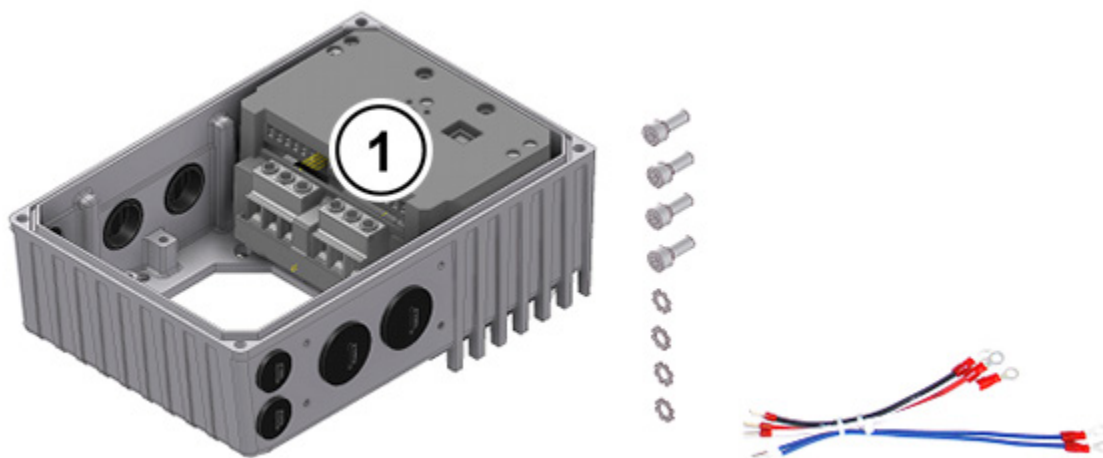
2.1.1 Work procedures for motor installation

1. If necessary, remove the original terminal box from the NORD motor, so that only the base of the terminal box and the motor terminal strip remain.
2. Set the bridges for the correct motor circuit at the motor terminal strip, and connect the pre-fabricated cables for motor and PTC connections to the respective connection points on the motor.
3. Remove the casing cover from the SK 1x5E. To do this, undo 4 fastening screws and then remove the casing cover vertically from above.



4. Fit the casing of the SK 1x5E to the terminal box base of the NORD motor using the existing screws and seal as well as the provided toothed contact washers. When doing this, align the casing so that the rounded side is facing the direction of the A bearing cover of the motor. Carry out mechanical adaptation using the "Adapter kit" (📖 Section 2.1.1.1 "Adapters for different motors"). With motors made by other manufacturers, it must be checked whether they can be attached.

If necessary, the plastic cover (1) for the electronics must be carefully removed in order to make the screw fastenings to the base of the terminal box. Proceed with extreme caution when doing this to avoid damage to the exposed PCBs.



5. Make electrical connections. For the cable gland of the connecting cable, appropriate screwed connections for cable cross-section must be used.
6. Re-attach the casing cover. In order to ensure that the protection class for the device is achieved, care must be taken that all the fastening screws of the housing cover are tightened crosswise, gradually and with the torque specified in the table below.

The cable glands that are used must at least correspond to the protection class of the device.

Size SK 1x5E	Screw size	Tightening torque
Size 1	M5 x 25	3.5 Nm ± 20 %
Size 2	M5 x 25	3.5 Nm ± 20 %

2.1.1.1 Adapters for different motors

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

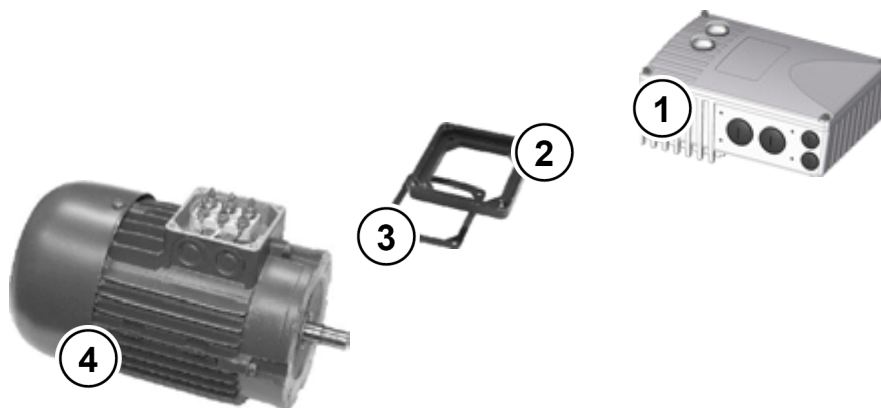
In order to ensure that the maximum IPxx protection class of the device is provided for the entire unit, all elements of the drive unit (e.g. motor) must correspond to at least the same protection class.

i Information

External motors

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

Information about converting a drive to the device can be found in [BU0320](#).



- 1 SK 1x5E
- 2 Adapter plate
- 3 Gasket
- 4 Motor, size 71

Figure 4: Example of motor size adaptation

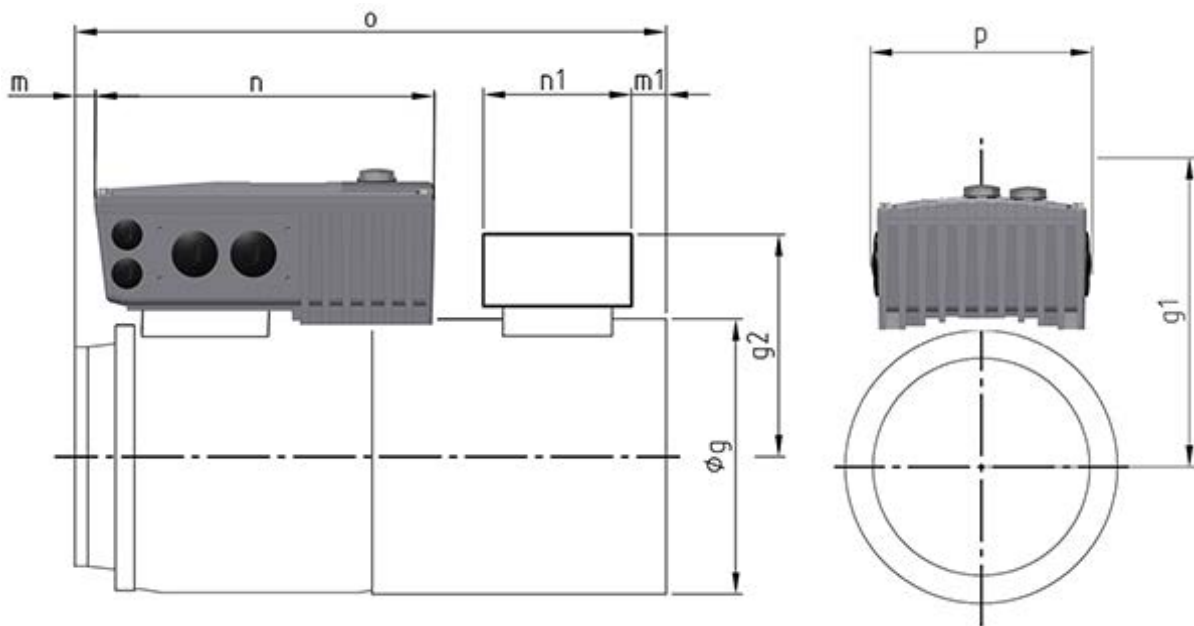
NORD motor sizes	Attachment SK 1x5E size 1	Attachment SK 1x5E size 2
Size 63 – 71	with adapter kit I	Not possible
Size 80 – 112	Direct mounting	with adapter kit II
Size 132	Not possible	Direct mounting

Overview of adapter kits

Adapter kit		Name	Components	Part No.
Adapter kit I	IP55	SK T14-12-Adapter kit_63-71	Adapter plate, terminal box frame seal and screws	275119050
	IP66	SK T14-12-Adapter kit_63-71-C		275274324
Adapter kit II	IP55	SK T14-3-Adapter kit_80-112	Adapter plate, terminal box frame seal and screws	275274321
	IP66	SK T14-3-Adapter kit_80-112-C		275274325

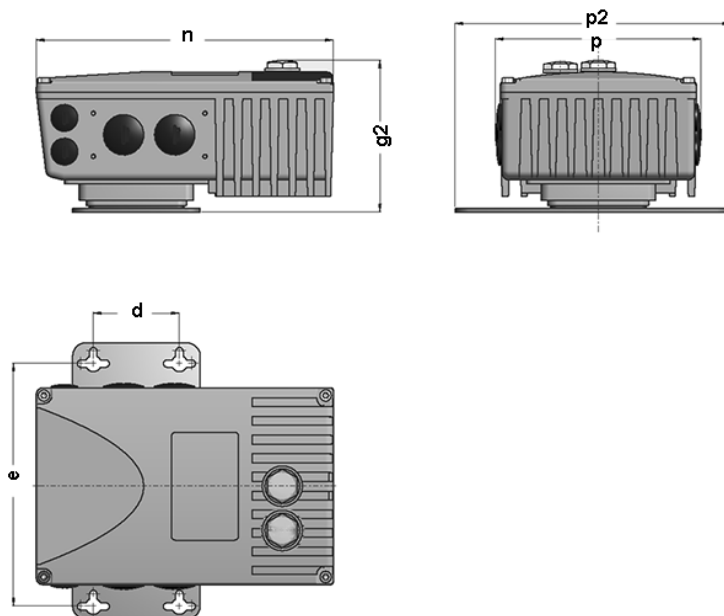
2.1.1.2 Dimensions, SK 1x5E mounted on motor

Size		Housing dimensions SK 1x5E / Motor					Weight of SK 1x5E without motor Approx. [kg]
Starter	Motor	Ø g	g 1	n	o	p	
Size 1	Size 71 ¹⁾	145	177.5	221	214	154	2.1
	Size 80	165	171.5		236		
	Size 90 S / L	183	176.5		251 / 276		
	Size 100	201	185.5		306		
Size 2	Size 80 ²⁾	165	193.5	221	236	154	2.1
	Size 90 S / L ²⁾	183	198.5		251 / 276		
	Size 100 ²⁾	201	209.5		306		
	Size 112 ²⁾	228	219.5		326		
	Size 132 S / M	266	216.5		373 / 411		
All dimensions in [mm] 1) incl. add. adapter and seal (18 mm) [275119050] 2) incl. add. adapter and seal (20 mm) [275274321]							



2.1.2 Wall mounting

As an alternative to wall mounting, the device can also be installed close to the motor using an optional wall-mounting kit.



Wall mounting kit SK TIE4-WMK-... (...1-K, ...2-K, ...1-NSD, 2-NSD)

This wall-mounting kit provides a simple method for installing the device close to the motor.

The SK TIE4-WMK-1-K and ...2-K versions are made of plastic. They are equally suitable for IP55 and IP66 devices.

The SK TIE4-WMK-1-NSD and ...2-NSD versions consist of stainless steel and elements which are provided with a special NSD tuPH surface treatment. These versions are intended for IP69K devices.

Any installation position is permissible with wall mounting, taking the electrical data into consideration.

Size of device	Wall mounting kit	Housing dimensions				Mounting dimensions			Total Weight Approx. [kg]
		g2	n	p	p2	d	e	Ø	
Size 1	SK TIE4-WMK-1-K Part. No. 275 274 004	113	221	154	205	64	180	5.5	2.2
	SK TIE4-WMK-1-NSD Part. No. 275 274 014								2.6
Size 2	SK TIE4-WMK-2-K Part. No. 275 274 015	115	221	154	235	74	210	5.5	2.5
	SK TIE4-WMK-2-NSD In preparation								2.9
All dimensions in [mm]									

Wall mounting kit SK TIE4-WMK-... (...1-EX, ...2-EX)

These wall mounting kits are intended for use in explosion hazard environments (☞ Section 2.4 "Operation in potentially explosive environments "). They are made of stainless steel and are equally suitable for IP55 and IP66 applications.

Size of device	Wall mounting kit	Housing dimensions				Mounting dimensions			Total Weight Approx. [kg]
		g2	n	p	p2	d	e	∅	
Size 1	SK TIE4-WMK-1-EX Part. No. 275 175 053	113	221	154	205	64	180	5.5	2.6
Size 2	SK TIE4-WMK-2-EX Part. No. 275 175 054	115	221	154	235	74	210	5.5	2.9
All dimensions in [mm]									

2.2 Installation of optional modules

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

2.2.1 Option locations on the device

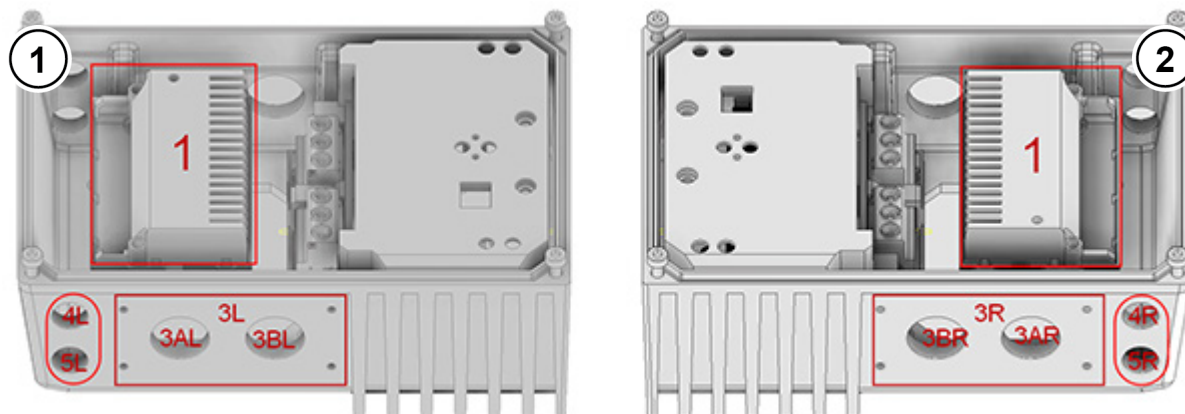
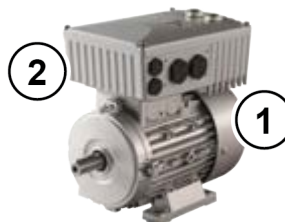


Figure 5: Option locations

- 1 View from left
- 2 View from right



The various installation locations for the optional modules are displayed in the above-mentioned drawings. Option location 1 is used to install an internal bus module or an internal power supply. External bus modules or 24 V DC power supplies can be implemented at option location 3L or 3R. Option locations 4 and 5 are used to install M12 sockets or connectors or for cable glands. Only one option can be attached in an option location, of course.

Option location	Position	Meaning	Size	Comments
1	Internal	Mounting location for customer units SK CU4-...		
3*	on side	Mounting location for <ul style="list-style-type: none"> • external technology unit SK TU4-... • power connector 		
3 A/B*	on side	Cable gland	M25	Not available if location 3 is occupied or SK TU4-... is fitted.
4*	on side	Cable gland	M16	Not available if SK TU4-... is fitted.
5*				

* R and L (right and left side) – with engine mounting: Viewing direction from fan impeller to motor shaft

2.2.2 Installation of internal customer unit SK CU4-... (installation)



Information

Installation location of customer unit

Installation of the SK CU4-... customer unit **separately** from the device is not permitted. It must always be installed inside the device in the intended position (option location 1). Only one customer unit can be installed per device!

Prefabricated cables are provided with the customer unit.

Connections are made according to the following table:



Similar to illustration

Bag enclosed with internal customer unit

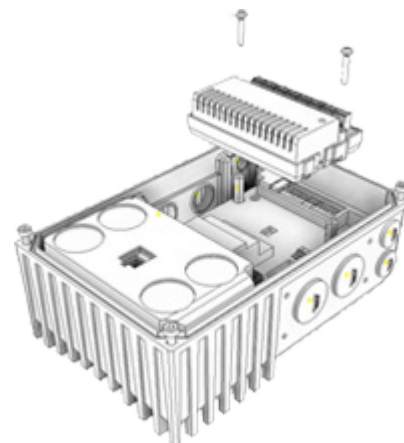
Allocation of the cable sets (bag enclosed with the customer unit)

	Function	Terminal label	Cable colour	
	Voltage supply (24V DC) (between device and customer unit)	44	24V	brown
		40	GND/0V	blue
	Power supply (mains (AC)) (between supply network and customer unit)	L1	L1	brown
		L2	L2	black

The customer units are installed inside the housing box of the device.

The customer unit is fastened with the two screws, which are provided.

Only one customer unit per device is possible!



2.2.3 Installation of external technology units SK TU4-... (attachment)

The technology units SK TU4-...(-C) require a connection unit SK TI4-TU-...(-C). This is the only way to create a closed functional unit. This can be attached to the device or installed separately by means of the optional SK TIE4-WMK-TU wall-mounting kit. In order to provide reliable operation, cable lengths of more than 20 m between the technology unit and the device must be avoided.



Information

Detailed installation information

A detailed description can be found in the documents for the connection unit concerned.

Connection unit	Document
SK TI4-TU-NET	TI 275280100
SK TI4-TU-NET-C	TI 275280600
SK TI4-TU-MSW	TI 275280200
SK TI4-TU-MSW-C	TI 275280700

2.3 Electrical Connection

⚠ WARNING

Electric shock

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

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

i Information

Temperature sensor and PTC (TF)

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

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

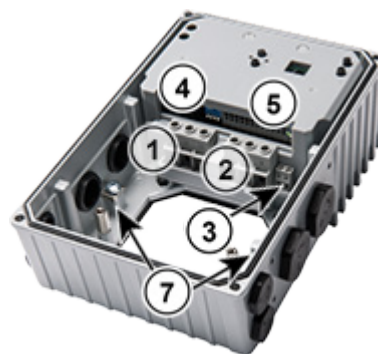
The housing cover must be removed from the device in order to make the electrical connection (📖 Section 2.1.1 "Work procedures for motor installation").

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

The PE connections (device earth) are located on the power connections for the motor and the mains, as well as on the base inside the cast housing.

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

	Connecting terminals for
(1)	Mains cable (X1.1)
(2)	Motor cable (X2.1)
(3)	Electro-mechanical brake cables (X3)
(4)	Control lines (X4) (SK 175E only)
(5)	Control lines (X5) and motor PTC
(7)	PE (X1.2 and X2.2)



2.3.1 Wiring guidelines

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

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

The shields of analogue setpoint cables should only be earthed on one side on the device.

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

In addition, EMC-compliant wiring must be ensured.

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

NOTICE

Damage due to high voltage

The device may be damaged by electrical loads which do not correspond to its specification.

- Do not perform any high voltage tests on the device itself.
- Disconnect the cable which is to be tested from the device before performing a high voltage insulation test.

Information

Looping of the mains voltage

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

If the device is installed according to the recommendations in this manual, it meets all EMC directive requirements, as per the EMC product standard EN 60947-4-2.

2.3.2 Electrical connection of power unit

NOTICE

EMC Interference to the environment

This device produces high frequency interference, which may make additional suppression measures necessary in domestic environments (☞ Section 8.1 "Electromagnetic compatibility (EMC)").

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

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

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

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

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



Information

Connection cables

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

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

Device	Cable Ø [mm²]		AWG	Tightening torque	
	rigid	flexible		[Nm]	[lb-in]
1 ... 2	0.5 ... 10	0.5 ... 10	20-6	1.2 ... 1.5	10.62 ... 13.27

Table 6: Connection data

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

No special fuses are required at the mains input side, nor is the use of a motor protection switch required. It is advisable to use normal mains fuses (see technical data) and a main switch.

Device data			Permissible mains data			
Type	Voltage	Power			3 ~ 230 V	3 ~ 400 V
SK...340-B	400 VAC	≥ 0.25 kW			X	X
Connections					L1/L2/L3	L1/L2/L3

Isolation from or connection to the mains must always be carried out for all the poles and synchronously (L1/L2/L3).

It is advisable to use a fuse module of type SK CU4-FUSE (☞ Section 3.2 "Optional modules").

Permissible network types

Size 1 devices can in principle be operated in **TN/TT** networks, as well as in **IT** networks. With operation in an **IT** network, compliance with the EMC limit value class B cannot be ensured under the

conditions stated in Section 8.1.3 "EMC of device". In this case, additional interference suppression measures must be provided.

Size 2 devices can in principle be operated in **TN/TT** networks. The device must be appropriately configured for operation in an **IT** network. This configuration can also be carried out at a later date; however it can only be carried out by the manufacturer. With the operation a device which is configured for an IT network, compliance with the EMC limit value class B cannot be ensured under the conditions stated in Section 8.1.3 "EMC of device". In this case, additional interference suppression measures must be provided.

Use with differing supply networks or network types

The frequency inverter may only be connect to and operated in supply networks which are explicitly stated in this section (☞ Section 2.3.2.1 "Mains supply (L1, L2, L3, PE)"). Operation in **deviating network types** may be possible, but must be **explicitly checked and approved by the manufacturer in advance**.

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

The motor cable must be connected properly.

2.3.2.3 Electromechanical brake

The device generates an output voltage at terminals 79 / 80 (MB+ / MB-) for actuating an electromagnetic brake. This is dependent on the supply voltage that is present in the device. The allocation is as follows:

Mains voltage / AC voltage	Brake coil voltage (DC)
230 V ~	105 V =
400 V ~	180 V =
460 V ~ / 480 V ~	205 V =
500 V ~	225 V =

The assignment of the correct brake and brake coil voltage must be taken into consideration in the design with regard to the mains voltage of the device.

Information

Parameters P107 / P114

For the connection of an electro-mechanical brake to the terminals of the device, parameters P107 / P114 (brake application time / release time) must be adjusted. In order to prevent damage to the brake control, parameter (P107) must contain a non-zero value.

2.3.3 Electrical connection of the control unit

Connection data:

Terminal bar		X3	X4, X5
Cable Ø *	[mm²]	0.2 ... 1.5	0.2 ... 1.5
Ø cable *	[mm²]	0.2 ... 0.75	0.2 ... 0.75
AWG standard		24-16	24-16
Tightening torque	[Nm]	0.5 ... 0.6	Clamping
	[lb-in]	4.42 ... 5.31	
Slotted screwdriver	[mm]	2.0	2.0

* Flexible cable with wire-end ferrules, **without** plastic collar or rigid cable

** Flexible cable with wire-end ferrules with plastic collar (for cable cross-section 0.75 mm², a wire-end ferrule with a length of 10 mm must be used)

The device must be provided with an external 24 V control voltage supply. Alternatively, an optionally available 24 V power of type SK CU4-... or SK TU4-... can be used.

The provisions in chapter 4.3 "AS Interface (AS-i)" apply to devices in which the **AS interface** is used.

i Information

Control voltage overload

A control unit overload caused by impermissibly high currents may destroy the unit. Impermissibly high currents occur if the actual total current that is drawn exceeds the permissible total current or if the 24 V control voltage for other devices is routed through the device. To avoid conduction through the frequency inverter, e.g. double wire end ferrules must be used.

i Information

Total currents

If necessary, 24 V can be drawn from several terminals. This also includes e.g. digital outputs or a operating module connected via RJ45

The total currents which are drawn off must not exceed 200 mA (SK 175E-...-ASI: 165 mA).

i Information

Reaction time of digital inputs

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

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

i Information

Cable laying

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

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

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

2.3.3.1 Control terminal details

Labelling, function

ASI+/-:	Integrated AS interface	PBR-A/B:	Integrated PROFIBUS DP
24 V:	24 V DC control voltage	DO:	Digital output
GND:	Reference potential for digital signals	DIN:	Digital input
MB+/-:	Control of electro-mechanical brake	TF+/-:	Motor thermistor (PTC) connection

Connection depending on the configuration

Terminal X3

SK 135E	Device type			SK 175E ASI / PBR
	Labelling			
	Pin			
MB+	79	1	79	MB+
MB-	80	2	80	MB-

Terminal X4 (SK 175E only)

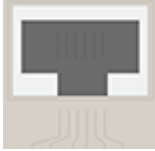

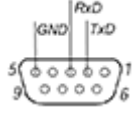
SK 175E ASI	Device type			SK 175E PBR
	Labelling			
	Pin			
GND	40	1	40	GND
DIN4 (BUS-DIN2)	C2	2	C2	DIN4 (BUS-DIN2)
DIN3 (BUS-DIN1)	C1	3	C1	DIN3 (BUS-DIN1)
24V (output)	43	4	43	24V (output)
ASI-	85	5	81	PBR-A
ASI+	84	6	82	PBR-B

Terminal X5

SK 135E	Device type			SK 175E ASI / PBR
	Labelling			
	Pin			
24V (input)	44	1	44	24V (input)
24V (input)	44	2	44	24V (input)
GND	40	3	40	GND
GND	40	4	40	GND
24V (input)	44	5	44	24V (input)
DIN1	21	6	21	DIN1
DIN2	22	7	22	DIN2
GND	40	8	40	GND
DO1	1	9	1	DO1
DO2	3	10	3	DO2
GND	40	11	40	GND
		12		
TF-	39	13	39	TF-
TF+	38	14	38	TF+

Meaning, Functions		Description / Technical data		
Terminal		Meaning		Parameter
No.	Designation	No.	Function of factory setting	
Digital outputs		Signalling of the operating statuses of the device		
		18 – 30 V DC, voltage level depending on the input voltage level	Maximum load 200 mA, SK 175E...-ASI: 165 mA when using the yellow cable With inductive loads: Provide protection via free-wheeling diode!	
1	DO1	Digital output 1	P434 [-01]	Fault / Warning
3	DO2	Digital output 2	P434 [-02]	Engine running
Digital inputs		Actuation of device using an external controller, switch or the like.		
		as per EN 61131-2 Type 1 Low: 0-5 V (~ 9.5 kΩ) High: 15-30 V (~ 2.5 - 3.5 kΩ)	Scan time: 1 ms Reaction time: ≥ 4 ms Input capacitance: 10 nF	
21	DIN1	Digital input 1	P420 [-01]	ON right
22	DIN2	Digital input 2	P420 [-02]	ON left
C1	DIN3	Digital input 3	P420 [-04]	ON right via bus
C2	DIN4	Digital input 4	P420 [-05]	ON left via bus
Note: Inputs DIN3 and DIN4 are only available with the SK 175E. The signals are passed to the controller via the AS Interface or PROFIBUS DP and not evaluated by the device itself.				
PTC resistor input		Monitoring of motor temperature using PTC		
		If the device is installed near the motor, a shielded cable must be used.	The input is always active. In order to make the device operational, a temperature sensor must be connected or both contacts must be jumpered.	
38	TF+	PTC resistor input	-	-
39	TF-	PTC resistor input	-	-
Control voltage source		Control voltage of device, e.g. for supplying accessories.		
		24 V DC ± 25 %, short circuit-proof	Maximum load 165 mA (SK 175E...-ASI) / 200 mA (SK 175E...-PBR) ¹⁾	
43	VO / 24V	Voltage output	-	-
40	GND / 0V	Reference potential GND	-	-
¹⁾ See "Total currents" information (📖 Section 2.3.3 "Electrical connection of the control unit")				
Control voltage connection		Supply voltage for the device		
		24 V DC ± 25 % The input is not short-circuit protected!	50 mA ... 400 mA, depending on the load of inputs and outputs and the use of options Daisy chaining for further devices up to max. 6 A is permissible.	
44	24V	Voltage input	-	-
40	GND / 0V	Reference potential GND	-	-
Brake actuation		Connection and actuation of an electromechanical brake. The device generates an output voltage for this. This depends on the mains voltage. The assignment of the correct brake coil voltage must be taken into account in the selection.		
		<i>Connected loads:</i> 📖 Section 2.3.2.3 "Electromechanical brake" Current: ≤ 500 mA	Permissible switching cycle time: to 150 Nm ≤ 1/s to 250 Nm ≤ 0.5/s	
79	MB+	Brake control	P107/114	0 / 0
80	MB-	Brake control		
PROFIBUS DP		Control of device via PROFIBUS DP		
81	PBR-A	PBR A		
82	PBR-B	PBR-B		

2 Assembly and installation

AS Interface		Control of device via simple field bus level: Actuator/sensor interface	
		26.5 – 31.6 V ≤ 240 mA	Use of yellow AS interface cable optional: Feed via black cable by means of jumper configuration
84	ASI+	ASI+	
85	ASI-	ASI-	
Communication interface		Connection of device to various communication tools	
		24 VDC ± 20 %	RS 232 (for connecting a PC (NORD CON)) 38400 Baud USS protocol Address 0
1	-		 <p>1 - 2 - 3 - 4 - 5 - 6</p>
2	-		
3	GND	Bus signal reference potential	
4	RS232 TXD	Data cable RS232	
5	RS232 RXD	Data cable RS232	
6	+24 V	Voltage output	
Connection cables (accessories / optional)		Connection of the device to an MS-Windows® PC with NORDCON software	
		<i>Length:</i> approx. 3.0 m + approx. 0.5 m <i>Part number:</i> 275274604 Suitable for connection to a USB port in a PC or alternatively to a SUB-D9 connection. Details: TI 275274604	 

2.3.3.2 Power supply SK xU4-24V-... - Connection example

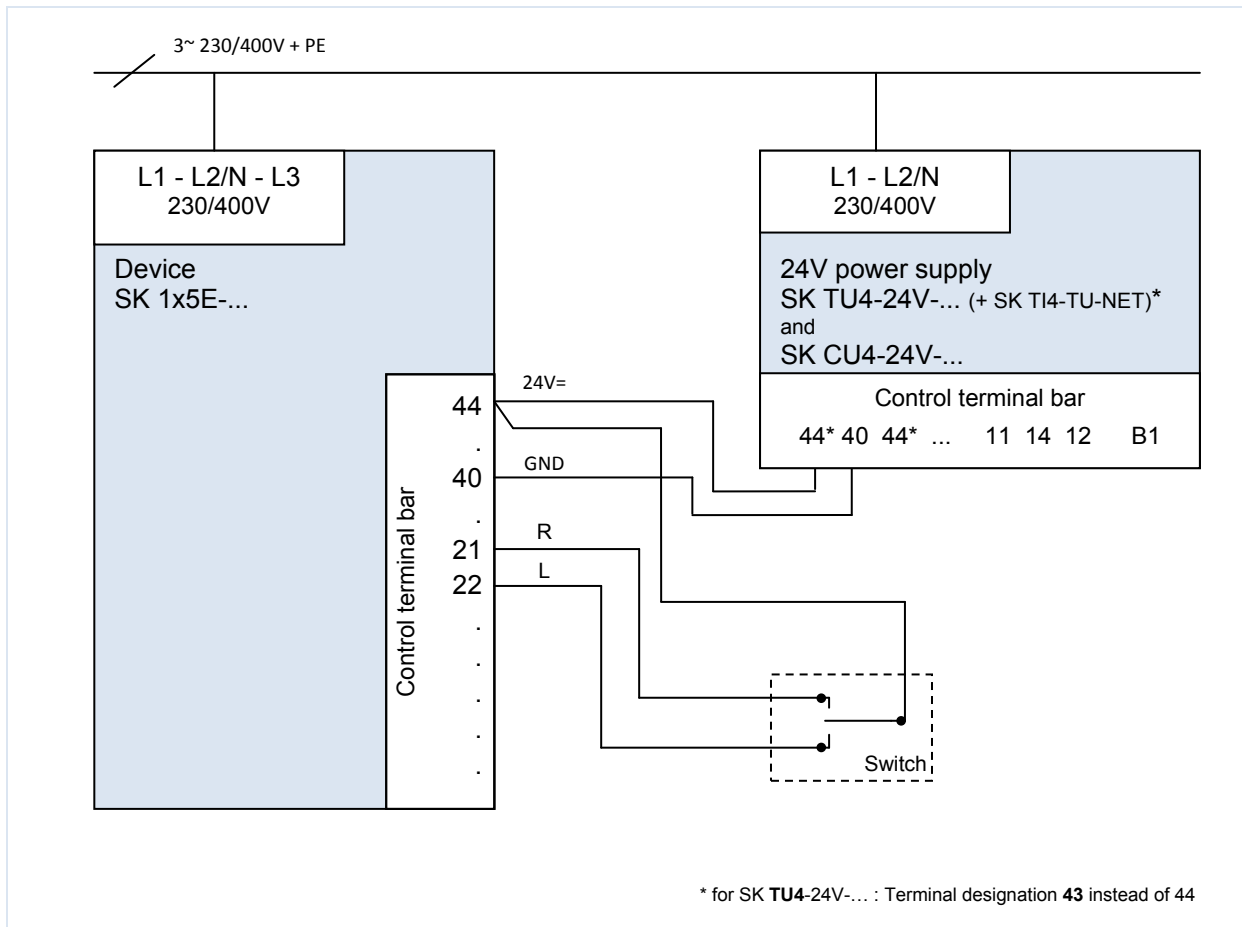


Figure 6: Connection example, power supply SK xU4-24V-...

2.4 Operation in potentially explosive environments

WARNING

Danger of explosion due to electricity



Electric sparks may ignite an explosive atmosphere.

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

WARNING

Explosion hazard due to high temperatures



High temperatures may cause the ignition of an explosive atmosphere.

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

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

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

If the device is connected to a motor and a gear unit, the EX labelling of the motor and the gear unit must also be observed. Otherwise the drive must not be operated.

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

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


2.4.1.1 Modification of the device for compliance with Category 3D

Only a specially modified device is permissible for operation in ATEX zone 22. This adaptation is only made at the NORD factory. In order to use the device in ATEX Zone 22, the diagnostic caps are replaced with aluminium / glass versions, among other things.



(1) Year of manufacture

(2) Marking of the device (ATEX)

IP55:  II 3D Ex tc IIIB T125 °C Dc X

IP66:  II 3D Ex tc IIIC T125 °C Dc X

Categorisation:

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

Information

Potential damage

Devices in series SK 1x5E and the permitted options are only designed for a degree of mechanical stress that corresponds to a low impact energy of 7J.

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

The necessary components for making adaptations are contained in the ATEX kits.

Device	Kit designation	Part Number	Quantity	Document
SK 1x5E-... (IP55)	SK 1xxE-ATEX-IP55	275274207	1 piece	TI 275274207
	SK 1xxE-ATEX-IP66	275274208	1 piece	TI 275274208
SK 1x5E-...-C (IP66)	SK 1xxE-ATEX-IP66	275274208	2 pieces	TI 275274208

2.4.1.2 Options for ATEX Zone 22, category 3D

In order to ensure that the device is ATEX-compliant, its optional modules must also be approved for potentially explosive areas. Option modules that are not in the following list may **not** be used in an

ATEX zone 22 3D. This also includes connectors and switches that may also not be used in such an environment.

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

Designation	Part Number	Use permissible
Power supply		
SK CU4-24V-123-B(-C)	275271108 / (275271608)	Yes
SK CU4-24V-140-B(-C)	275271109 / (275271609)	Yes
Fuses		
SK CU4-FUSE(-C)	275271122 / (275271622)	Yes
Wall mounting kits		
SK TIE4-WMK-1-EX	275175053	Yes
SK TIE4-WMK-2-EX	275175054	Yes
Adapter kits		
SK TI4-12-Adapter kit_63-71-EX	275175038	Yes
SK TI4-3-Adapter kit_80-112-EX	275175039	Yes

2.4.1.3 Commissioning information

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


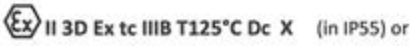
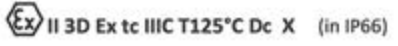
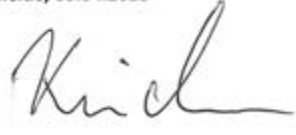

The motors are protected from overheating by the device. This takes place by means of evaluation of the motor PTC (TF) at the device side. In order to ensure this function, the PTC must be connected to the intended input (Terminal 38/39).

It must also be ensured that the nominal current of the motor has been set.

Overview of required parameter settings:

Parameter	Setting value	Factory setting	Description
P203 Rated motor current	Data according to rating plate	[xxx]	Setting takes place at the factory side or must be carried out as per the motor type plate.
P535 I ² t motor	According to motor and ventilation	[0]	The I ² t- monitoring of the motor must be switched on. The set values depend on the type of ventilation and the motor used. See B1091-1

2.4.1.4 EU conformity declaration - ATEX

<p style="font-size: 1.2em; margin: 0;">GETRIEBEBAU NORD</p> <p style="margin: 0;">Member of the NORD DRIVESYSTEMS Group</p>																			
<p style="font-size: 0.8em; margin: 0;">Getriebebau NORD GmbH & Co. KG</p> <p style="font-size: 0.7em; margin: 0;">Getriebebau-Nord-Str. 1. 22941 Bargteheide, Germany . Fon +49(0)4532 289 - 0. Fax +49(0)4532 289 - 2253 . info@nord.com C432810_1418</p>																			
<p style="font-size: 1.1em; margin: 0;">EU Declaration of Conformity</p> <p style="font-size: 0.8em; margin: 0;">In the meaning of the EU directives 2014/34/EU Annex X, 2014/30/EU Annex II and 2011/65/EU Annex VI</p>																			
<p>Getriebebau NORD GmbH & Co. KG as manufacturer in sole responsibility hereby declares, Page 1 of 1 that the electronic motor starter of the product series</p> <ul style="list-style-type: none"> • SK 105E-xxx-340-B-.. , SK 115E-xxx-340-B-.. , SK 125E-xxx-340-B-.. , SK 135E-xxx-340-B-.. • SK 145E-xxx-340-B-.. , SK 155E-xxx-340-B-.. , SK 165E-xxx-340-B-.. , SK 175E-xxx-340-B-.. (xxx= 301 or 751) <p>and the further options/accessories: SK CU4-24V-123-B, SK CU4-24V-140-B, SK TIE4-WMK-1, SK TIE4-WMK-2, SK TIE4-M12-M16</p> <p>with ATEX labeling  (in IP55) or  (in IP66)</p> <p>comply with the following regulations:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">ATEX Directive for products</td> <td style="width: 15%;">2014/34/EU</td> <td style="width: 55%;">OJ. L 96 of 29.3.2014, P. 309–356</td> </tr> <tr> <td>EMC Directive</td> <td>2014/30/EU</td> <td>OJ. L 96 of 29.3.2014, P. 79–106</td> </tr> <tr> <td>RoHS Directive</td> <td>2011/65/EU</td> <td>OJ. L 174 of 1.7.2011, P. 88–110</td> </tr> </table> <p>Applied standards:</p> <table style="width: 100%; border: none;"> <tr> <td>EN 60079-0:2012+A11:2013</td> <td>EN 60079-31:2014</td> <td>EN 50581:2012</td> </tr> <tr> <td>EN 60947-1:2007+A1:2011+A2:2014+AC:2017</td> <td>EN 60947-4-2:2012</td> <td></td> </tr> <tr> <td>EN 60529:1991+A1:2000+A2:2013+AC:2016</td> <td></td> <td></td> </tr> </table> <p>It is necessary to notice the data in the operating manual to meet the regulations of the EMC-Directive. Specially take care about correct EMC installation and cabling, differences in the field of applications and if necessary original accessories.</p> <p>First marking was carried out in 2015.</p> <p>Bargteheide, 06.04.2018</p> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: center;">  <p style="margin: 0;">U. Küchenmeister Managing Director</p> </div> <div style="text-align: center;">  <p style="margin: 0;">pp F. Wiedemann Head of Inverter Division</p> </div> </div>		ATEX Directive for products	2014/34/EU	OJ. L 96 of 29.3.2014, P. 309–356	EMC Directive	2014/30/EU	OJ. L 96 of 29.3.2014, P. 79–106	RoHS Directive	2011/65/EU	OJ. L 174 of 1.7.2011, P. 88–110	EN 60079-0:2012+A11:2013	EN 60079-31:2014	EN 50581:2012	EN 60947-1:2007+A1:2011+A2:2014+AC:2017	EN 60947-4-2:2012		EN 60529:1991+A1:2000+A2:2013+AC:2016		
ATEX Directive for products	2014/34/EU	OJ. L 96 of 29.3.2014, P. 309–356																	
EMC Directive	2014/30/EU	OJ. L 96 of 29.3.2014, P. 79–106																	
RoHS Directive	2011/65/EU	OJ. L 174 of 1.7.2011, P. 88–110																	
EN 60079-0:2012+A11:2013	EN 60079-31:2014	EN 50581:2012																	
EN 60947-1:2007+A1:2011+A2:2014+AC:2017	EN 60947-4-2:2012																		
EN 60529:1991+A1:2000+A2:2013+AC:2016																			

2.4.2 Operation in potentially explosive environments - EAC Ex

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

2.4.2.1 Modification of the device

Section 2.4.1.1 "Modification of the device for compliance with Category 3D"applies.

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

Labelling of the device:



The following applies for wall mounted devices;

IP55: Ex tc IIIB T125 °C Dc X

IP66: Ex tc IIIC T125 °C Dc X



The following applies for motor mounted devices;

IP55: Ex tc IIIB Dc U

IP66: Ex tc IIIC Dc U

Categorisation:

- Protection with "housing"
- Procedure "A" Zone "22" Category 3D
- Protection class IP55 / IP66 (depending on the device)
 - IP66 is required for conductive dust
- Maximum surface temperature 125 °C
- Ambient temperature -20 °C to +40 °C

i Information

Code "U"

Code "U" applies for frequency inverters which are intended for motor mounting. Devices which are so labelled are considered to be incomplete and may only be operated in combination with a corresponding motor. If a device which is coded "U" is mounted in a motor, the labels and restrictions which are marked on the motor or the geared motor also apply.

i Information

Code "X"

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

2.4.2.2 Further Information

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


Description	Section
"Options for ATEX Zone 22, category 3D"	2.4.1.2
"Commissioning information"	2.4.1.3

2.4.2.3 EAC Ex certificate

[TC RU C-DE.AA87.B.01108](#)

2.5 Outdoor installation

The device and the technology units (SK TU-...) can be installed outdoors under the following conditions:

- IP66 version (incl. UV-resistant blank screw caps, see special measures, section 1.9 "Version in protection class IP55, IP66, IP69K"),
- UV-resistant inspection windows (Part Number: 200852000 ( [TI 200852000](#))), number of pieces: 2,
- Cover the device to ensure that it is protected from the direct influence of the weather (rain/sun),
- Used accessories (e.g. connectors), also at least IP66.

3 Display, operation and options

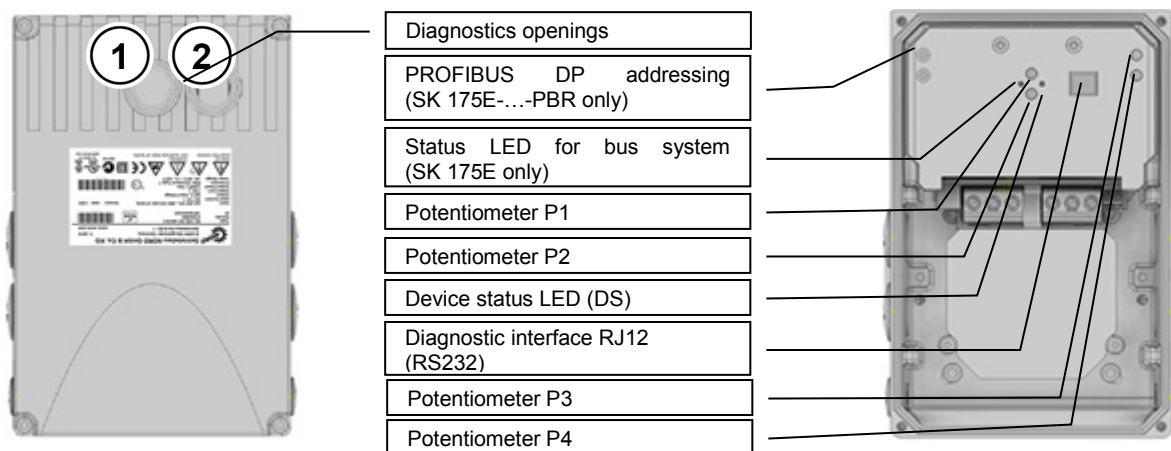
WARNING

Electric shock

When devices are open, electrically conducting elements (e.g. connection terminals, connection cables, PCBs, etc.) are freely accessible. These may be live, even if the device has been switched off.

- Avoid all contact.

The device can be basically started up without parameter adaptation, i.e. programming-technical aids. 4 potentiometers (P1 – P4) and a 4-pin DIP switch block (S1) are available for this. Access to P1 and P2 takes place using the diagnostics opening in the centre. This is where the status LEDs of the device are located. Potentiometers P3 and P4 and the PROFIBUS DP addressing (SK 175E-...-PBR only) are accessible by removing the cover of the device.



The SK 1x5E can be easily adapted to a wide range of requirements by using function-enhancing modules for display, control and parametrisation.

Optionally available control devices from NORD or the free "NORDCON" PC software can be used for targeted adaptation of individual parameters. The right-hand diagnostic connection must be opened to access the diagnostic interface. Devices with an older manufacturing date (serial number (ID) "26P..." or less) only have the diagnostic opening in the centre. The diagnostics interface is then only accessible by removing the cover of the device.

3.1 Control and parametrisation options

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

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

Designation		Part Number	Document
Switch (attachment)			
SK TIE4-SWT	Switch "L-OFF-R"	275274701	TI 275274701
Control and parametrisation units //(handheld)			
SK CSX-3H	SimpleBox	275281013	BU0040
SK PAR-3H	ParameterBox	275281014	BU0040

3.1.1 Control and parametrisation units, use

Access to the parameters of the SK 1x5E can take place either using the NORD CON software or with the aid of an optionally available SimpleBox or ParameterBox. Permanent parameter changes must be saved in the Flash memory of the device using parameter **P550**.

A SimpleBox or ParameterBox cannot be connected directly to the device, but must be connected using an RS 232 / RS 485 converter (SK TIE4-RS485-RS232, Part No. 275274603). When doing this the parametrisation unit must be connected to the converter before making the connection to the motor starter. The motor starter must be ready for operation when this takes place.

i Information

Status LED DS

With active RS232 communication to the PC (NORD CON) or to a connected parametrisation unit, the status of the device cannot be indicated via the LEDs. In this case, the "DS" LEDs signal that communication activity is taking place by being permanently on in green. The red LED is then switched off.

The green LED can also be made to flash by adjusting potentiometer **P1**.



Figure 7: SK CSX-3H / SK PAR-3H / SK TIE4-RS485-RS232 (l-r)

Module	Description	Data
SK CSX-3H *) (handheld SimpleBox)	Used for commissioning, parametrisation, configuration and control of the device.	4-digit, 7-segment LED display, membrane key IP20 RJ12-RJ12 cable (connection to the device 1)
SK PAR-3H *) (handheld ParameterBox)	Used for commissioning, parametrisation, configuration and control of the device (only in ControlBox mode) and its options (SK xU4-...). Entire parameter data sets can be stored.	4-line backlit LCD display, membrane keyboard Stores up to 5 complete parameter data sets IP20 RJ12-RJ12 cable (connection to device) USB cable (connection to PC)
* Also required: Converter SK TIE4-RS485-RS232	Connection extension for the conversion of the RS485 signal of the parametrisation units SK CSX-3H or SK PAR-3H to the RS232 signal of the starter Data sheet TI 275274603 (www.nord.com)	IP20 Cable RJ12-RJ12 (connection to device / option) Part No. 275274603

Connection to motor starter

1. Remove right-hand diagnostics glass (transparent cable gland) of the RJ12 socket from the housing cover, alternatively remove housing cover (illustration on right)

WARNING: Electric shock possible from touching conducting parts with device open!

2. Set DIP switch to **Master RS 485** at converter (SK TIE4-RS485-RS232)
3. Connect control and parametrisation unit to converter
4. Check that the 24 V DC voltage supply at the motor starter is switched on.
5. Connect converter with connected control and parametrisation unit to diagnostics socket.



After completing commissioning, the power supply must be switched off again and the device correctly closed off again (casing cover, diagnostics caps and cable glands) in order to restore operating safety and the IP protection class).

i Information

Diagnostic cap tightening torque

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

i Information

Control with SK PAR-3H

In order to be able to **control** the motor starter with the **ParameterBox** (SK PAR-3H) (Start / Stop), it must be put into **ControlBox Mode** beforehand.

Step	Menu item		Selection		
1	Display	← →			o.k.
2	1003 selection	← →	ControlBox	↑ ↓	o.k.
3	P0 back	← →			o.k.

However, motor starter parametrisation can be carried out independently of the mode that has been selected.

3.2 Optional modules

3.2.1 Internal customer interfaces SK CU4-... (installation of modules)

Internal customer units allow the scope of functionality of the devices to be extended without changing the physical size thereof. The device provides an installation location for the installing an appropriate option. If other option modules are required the external technology units must be used for these (📖 Section 3.2.2 "External technology units SK TU4-... (module attachment)").



Figure 8: internal customer units SK CU4 ... example

Name *)	Part Number	Document
I/O expansions		
SK CU4-REL(-C)	275271011 / (275271511)	TI 275271011 / TI 275271511
Power supply		
SK CU4-24V-123-B(-C)	275271108 / (275271608)	TI 275271108 / TI 275271608
SK CU4-24V-140-B(-C)	275271109 / (275271609)	TI 275271109 / TI 275271609
Miscellaneous		
SK CU4-FUSE(-C) Fuse module	275271122 / (275271622)	TI 275271122 / TI 275271622

* All modules with designation **-C** have lacquered PCBs so that they can be used in IP6x devices.

3.2.2 External technology units SK TU4-... (module attachment)

External technology units allow the scope of functionality of the devices to be extended in a modular way.

Depending on the type of module, different versions are available (differentiated according to IP protection class, with/without connector etc.). They can be fitted directly to the device using the relevant connection unit or in the vicinity of the device using an optional wall mounting kit.

Each SK TU4-... technology unit requires an associated SK T14-TU-... connection unit.



Figure 9: external technology units SK TU4-... (example)

Type	IP55	IP66	Designation	Part Number	Document
Power supply 24V / 1~ 230V	X		SK TU4-24V-123-B	275 281 108	TI 275281108
		X	SK TU4-24V-123-B-C	275 281 158	TI 275281158
Power supply 24V / 1~ 400V	X		SK TU4-24V-140-B	275 281 109	TI 275281109
		X	SK TU4-24V-140-B-C	275 281 159	TI 275281159
Required accessories (each module must have an associated connection unit)					
Connection unit	X		SK T14-TU-NET	275 280 100	TI 275280100
		X	SK T14-TU-NET-C	275 280 600	TI 275280600
Optional accessories					
Wall-mounting kit	X	X	SK TIE4-WMK-TU	275 274 002	TI 275274002

Table 7: external modules with SK TU4-24V- ... power supply

Type	IP55	IP66	Designation	Part Number	Document
Maintenance switch	X		SK TU4-MSW	275 281 123	TI 275281123
		X	SK TU4-MSW-C	275 281 173	TI 275281173
	X		SK TU4-MSW-RG	275 281 125	TI 275281125
		X	SK TU4-MSW-RG-C	275 281 175	TI 275281175
Required accessories (each module must have a matching connection unit)					
Connection unit	X		SK T14-TU-MSW	275 280 200	TI 275280200
		X	SK T14-TU-MSW-C	275 280 700	TI 275280700
Optional accessories					
Wall-mounting kit	X	X	SK TIE4-WMK-TU	275 274 002	TI 275274002

Table 8: external modules – maintenance switch SK TU4-MSW- ...

3.2.3 plug connectors

The use of optionally available plug connectors for power and control connections not only makes it possible to replace the drive unit with almost no loss of time in case of servicing, but also minimises the danger of installation errors when connecting the device. The most common plug connector versions are summarised below. The possible installation locations on the device are listed in section 2.2 "Installation of optional modules".

3.2.3.1 Plug connectors for power connections

Various connectors are available for the motor or mains connection.

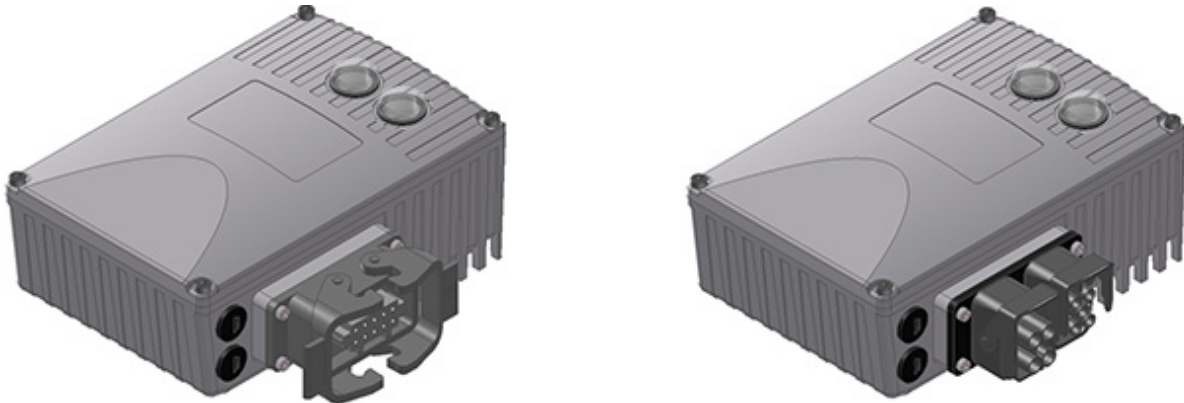


Figure 10: Examples of devices with connectors for connecting the power

3 different connections are available, which can also be combined (example "-LE-MA"):

Mounting version	Meaning
... - LE	Power input
... - LA	Power output
... - MA	Motor output

Connector (selection)

Type	Data	Designation	Material no.	Document
Power input	500 V, 16 A	SK TIE4-HANQ8-K-LE-MX	275 135 030	TI 275135030
Power input	500 V, 16 A	SK TIE4-HAN10E-M1B-LE	275 135 070	TI 275135070
Power input	500 V, 16 A	SK TIE4-HAN10E-M2B-LE	275 135 000	TI 275135000
Power input	690 V, 20 A	SK TIE4-QPD_3PE-K-LE	275 274 125	TI 275274125
Power input	630 V, 16 A	SK TIE4-NQ16-K-LE	275 274 133	TI 275274133
Power input + power outlet	400 V, 16 A	SK TIE4-2HANQ5-K-LE-LA	275 274 110	TI 275274110
Power input + motor outlet	600 V, 16 A	SK TIE4-2HANQ5-M-LE-MA-001	275 274 123	TI 275274123
Power output	500 V, 16 A	SK TIE4-HAN10E-M2B-LA	275 135 010	TI 275135010
Power output	500 V, 16 A	SK TIE4-HANQ8-K-LA-MX	275 135 040	TI 275135040
Motor output	500 V, 16 A	SK TIE4-HAN10E-M2B-MA	275 135 020	TI 275135020
Motor output	500 V, 16 A	SK TIE4-HANQ8-K-MA-MX	275 135 050	TI 275135050

Information

Looping of the mains voltage

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

The use of a SK CU4-FUSE(-C) is recommended for internal device protection, which must be incorporated directly in the power supply cable of the device concerned. This ensures that in the event of a fault, only the defective device is disconnected from the power and not the entire power supply line.

3.2.3.2 Plug connectors for control connection

Various M12 round plug connectors are available as flanged plugs or flanged sockets. The plug connectors are intended for installation in an M16 cable gland of the device, or in an external technology unit. The protection class (IP67) of the plug connector only applies in the screwed state. Similarly to the use of coding pins / grooves, the colour coding of the connectors (plastic unit inside and cover caps) is based on functional requirements and is intended to avoid erroneous operation.

Suitable expansion and reducer adapters are available for installation in M12 and M20 cable glands.



Connector (selection)

Type	Version	Designation	Part Number	Document
Power supply	Connector	SK TIE4-M12-POW	275 274 507	TI 275274507
Sensors / actuators	Socket	SK TIE4-M12-INI	275 274 503	TI 275274503
Initiators and 24 V	Connector	SK TIE4-M12-CAO	275 274 516	TI 275274516
AS Interface	Connector	SK TIE4-M12-ASI	275 274 502	TI 275274502
AS Interface – Aux	Connector	SK TIE4-M12-ASI-AUX	275 274 513	TI 275274513
PROFIBUS (<i>IN + OUT</i>)	Plug connector + socket	SK TIE4-M12-PBR	275 274 500	TI 275274500

4 Commissioning

WARNING

Unexpected movement

Connection of the supply voltage may directly or indirectly set the drive unit into motion. This may cause an unexpected movement of the drive unit and the machine which is connected to it. This unexpected movement may cause severe or fatal injuries and/or material damage.

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

- Parameterisation of an "automatic start",
- Incorrect parameterisation,
- Control of the device with an enabling signal from a higher level control unit (via IO or bus signals),
- Incorrect motor data,
- Release of a mechanical holding brake,
- External influences such as gravity or other kinetic energy which acts on the drive unit.


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

4.1 Factory settings

All motor starters supplied by Getriebebau NORD are pre-programmed with the default setting for standard applications with 4-pole standard motors (same voltage and power). The nominal current of the motor (see motor type plate, for example) can be set for the respective motor circuit using potentiometer P1, which has priority in the factory setting or the as-delivered condition. If parameter **P130**=1, the nominal current of the motor must be set in parameter **P203** "Rated motor current".

Information

Hardware configuration

It must be ensured that the hardware can essentially be configured mechanically using DIP switch block S1 and potentiometers P1 ... P4 or alternatively by adapting individual parameters. The decision concerning this is made by setting parameter **P130** ( Section 4.2.2 "Configuration").

4.2 Starting up the device

The motor starter can be started up in various ways:

- a) For simple applications (e.g conveyor applications) by means of the DIP switches (**S1**) integrated in the device (internal), the two externally accessible potentiometers **P1** and **P2** and internal potentiometers **P3** and **P4**.
- b) By adapting parameters using the control and parametrisation unit (SK CSX-3H or SK PAR-3H) or the NORD CON PC - supported software.

Attention must be paid to the setting of parameter **P130** when doing this. The parameter settings are only effective if **P130** = 1!

After completing the **parametrisation** of the motor starter, the parameter values must be transferred from the RAM memory **to the Flash memory of the device (→ P550)**! Otherwise the settings that have been made will be lost again when the device is shut off.

Note: Flash memory! Approximately 100 memory cycles are possible!

4.2.1 Connection

In order to provide basic operational capability, after the device has been attached to the motor or the wall mounting kit, the power and motor lines must be connected to the relevant terminals (📖 Section 2.3.2 "Electrical connection of power unit").

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

i Information Control voltage

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

4.2.2 Configuration

The device can be configured for the majority of operating modes by setting potentiometers (P1-P4) and DIP switches (S1). For extended functions or for diagnostic purposes it may be necessary to adjust or view individual parameters.

The basic steps for successful start-up of the motor starter are listed in the following. To begin with, it must be decided whether the start-up is to take place via DIP switches and the potentiometers, or exclusively by means of parameter setting.

The software adaptations that are made via the **parameters** are only **taken into consideration** if parameter **P130** is set to a value of (**1**).

Any **parameters that are not listed here always have an influence** on the functionality of the motor starter, irrespective of the setting of parameter **P130**. However, they always remain in the factory setting at **P130 = "0"**.

Step	Commissioning via			
	Switches / potentiometers (Hardware adaptations)		Parameter settings (Software adaptation)	
	Element	Default	Parameter	Default
1. Parameter source	P130 = 0	{ 0 }	P130 = 1	{ 0 }
2. Rated motor current	P1	- ¹⁾	P203	{ 3 }
3. Locking time	P2	- ¹⁾	P570	{ 0.5 }
4. Start voltage	P3	- ¹⁾	P210	{ 50 }
5. Acceleration time	P4	- ¹⁾	P102	{ 1 }
6. Run time			P103	{ 1 }
7. Automatic starting	S1-DIP1	{ OFF }	P428	{ 0 }
8. Phase sequence detection	S1-DIP2	{ OFF }	P581	{ 0 }
9. Switch-off mode	S1-DIP3/4	{ OFF/OFF }	P108	{ 2 }
10. Save data permanently			P550 = 1 ²⁾	{ 0 }

1) For technical manufacturing reasons, no clear factory settings (defaults) can be stipulated.

2) After completing the software adaptations, the data must be transferred from the RAM memory of the device to the Flash memory in order to retain them permanently. Otherwise the data changes will be lost when the device is switched off.

Table 9: Configuration - comparison of hardware and software adaptation

4.2.2.1 Parametrisation

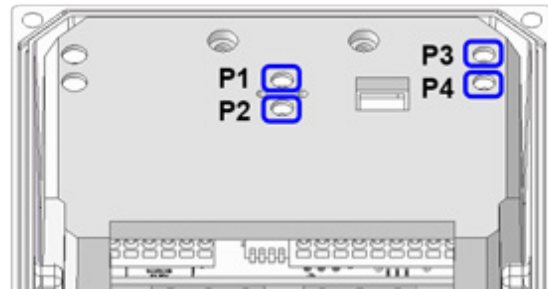
The use of a control and parametrisation unit (SK CSX-3H / SK PAR-3H) or the NORDCON software is required to adapt the parameters. The most important parameters are shown in the following, depending on the setting of parameter **P130**:

Parameter group	Parameter numbers	Functions	Comments
Basic parameters	P102 ... P103	Start-up and shut-down time	Factory setting: Value of potentiometer P4
	P108	Switch-off mode	Factory setting: Value of DIP switch S1-DIP3/4
	P130	Parameter source P130=0 → Potentiometer/ Switch P130=1 → Flash memory	P130=0 (Factory setting): Potentiometers (P1-P4) and DIP switch (S1) effective P130=1 : Parameter settings effective
Motor data	P203	Rated motor current	Factory setting: Value of P1
	P210	Start voltage	Factory setting: Value of potentiometer P3
Control terminals	P420, P434	Digital inputs and outputs	Factory setting: See description of parameter(s)
Additional parameters	P570	Locking time	Factory setting: Value of potentiometer P2

Table 10: Parameters and functions depending on P130

4.2.2.2 Potentiometers P1 to P4

Basic settings for the operation of the motor starter can be made using potentiometers P1 to P4. They are non-latching and each one has 10 scale values. The potentiometers are provided with non-linear characteristic curves at the software side.



Potentiometer P1

→ Nominal motor current setting

Device type	Scale value (Setting in accordance with motor type plate) [A]									
	SK 1x5E-301-...	0.9	1.3	1.7	2.3	3.1	4.0	5.5	7.5	9.5
SK 1x5E-751-...	3.1	4.0	5.5	7.5	9.5	12.5	16.0	19.0	23.5	OFF ¹⁾

1) I²t monitoring deactivated



Figure:
P1 of a 7.5 kW motor starter

Potentiometer P2

→ Locking time setting

Device type	Scale value [s]									
	SK 1x5E-301-...	OFF ¹⁾	0.1	0.2	0.4	0.8	1.6	3.2	6.4	12.8
SK 1x5E-751-...										

1) Without locking time

Potentiometer P3

→ Starting torque setting (voltage)

Device type	Scale value [%]									
	SK 1x5E-301-...	10	15	20	25	30	40	50	60	80
SK 1x5E-751-...										

Potentiometer P4

→ Start-up and shut-down time setting

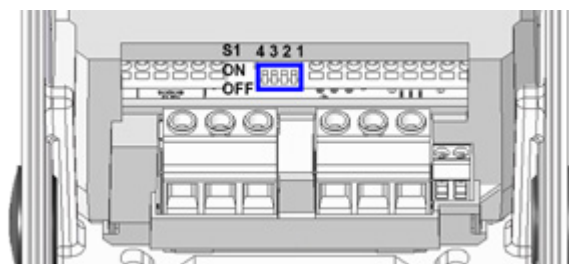
Device type	Scale value [s]									
	SK 1x5E-301-...	OFF ¹⁾	0.1	0.2	0.4	0.8	1.6	3.2	6.4	12.8
SK 1x5E-751-...										

1) Soft start disabled

4.2.2.3 DIP switches (S1)

The basic functionality of the motor starter is set using DIP switch (S1).

In the as-delivered condition, all four DIP switches are in position "0" ("OFF").



No.	DIP switch (S1)		DIP-No	
Bit			4	3
4/3 2 ^{3/2}	Switch-off mode	0	0	Switch-off mode 1 (factory setting)
		1	0	Switch-off mode 2
		0	1	Switch-off mode 3
		1	1	Switch-off mode 4
2 2 ¹	Phase sequence detection	0	Phase sequence according to mains connection(factory setting)	
		1	Phase sequence according to required direction of rotation, → automatic detection of phase sequence	
1 2 ⁰	Automatic starting	0	Enable with flank (factory setting)	
		1	Enable with level ATTENTION, drive can start off immediately!	

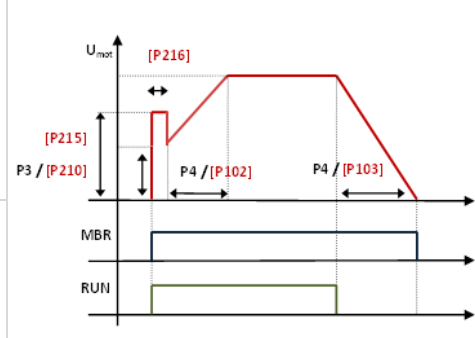
4.2.2.4 Overview of switch-off modes

The switch-off mode determines the start-up and shut-down behaviour of the drive.

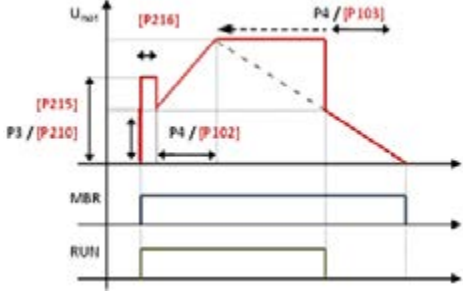
Parameter **P130** determines whether the switch-off mode should be set by means of hardware adaptation (DIP switch (S1), potentiometer (P1-P4)) or software adaptation (parametrisation of **P108**).

The main modes of behaviour can be set by means of hardware adaptation (factory setting).

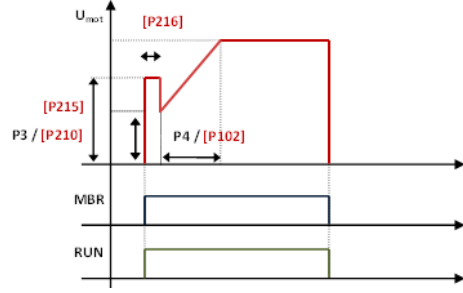
Other settings can be made by means of parameter adaptations if there is a need for further optimisation.

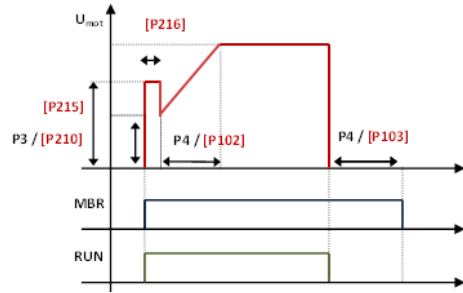
Switch-off mode 1		DIP3/4: OFF/OFF (Factory setting)	or	P108 = 0
Switch on (Set enable)	<ol style="list-style-type: none"> P3 and P210 determine the starting voltage (starting torque) that is applied to the motor. The brake opens. P4 and P102 determine the duration for which the voltage is continuously increased until the full voltage (100 %) is reached. 			
Switch off (Cancellation of release)	<ol style="list-style-type: none"> P4 and P103 determine the duration for which the voltage is continuously reduced from 100 % to 0 %. ¹⁾ The brake is applied when the voltage reaches "0 %" or after P107 has elapsed. 			

1) For technical reasons, the motor starter switches immediately to 0 % when approx. 10 % of the starting voltage is reached.

Switch-off mode 2		DIP3/4: OFF/ON	or	P108 = 1
Switch on (Set enable)	<ol style="list-style-type: none"> P3 and P210 determine the starting voltage (starting torque) that is applied to the motor. The brake opens. P4 and P102 determine the duration for which the voltage is continuously increased until the full voltage (100 %) is reached. 			
Switch off (Cancellation of release)	<ol style="list-style-type: none"> P3 and P210 determine the voltage (torque) to which the motor controller immediately drops. P4 and P103 determine the duration for which the voltage would be continuously reduced from 100 % to 0 %. However, only the part of the duration that is needed to reduce from the set starting voltage (P3 or P210) to 0 % is used. ¹⁾ The brake is applied when the voltage reaches "0 %" or after P107 has elapsed. 			

1) For technical reasons, the motor starter switches immediately to 0 % when approx. 10 % of the starting voltage is reached.

Switch-off mode 3		DIP3/4: ON/OFF	or	P108 = 2 (Factory setting)
Switch on (Set enable)	<ol style="list-style-type: none"> P3 and P210 determine the starting voltage (starting torque) that is applied to the motor. The brake opens. P4 and P102 determine the duration for which the voltage is continuously increased until the full voltage (100 %) is reached. 			
Switch off (Cancellation of release)	<ol style="list-style-type: none"> The motor is switched off immediately (voltage "0 %") and runs down to a standstill. The brake is applied when the voltage reaches "0 %" or after P107 has elapsed. 			

Switch-off mode 4		DIP3/4: ON/ON	or	P108 = 3
Switch on (Set enable)	<ol style="list-style-type: none"> P3 and P210 determine the starting voltage (starting torque) that is applied to the motor. The brake opens. P4 and P102 determine the duration for which the voltage is continuously increased until the full voltage (100 %) is reached. 			
Switch off (Cancellation of release)	<ol style="list-style-type: none"> The motor is switched off immediately (voltage "0 %") and runs down to a standstill. P4 and P103 determine the duration of the delay, during which the brake is not yet applied. The brake is applied. 			

4.2.3 Commissioning examples

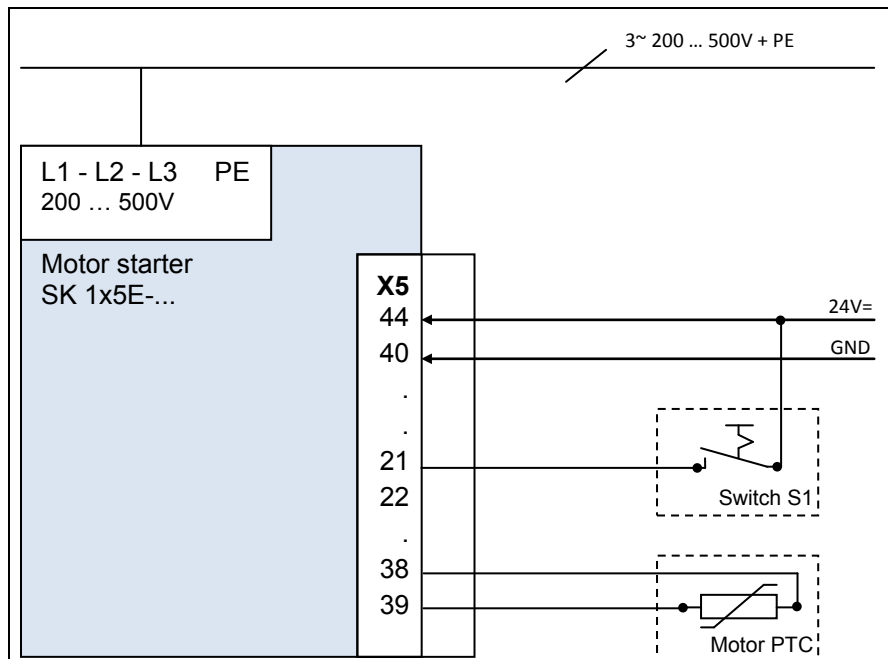
All SK 1x5E devices can basically be operated in the condition in which they are delivered.

If an automatic start-up is required when "Mains on" takes place (depending on setting **P130**), either adapt parameter (**P428**) or set DIP switch **S1-DIP1** = ON.

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

The motor starter must be provided with an external 24 V DC control voltage.

Minimal configuration



Motor start via switch

Motor start with direction of rotation "right":

- If the switch is set to "On" and 24 V DC is therefore present at digital input 1 (terminal 21), the motor starter starts to operate in the "right" (clockwise) direction.

Motor start with direction of rotation "left":

- If the switch is set to "On" and 24 V DC is therefore present at digital input 2 (terminal 22), the motor starter starts to operate in the "left" (anticlockwise) direction.

Motor start via mains voltage "ON"

DIP switch S1 / DIP1 = ON corresponds to automatic start

Motor start with direction of rotation "right":

- If the mains voltage is set to "On" and 24 V DC is therefore present at digital input 1 (terminal 21), the motor starter automatically starts to operate in the "right" (clockwise) direction.

Motor start with direction of rotation "left":

- If the mains voltage is set to "On" and 24 V DC is therefore present at digital input 2 (terminal 22), the motor starter automatically starts to operate in the "left" (anticlockwise) direction.

4.3 AS Interface (AS-i)

This section is only relevant for device of type SK 175E-...-ASI.

4.3.1 The bus system

General information

The **Actuator-Sensor-Interface** (AS interface) is a bus system for the lower field bus level. It is fully defined in the AS interface *Complete Specification* and standardised as per EN 50295, IEC62026.

The transmission principle is a single master system with cyclical polling. Since *Complete Specification V2.1*, a maximum of **31 standard slaves** which use device profile **S-7.0**. or **62 A/B slaves** that use device profile **S-7.A**. can be operated on a non-shielded two-wire cable up to 100 m in length with any network structure.

The number of possible slave subscribers can be doubled by means of double assignment of addresses 1-31 and designation "A Slave" or "B Slave". A/B Slaves are designated by the ID code A, and therefore can be uniquely identified by the Master.

Devices with slave profiles **S-7.0** and **S-7.A** can be jointly operated within an AS-i network as of version 2.1 (**Master profile M4**) with observance of the allocation of addresses (see example).

Permissible	Not permissible
Standard slave 1 (Address 6)	Standard slave 1 (Address 6)
A/B slave 1 (Address 7A)	Standard slave 2 (Address 7)
A/B slave 2 (Address 7B)	A/B slave 1 (Address 7B)
Standard slave 2 (Address 8)	Standard slave 3 (Address 8)

Addressing is implemented via the master, which can also provide other management functions, or via a separate addressing device.

Device-specific information

The transfer of the 4-bit reference data (in each direction) is performed with effective error protection for standard slaves with a maximum cycle time of 5 ms. Due to the correspondingly higher number of participants, for A/B slaves the cycle time (*max. 10 ms*) is doubled for data *which is sent from the slave to the master*. Extended addressing procedures for the transmission of *data to the slave* also cause an additional doubling of the cycle time *to max. 21 ms*.

The yellow AS interface cable supplies data and energy.

The motor starter is configured in such a way that no additional auxiliary voltage has to be connected. However, by adapting a jumper it is possible to configure the motor starter in such a way that the yellow AS-i cable is only used for data transmission and supplies the AS-i bus. The device itself and sensors and the like that are connected via the device are then provided with an auxiliary voltage (24 V DC) by a **second two-wire cable (black)**. When doing this it is **essential** to provide the supply via a protective low voltage (**PELV - Protective Extra Low Voltage**).

4.3.2 Features and technical data

The device can be directly integrated in an AS interface network is parametrised in its factory settings so that the most frequently used AS-i functionality is available immediately. Only adaptations for application-specific functions of the device or the bus system, the addressing and proper connection of the supply, BUS, sensor and actuator cables need to be carried out.

Features

- Electrically isolated bus interface
- Status display (1 LED)
- Configuration, optionally via
 - integrated potentiometers and DIP switches
 - or by means of parametrisation
- 24 V DC supply of integrated AS-i module via yellow AS-i cable
- 24 V DC supply to the motor starter
 - via yellow AS-i cable (factory setting)
 - or separately via black cable or another 24 V DC source – e.g. SK xU4-24V-... power supply (configurable with jumpers)
- Connection to device
 - via terminal strip
 - or via M12 flanged connectors

Technical data for AS interface

Designation	Value	
	Jumper position "AUX"	Jumper position "AS-I"
Supply via AS-i (yellow cable)	26.5 – 31.6 V DC, max. 25 mA	26.5 – 31.6 V DC, max. 240 mA ¹⁾
AUX supply (black cable)	24 V DC ± 25 %, max. 400 mA	<i>Connection not permitted</i>
Slave profile	S-7.A	S-7.A
I/O-Code	7	7
ID Code	A	A
External ID Code 1 / 2	7	7
Address	1A – 31A and 1B - 31B (Delivery condition: 0A)	1A – 31A and 1B - 31B (Delivery condition: 0A)
Cycle time	Slave → Master ≤ 10 ms Master → Slave ≤ 21 ms	Slave → Master ≤ 10 ms Master → Slave ≤ 21 ms
Quantity of (BUS I/O)	4I / 4O	4I / 4O

1) Of which max. 165 mA is for peripherals (initiators, connected parametrisation tool, actuators)

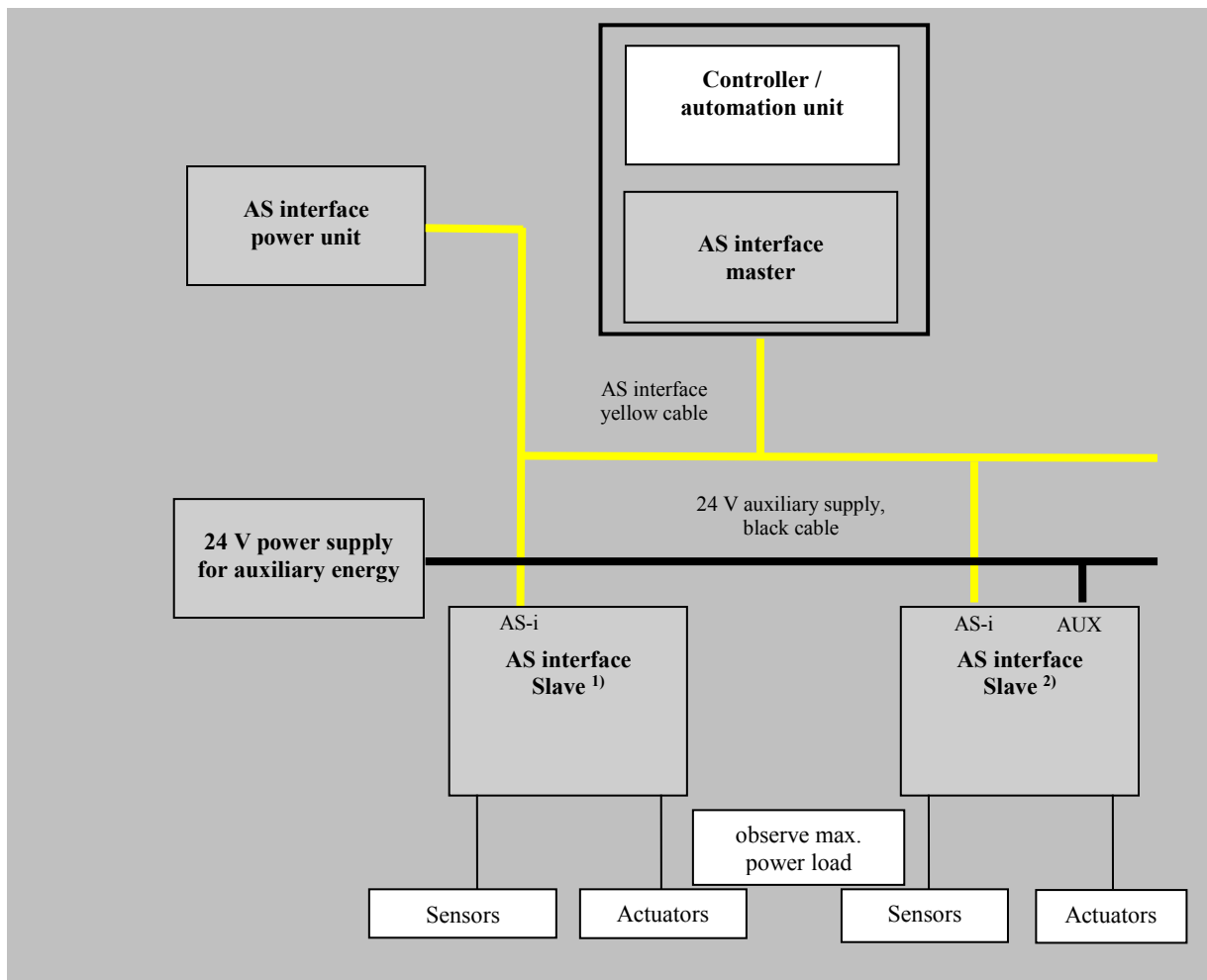
4.3.3 Bus structure and topology

The AS Interface network must be set up in any form (line, star, ring and tree structure) and is managed by an AS interface master as the interface between the PLC and slaves. Additional slaves can be added to an existing network at any time, up to a limit of 31 standard slaves or 62 A/B slaves. The slaves are addressed by the master or an appropriate addressing device.

An AS-i master communicates independently and exchanges data with the connected AS-i slaves. Normal power units may not be used in the AS interface network. Only a special AS interface power unit may be used for the power supply for each AS interface connector. This AS interface power supply is directly connected to the yellow standard cable (AS-i(+) and AS-i(-) cable) and should be positioned as close as possible to the AS-i master in order to keep the voltage drop small.

In order to avoid problems, the **PE connection of the AS interface power supply** (if present) **must be earthed**.

The brown **AS-i(+)** and the blue **AS-i(-)** wire of the yellow AS interface cable **must not be earthed**.



1)	SK 175E-...-ASI	Device with jumper position AS-I
2)	SK 175E-...-ASI	Device with jumper position AUX (separate 24 V DC supply for AS-i and motor starter)

4.3.4 Commissioning

4.3.4.1 Connection

Connection of the AS interface cable (yellow) is made via terminals 85/85 of the terminal strip and can optionally be made to an appropriately labelled M12 flange plug connector (yellow)

Details of control terminals (📖 Section 2.3.3 "Electrical connection of the control unit")

Details of connector (📖 Section 3.2.3.2 "Plug connectors for control connection")

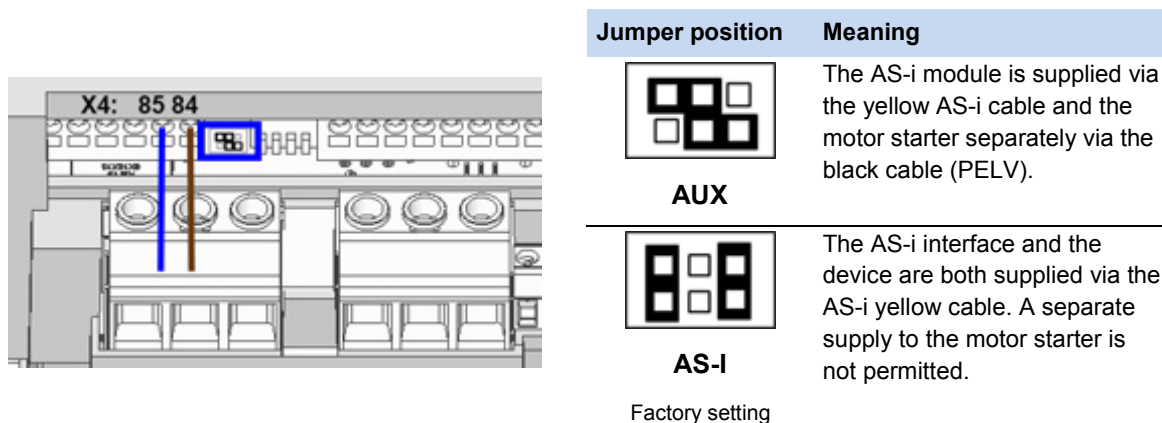



Figure 11: AS-i, connecting terminals and jumper position (example of "AUX" position)

Type	Jumper position	AS interface connection		Control voltage connection AUX cable of a PELV	
		AS-i(+)	AS-i(-)	24 V DC	GND
SK 175E-...-ASI	AS-I	84	85	Connection not permitted!	
SK 175E-...-ASI	AUX	84	85	44	40

Table 11: AS interface, connection of signal and supply cables

In order to ensure that proper **potential equalisation** takes place, the connection of a **second earthing line** is recommended. This must be connected to the PE connection of the device.

If the AS interface ("yellow cable") is not used, the normal connection requirements for the device apply (📖 Section 2.3.3 "Electrical connection of the control unit").

 Information	24 V DC / AS interface
<p>If the yellow AS interface cable and jumper position AS-I are used:</p> <ul style="list-style-type: none"> – no voltage source may be connected to terminals 44/40, – the device is supplied via the yellow AS-I cable, – the supply voltage (24 V DC) for the use of the digital inputs or other external peripherals (e.g. actuators) can be obtained from terminals 43/40. The permissible total current for this is limited to 165 mA! 	

4.3.4.2 Displays

The status of the AS interface is signalled by a multi-colour **AS-i** LED.



AS-i LED	Meaning
OFF	<ul style="list-style-type: none"> No AS interface voltage to the module Connections not connected or exchanged
green ON	<ul style="list-style-type: none"> Normal operation (AS interface active)
red ON	<ul style="list-style-type: none"> No exchange of data <ul style="list-style-type: none"> Slave address = 0 (slave still in factory setting) Slave not in LPS (list of planned slaves) Slave with incorrect IO/ID Master in STOP mode Reset active
Alternately flashing red / green Flashing (2 Hz) ¹⁾	<ul style="list-style-type: none"> Peripheral error <ul style="list-style-type: none"> Control unit in device not starting (AS-i voltage too low or control unit defective)
Alternately flashing red / yellow Flashing (2 Hz) ¹⁾	<ul style="list-style-type: none"> No exchange of data <ul style="list-style-type: none"> Slave address = 0 (slave still in factory setting)
red Flashing (2 Hz) ¹⁾	<ul style="list-style-type: none"> EMC / Hardware error

1) Switch-on frequency per second, example: 2 Hz = LED 2 x per second "On"

4.3.4.3 Configuration

The most important functionality is assigned via the arrays [-04] ... [-07] of parameter (P420) and via the arrays [-01] ... [-02] of parameter (P434).

Bus I/O bits

WARNING

Unexpected movement due to automatic starting

In the event of a fault (communication interrupted or bus cable disconnection, the device automatically switches off, since the device enable is no longer present.

Restoration of communication may result in an automatic start and therefore, unexpected movement of the drive unit. To prevent any hazard, a possible automatic start must be prevented as follows:

- If a communication error occurs, the bus master must actively set the control bits to "zero".

The device is equipped with two additional digital inputs for connecting initiators. However, there are no optional outputs for connecting actuators which are operated directly via the BUS. The following connections are each provided for four reference data bits:

BUS-IN	Function (P420[-04....-07])	Status		Status
		Bit 1	Bit 0	
Bit 0	Enable right	0	0	Motor is switched off
Bit 1	Enable left	0	1	Field of rotation right present at motor
Bit 2	Acknowledge fault ¹⁾	1	0	Field of rotation left present at motor
Bit 3	Release brake manually ²⁾	1	1	Motor is switched off

- 1) Acknowledge with flank 0 → 1.
For control via the bus, acknowledgement is not automatically performed by a flank on one of the enable inputs
- 2) 0 = Brake applied, will be released automatically if required
1 = Brake is released immediately.

BUS-OUT	Function (P434 [-01 ... -02])	Status		Status
		Bit 1	Bit 0	
Bit 0	Fault (status bit 0)	0	0	Error active
Bit 1	Operation (status bit 1)	0	1	Standby (motor stationary)
Bit 2 ¹⁾	Status of initiator 1 (DIN3 / C1)	1	0	Warning (but motor running)
Bit 3 ¹⁾	Status of initiator 2 (DIN4 / C2)	1	1	Run (motor running without warning)

- 1) Bits 2 and 3 are directly coupled to digital inputs 3 and 4.

Parallel actuation via the BUS and the digital inputs (C1, C2) is possible. The relevant inputs are dealt with more or less as normal digital inputs. If a changeover between manual and automatic is going to take place, it must be ensured that no enable via the normal digital inputs takes place in automatic mode. This could be implemented e.g. with a three-position key switch. Position 1: "Manual left" Position 2: "Automatic" Position 3: "Manual right".

If an enable is present via one of the two "normal" digital inputs, the control bits from the bus system are ignored. An exception is the control bit "Acknowledge fault". This function is always possible in parallel, regardless of the control hierarchy. The bus master can therefore only take over control if no actuation via a digital input takes place. If "Enable left" and "Enable right" are set simultaneously, the enable is removed and the motor stops without a deceleration ramp (block voltage).

4.3.4.4 Addressing

In order to use the device in an AS-i network, it must have a unique address. The address is set to 0 in the factory. This means that the device can be recognised as a "new device" by an AS-i master (prerequisite for automatic address assignment by the master).

Course of action

- Ensure power supply of the AS interface via the yellow AS interface cable.
- Disconnect the AS interface master during addressing
- Set the address ≠ 0
- Do not doubly assign addresses

In many other cases, addressing is carried out using a normal addressing device for AS interface slaves (example follows).

- Pepperl+Fuchs, VBP-HH1-V3.0-V1 (separate M12 connection for external power supply)
- IFM, AC1154 (battery operated addressing device)

i Information

Addressing device selection

Jumper position "AS-I" (factory setting)

- The use of an addressing device with a separate 24 V connection is recommended.
- The use of a battery-operated addressing device is only possible if the total power consumption of the motor starter (up to 240 mA, depending on connected initiators or the like) does not exceed the current rating of the addressing device.

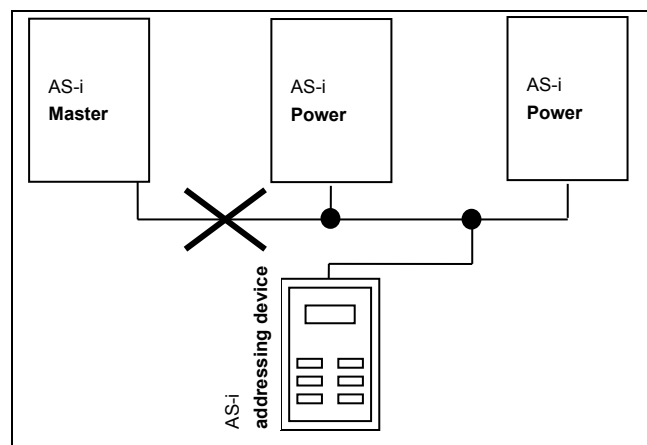
Jumper position "AUX"

- The use of a battery-operated addressing device or an addressing device with a separate 24 V DC connection is possible.

Ways in which AS-i Slave addressing can be implemented in practice with an addressing device, provided that the yellow AS interface cable is used for transferring data and supplying the motor starter (jumper position AS-I), are shown in the following.

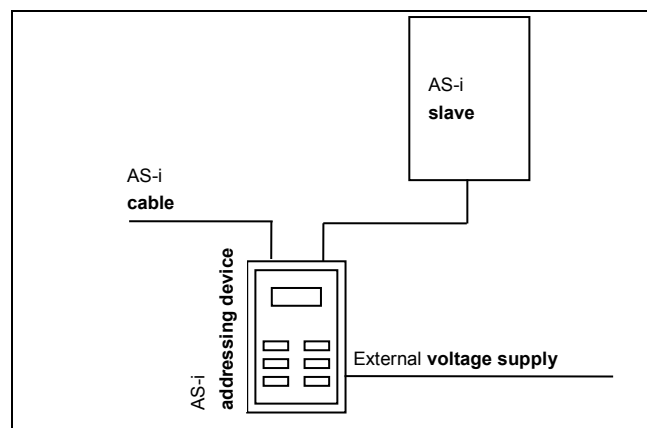
Version 1

Using an addressing device which is equipped with an **M12 connector** for connecting to the **AS-i bus**, you can incorporate yourself into a the AS interface network via an appropriate access. The prerequisite for this is that the AS interface master can be switched off.



Version 2

With an addressing device that is equipped with an **M12 connector** for connecting to the **AS-i bus** and an additional **M12 connector** for connecting an external **voltage supply**, the addressing device can be directly incorporated in the AS-i cable.



4.3.5 Certificate

Currently available certificates can be found on the Internet at [Link "www.nord.com"](http://www.nord.com)

4.4 PROFIBUS DP

This section is only relevant for device of type **SK 175E-...-PBR**.

4.4.1 The bus system

PLC's, PC's, operating devices and monitoring devices can all communicate via a uniform bus in serial bit mode using PROFIBUS DP. PROFIBUS DP is preferably used where time-critical rapid and complex communication between individual devices is required. The bus system is suitable as a substitute for cost-intensive parallel 24 V DC signal transfer of process data.

PROFIBUS communication is specified in the international standards IEC 61158 and IEC 61784. Application and planning aspects are specified and documented in the guidelines of the PROFIBUS users' organisation (PNO). This ensures that devices from different manufacturers can communicate with each other. The data exchange is specified in DIN 19245 parts 1 and 2 and application-specific extensions in part 3 of this standard. As part of the European field bus standardisation process, PROFIBUS is being integrated into the European field bus standard EN 50170.

4.4.2 Features

- Electrically isolated bus interface
- Status display (1 LED)
- Address setting via two rotary coding switches (beneath the casing cover)
- The PROFIBUS termination resistor can be switched in via jumpers
- Transfer of 4 control bits and 4 status bits
- Supports Sync Mode and Freeze Mode of the PROFIBUS DP communication function
- Watchdog function, in case of malfunction all bits of the setpoint PDO are set to 0
- No parameter communication
- Baud rate 12 Mbit/s
- Connection to device
 - via terminal strip
 - or via M12 system connectors

4.4.3 Commissioning

4.4.3.1 Connection

Connection of the PROFIBUS cable (lilac) is made via the terminal strip and can optionally be made to an appropriately labelled M12 flange plug contact (lilac)

The connection to the terminal strip must not be made via a stub, i.e. the "incoming" and "outgoing" PROFIBUS cables must be connected in one terminal together using a double wire end sleeve, for example!

Details of control terminals (📖 Section 2.3.3 "Electrical connection of the control unit")

Details of connectors (📖 Section 3.2.3.2 "Plug connectors for control connection")

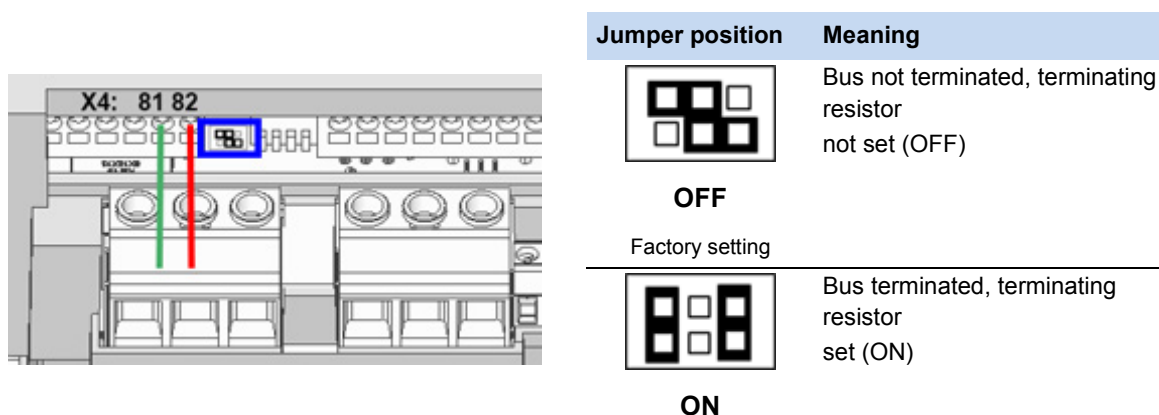


Figure 12: PROFIBUS, connecting terminals and jumper position (example of "OFF" position)

Type	PROFIBUS DP connection		Control voltage connection	
	PBR-A	PBR-B	24 V DC	GND
SK 175E-...-PBR	81	82	44	40

Table 12: PROFIBUS DP, connection of signal and supply cables

In order to ensure that proper **potential equalisation** takes place, the connection of a **second earthing line** is recommended. This must be connected to the PE connection of the device.

The bus terminating resistor is terminated at the first and last bus subscribers (see above for jumper position SK 175E-...-PBR).

4.4.3.2 Displays

The status of the PROFIBUS is signalled by a **BR LED**.



LED BR	Meaning
OFF	No cyclic process data communication active, i.e. no data communication with slave. <ul style="list-style-type: none"> • PLC / Master in STOP or switched off • Missing 24 V DC voltage supply to motor starter • Profibus cable between PLC / Master and motor starter / Slave not connected • Connections not connected or exchanged • Bus terminating resistor not set correctly (at first and last slave of bus line) • Erroneous addressing (wrong address set) • Missing hardware configuration in PLC / Master, possible wrong GSD file (NORD0DA5.gsd) used (Link)
green ON	<ul style="list-style-type: none"> • Normal operation (cyclic process data communication in operation)

4.4.3.3 Configuration

Process data

The process data is used to control the motor starter and communicate its status. The transfer of this data is carried out cyclically. There is only one process data object (PDO) for the motor starter, with a fixed data length of 1 byte. Only the bottom 4 bits are used. A distinction is made between the setpoint PDO (from PLC to device (BUS-IN bits)) and the actual value PDO (from device to PLC (BUS-OUT bit)).

Bus I/O bits

 **WARNING**

Unexpected movement due to automatic starting

In the event of a fault (communication interrupted or bus cable disconnection, the device automatically switches off, since the device enable is no longer present.

Restoration of communication may result in an automatic start and therefore, unexpected movement of the drive unit. To prevent any hazard, a possible automatic start must be prevented as follows:

- If a communication error occurs, the bus master must actively set the control bits to "zero".

The device is equipped with two additional digital inputs for connecting initiators. However, there are no optional outputs for connecting actuators which are operated directly via the BUS. The following connections are each provided for four reference data bits:

BUS-IN	Function (P420[-04...-07])	Status		Status
		Bit 1	Bit 0	
Bit 0	Enable right	0	0	Motor is switched off
Bit 1	Enable left	0	1	Field of rotation right present at motor
Bit 2	Acknowledge fault ¹⁾	1	0	Field of rotation left present at motor
Bit 3	Release brake manually ²⁾	1	1	Motor is switched off

- 1) Acknowledge with flank 0 → 1.
For control via the bus, acknowledgement is not automatically performed by a flank on one of the enable inputs
- 2) 0 = Brake applied, will be released automatically if required
1 = Brake is released immediately.

BUS-OUT	Function (P434 [-01 ... -02])	Status		Status
		Bit 1	Bit 0	
Bit 0	Fault (status bit 0)	0	0	Error active
Bit 1	Operation (status bit 1)	0	1	Standby (motor stationary)
Bit 2 ¹⁾	Status of initiator 1 (DIN3 / C1)	1	0	Warning (but motor running)
Bit 3 ¹⁾	Status of initiator 2 (DIN4 / C2)	1	1	Run (motor running without warning)

1) Bits 2 and 3 are directly coupled to digital inputs 3 and 4.

Parallel actuation via the BUS and the digital inputs (C1, C2) is possible. The relevant inputs are dealt with more or less as normal digital inputs. If a changeover between manual and automatic is going to take place, it must be ensured that no enable via the normal digital inputs takes place in automatic mode. This could be implemented e.g. with a three-position key switch. Position 1: "Manual left" Position 2: "Automatic" Position 3: "Manual right".

If an enable is present via one of the two "normal" digital inputs, the control bits from the bus system are ignored. An exception is the control bit "Acknowledge fault". This function is always possible in parallel, regardless of the control hierarchy. The bus master can therefore only take over control if no actuation via a digital input takes place. If "Enable left" and "Enable right" are set simultaneously, the enable is removed and the motor stops without a deceleration ramp (block voltage).

4.4.3.4 Addressing

The motor switch is addressed via two decimal rotary coding switches.

Switch "x1 S3"

- Setting of decimal number range from 0 to 9

Switch "x10 S2"

- Setting of 10's location of the address. The setting range 0 to 9 is linked with a factor of 10.



Example

Switch S2 = 4 (→ 4x)

Switch S3 = 2 (→ x2)

→ Resulting PROFIBUS address = **42**

The PROFIBUS address of the motor starter can be set within a range of 1 to 79 and 81 to 99 with the rotary coding switches.

If **addresses 0 or 80** are set, the motor starter interprets these values as an address of 126. **Communication is not possible** in this case.

The address is read in directly after switching on the 24 V supply of the motor starter.

An **address change** only comes into effect on the voltage supply of the device **after switching the 24 V DC on again!**

5 Parameter



WARNING

Unexpected movement due to parameter changes

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

Therefore:

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

The relevant parameters for the device are described in the following. The parameters are accessed using a parametrisation tool (e.g. NORDCON software or control and parametrisation unit, see also (📖 Section 3.1 "Control and parametrisation options ") and therefore makes it possible to adapt the device to the drive task in the best possible way. Different device configurations can result in dependencies for the relevant parameters.

The parameters can only be accessed if the control unit of the device is active.

The device must be provided with a 24 V DC control voltage to do this (📖 Section 2.3.3 "Electrical connection of the control unit").

Connections and possible priority switching with the potentiometers (**P1...**) and the DIP switch (**S1**) are described in a suitable location and must be taken into consideration (pay attention to **P130**).

Parameter changes only have a direct influence on the RAM memory of the device and are therefore volatile. In order to retain these changes, a copy job (**P550**) must be triggered after completing the parameter changes. This causes the data to be transferred to the permanent memory (Flash memory) of the device.

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

Menu group	No.	Master function
Operating displays	(P0--)	Display of parameters and operating values
Basic parameters	(P1--)	Basic device settings such as behaviour when switching on/off
Motor data	(P2--)	Electrical settings for the motor (motor current or starting voltage (start-off voltage))
Control terminals	(P4--)	Assignment of functions for the inputs and outputs
Additional parameters	(P5--)	Priority monitoring function and other parameters
Information	(P7--)	Display of operating values and status messages



Information

Factory setting P523

The factory settings of the entire parameter set can be loaded at any time using parameter **P523**. For example, this can be useful during commissioning if it is not known which device parameters have been changed earlier, and could have an unexpected influence on the operating behaviour of the drive.

Restoring the factory settings (**P523**) affects all parameters. This means that all motor data must subsequently be checked or reset.

The potentiometers (**P1-P4**) and DIP switches (**S1**) are also reactivated.

5.1 Parameter overview

Operating displays

P000 Operating display	P001 Selection of display value	P003 Supervisor code
-------------------------------	--	-----------------------------

Basic parameters

P102 Acceleration time	P103 Run time	P107 Brake reaction time
P108 Switch-off mode	P114 Brake delay off	P130 Parameter source
P131 Phase control mode		

Motor data

P203 Rated motor current	P210 Start voltage	P215 Boost voltage
P216 Time boost		

Control terminals

P400 Function Analogue input	P420 Digital inputs	P427 Emerg. stop Fault
P428 Automatic starting	P434 Digital output	P499 Function DIP switch

Additional parameters

P523 Factory setting	P535 1 st motor	P538 Mains voltage Monitoring
P539 Output monitoring	P550 Flash copy order	P570 Locking time
P580 Error in the event of overtemp.	P581 Phase sequence detection	P582 Manual brake release

Information

P700 Present Operating status	P707 Software version	P708 Status of digital in.
P709 Potentiometer status	P711 Digital output status	P716 Current frequency
P718 Mains frequency	P719 Actual current	P720 Effective current
P721 Reactive current	P722 Current voltage	P723 Voltage -d
P724 Voltage -q	P725 Current cos phi	P726 Apparent power
P727 Mechanical power	P728 Current mains voltage	P732 Phase U current
P733 Phase V current	P734 Phase W current	P740 Process data Bus In
P741 Process data Bus Out	P743 Device type	P744 Configuration
P749 Status of DIP switches	P762 Phase U voltage	P763 Phase V voltage
P764 Phase W voltage		

5.2 Description of parameters

P000 (parameter number)	Operating display (parameter name)	xx ¹⁾	S	P
Setting range (or display range)	Display of typical display format (e.g. (bin = binary)) of possible setting range and number of decimal places	Other applicable parameter(s):	List of other parameters that are directly associated	
Arrays	[-01]	If parameters have a substructure in several arrays, this is shown here.		
Factory setting	{ 0 }	Default setting that the parameters typically have in the as-delivered condition of the device or to which it is set after carrying out "Restore factory settings" (see parameter P523).		
Scope of Application	List of device variants to which this parameter applies. If the parameter is generally valid, i.e. for the entire model series, this line is omitted.			
Description	Description, functionality, meaning and the like for this parameter.			
Note	Additional notes about this parameter			
Setting values (and display values)	List of possible settings with description of the respective functions			

1) xx = other identification

Figure 13: Explanation of parameter description

 Information	Description of parameters
Unused lines of information are not listed.	

Note / Explanation:

Code	Designation	Meaning
S	Supervisor-Parameter	The parameter can now be displayed and modified if the relevant supervisor code has been set (see parameter P003).
P	Parameter set-dependent	The parameter provides different setting options that are dependent upon the selected parameter set.
RD	READ	Parameter can only be read.
RM	RAM	The parameter can be modified but not stored in the Flash memory.
RF	READ/FLASH	According to the setting of parameter P130 , the parameter can either only be read or can be changed and saved in the flash memory.
FL	FLASH	The parameter is read out of the flash memory and can be changed.

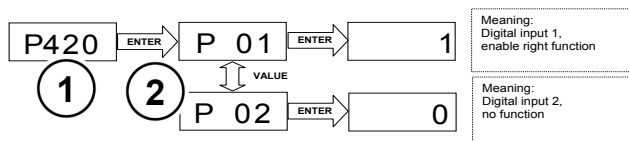
Array parameter display

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

If the SimpleBox SK CSX-3H is used, the array level is shown by `_ - 0 1`. With the ParameterBox SK PAR-3H (picture on right) the selection options for the array level appear at the top right of the display (Example: `[01]`).

Array display:

SimpleBox SK CSX-3H



- 1 Parameter number
- 2 Array

ParameterBox SK PAR-3H



- 1 Parameter number
- 2 Array

5.2.1 Operating displays

P000		Operating display	RD
Display range	0.01 ... 9999		Other applicable parameter(s): P001
Description	In the SimpleBox (SK CSX-3H) display, the operating value selected in parameter online is displayed.		

P001		Selection of display value	RM
Setting range	0 ... 11		Other applicable parameter(s): P000
Factory setting	{ 0 }		
Description	Selection of the operating value to be displayed (see P000)		
Setting values	Value	Meaning	
	0	Actual frequency [Hz]	Output frequency currently being supplied by device
	1	Nominal frequency [Hz]	Frequency of mains voltage that is currently present
	2	Current [A]	Current output current measured by device
	3	Effective current [A]	Effective current currently being supplied by device
	4	Reactive current [A]	Reactive current currently being supplied by device
	5	Mains voltage [V]	Voltage currently being measured at the input terminals
	6	cos Phi [-]	Calculated value of current power factor
	7	Apparent power KVA	Calculated value of current apparent power
	8	Effective power [kW]	Calculated value of current effective power
	9	Mains phase sequence [-]	0 = Clockwise rotating field 1 = Counter-Clockwise rotating field
	10	Duty factor [%]	Phase angle control value currently being achieved by device. 0 % = "Motor off", 100 % = "Motor voltage = Mains voltage"
	11	Actual current amplification [%]	Actual measured current in relation to the measurement range

P003		Supervisor code	RM
Setting range	0 ... 9999		
Factory setting	{ 1 }		
Description	The scope of the visible parameters can be influenced by setting the supervisor code.		
Setting values	Value	Meaning	
	0	Supervisor mode off	The supervisor parameters are not visible.
	1	Supervisor mode on	All parameters are visible.
	2 ...	Supervisor mode off	The supervisor parameters are not visible.

5.2.2 Basic parameters

P102	Acceleration time		RF
Setting range	0.00 ... 25.50 s	Other applicable parameter(s): P130, P216	
Factory setting	{ 1.00 }		
Description	The acceleration time is the time that the drive needs to reach the maximum speed after receiving the enable. Since the acceleration time is determined by the phase control variation, it is only a case of indirect control of the acceleration time here. The actual acceleration time of the motor essentially depends on the motor which is used, the inertial masses and the counter-torque.		
Note	<p>As long as parameter P130=0 is set, the acceleration time is determined via potentiometer P4. In this case the parameter can only be read, but not changed. It then corresponds to the setting determined by the potentiometer.</p> <p>If the motor is idling or in the case of drives with extremely low counter-torque, the soft start should be selected. Because the inertial masses and the counter-torque are disproportional, the phase control procedure cannot control the drive properly. The drive unit and its surroundings may be subjected to unwanted mechanical loads (vibration or the like).</p>		
P103	Run-down time		RF
Setting range	0.00 ... 25.50 s	Other applicable parameter(s): P107, P108, P130	
Factory setting	{ 1.00 }		
Description	The run-down time is the time that the drive needs to reach a speed of "0" after the enable has been removed. Since the run-down time is determined by the phase control variation, it is only a case of indirect control of the run-down time here. The actual run-down time of the motor essentially depends on the motor which is used, the inertial masses and the counter-torque.		
Note	<p>As long as parameter P130=0 is set, the run-down time is determined via potentiometer P4. In this case the parameter can only be read, but not changed. It then corresponds to the setting determined by the potentiometer.</p> <p>If the motor is idling or in the case of drives with extremely low counter-torque, the soft start should be selected. Because the inertial masses and the counter-torque are disproportional, the phase control procedure cannot control the drive properly. The drive unit and its surroundings may be subjected to unwanted mechanical loads (vibration or the like).</p>		
P107	Brake reaction time		FL
Setting range	0.00 ... 25.50 s	Other applicable parameter(s) P103, P108	
Factory setting	{ 0.00 }		
Description	<p>Time delay for the application (closing) of an electro-magnetic brake after the run-down time has been reached (P103) or the enable removed.</p> <p>Once the motor starter has blocked its voltage at the output, a connected mechanical brake remains open until the time set in P107 has elapsed. This allows the motor to reduce its speed or even stop before the brake is applied.</p>		
Note	<p>In switch off mode 4 (DIP switch S1-DIP3/4) the application time of the brake is determined by parameter P103/Potentiometer P4.</p> <p>Depending on the reaction time of the brake, the motor can be expected to switch off before the brake is applied. For lifting equipment applications, this means that there is a risk of the load dropping at the time of stopping.</p>		

P108		Switch-off mode		RF
Setting range	0 ... 3	Other applicable parameter(s): P103, P107, P130, P210		
Factory setting	{ 2 }			
Description	This parameter determines the reaction of the motor starter on the removal of the enable.			
Note	As long as parameter P130=0 is set, switch-off mode is determined via the DIP switch S1-DIP3/4. In this case the parameter can only be read, but not changed. It then corresponds to the setting that is determined by the DIP switch. (📖 Section 4.2.2.4 "Overview of switch-off modes")			
Setting values	Value	Meaning		
	0	Switch-off mode 1	The phase control becomes continuous, increased from 0 to 100% within the time period in accordance with P103 or potentiometer P4 (voltage drops). The brake is then applied in accordance with the time specified by P107 or P4.	
	1	Switch-off mode 2	The phase control becomes continuous, increased from a start value (Y) to 100% within a time period (X) (voltage drops). The start value (Y) is determined by P210 or potentiometer P3. The time period (X) is determined by P103 or potentiometer P4, whereby the starting point of the time axis is shifted to the theoretical start value (Y=0 %). The brake is then applied in accordance with the time specified by P107 or P4.	
	2	Switch-off mode 3	The output voltage is shut off immediately and the brake is applied when the voltage reaches "0 %" or after P107 has elapsed.	
	3	Switch-off mode 4	The output voltage is shut off immediately and the brake is applied in accordance with the time specified by P103 or P4.	

P114		Brake release time		FL
Setting range	0.00 ... 25.50 s			
Factory setting	{ 0.05 }			
Description	Setting of the time delay for enabling the motor after switch on.			
Note	Electromagnetic brakes have a delayed reaction time for their release, which depends on physical factors. If the brake release time set in parameter P114 is too long the motor operates against the brake, which is still applied. This can result in a start-up current that is too high, which will make the starter shut off with an overcurrent error.			

P130		Parameter source		FL
Setting range	0 ... 1	Other applicable parameter(s) P550		
Factory setting	{ 0 }			
Description	Selection of whether the DIP switches (S1) and potentiometers (P1-P4) have priority over the parameter setting.			
Note	<ul style="list-style-type: none"> Switch-over of P130 from setting 1 → 0: The RAM memory is deleted, parameter settings which have not been transferred to the flash memory (P550) are lost. Switch-over of P130 from setting 0 → 1: The default values of the parameter are used. To adopt parameter values from the flash memory the FI must be restarted (note the wait time between two mains switch on cycles! (📖 Section) 7 "Technical data"). 			
Setting values	Value	Meaning		
	0	Potentiometer/Switch	All parameters which are marked "RF" can only be read but cannot be changed. These are determined by (S1) and (P1-P4).	
	1	Flash memory	All settings at the device are determined by the parameters. (S1) and (P1-P4) have no influence.	
	2	Potentiometer switch + flash	As for setting "0" However, the functions of the digital inputs and outputs are determined via the parameters (P420 or P434).	

P131	Phase control mode		FL
Setting range	0 ... 1		
Factory setting	{ 0 }		
Description	Adaptation of the operating behaviour (running characteristics) of the motor		
Setting values	Value	Meaning	
	0	Current-optimised	Optimisation of phase control for an even current flow. This reduces the losses in the motor when starting up, but leads to an increased tendency to oscillate in the event of long ramps and an idling motor.
	1	Oscillation-optimised	Optimisation of phase control for reduced tendency to oscillate with idling motors or long ramps.

5.2.3 Motor data

P203	Rated motor current		RF
Setting range	1.00 ... 28.00 A	Other applicable parameter(s): P130	
Factory setting	{ 3.00 }		
Description	The rated motor current is needed for I ² t monitoring. For normal applications, the setting corresponds to the nominal current as per the motor type plate.		
Note	As long as parameter P130 =0 is set, the rated motor current is determined via potentiometer P1 . In this case the parameter can only be read, but not changed. It then corresponds to the setting determined by the potentiometer.		

P210	Start voltage		RF
Setting range	10.0 ... 100.0 %	Other applicable parameter(s): P108, P130	
Factory setting	{ 50.0 }		
Description	The start voltage is the voltage that the device supplies immediately after setting the enable at the motor terminals.		
Note	As long as parameter P130 =0 is set, the rated motor current is determined via potentiometer P3 . In this case the parameter can only be read, but not changed. It then corresponds to the setting determined by the potentiometer.		
Setting values	100.0 = the soft start is disabled.		

P215	Boost voltage		FL
Setting range	0.0 ... 100.0 %	Other applicable parameter(s): P210, P216	
Factory setting	{ 0.0 }		
Description	The boost voltage determines a boost to the start voltage in the starting phase. The required breakaway torque is therefore provided for drives with increased starting torque.		
Note	The boost voltage time is limited by P216 .		

P216	Time boost		FL
Setting range	0.00 ... 25.50 s	Other applicable parameter(s): P102, P215	
Factory setting	{ 0.00 }		
Description	P216 defines the time limit of the boost voltage (P215) or the increased starting torque.		
Note	The resulting acceleration time (T_{total}), which achieved until full control of the voltage, is calculated accordingly as: $T_{total} = T_{P102} + T_{P216}$.		

5.2.4 Control terminals

P400	Function Analogue input		RD
Display range	0 ... 6	Other applicable parameter(s): P102, P103, P130, P203, P210, P570	
Arrays	[-01] = Function Analogue input 1 (= value for P203 from potentiometer P1) [-02] = Function Analogue input 2 (= value for P570 from potentiometer P2) [-03] = Function Analogue input 3 (= value for P210 from potentiometer P3) [-04] = Function Analogue input 4 (= value for P102 / 103 from potentiometer P4)		
Description	Representation of function of respective potentiometer P1 ... P4 , for as long as the relevant potentiometer is active.		
Note	If P130=1 is set, all potentiometers are inactive. "0" = "No function" is displayed in all arrays.		
Display values	Value	Meaning	
	0	No function	The potentiometer is not used.
	1	Rated motor current	The potentiometer supplies the value for P203
	2	Locking time	The potentiometer supplies the value for P570
	3	Starting torque	The potentiometer supplies the value for P210
	4	Ramp times	The potentiometer supplies the value for P102 / P103
	5 ...	<i>reserved</i>	

P420	Digital inputs		RF
Setting range	0 ... 9	Other applicable parameter(s): P130, P428	
Arrays	[-01] = Digital input 1 (= value for digital input DIN1) [-02] = Digital input 2 (= value for digital input DIN2) [-03] = PTC input (= value for PTC input TF) [-04] = Bus In bit 0 (= value for Bus In bit 0) [-...] ... [-07] = Bus In bit 3 (= value for Bus In bit 3)		
Factory setting	{ [-01] = 1 }	{ [-02] = 2 }	{ [-03] = 8 } { [-04] = 3 } { [-05] = 4 } { [-06] = 7 } { [-07] = 9 }
Description	Assignment of functions for the various digital inputs.		
Note	In order to change parameter values, P130=1 must be set. Otherwise the settings of P420 can only be read. Non-permissible settings are ineffective and are not saved. The parametrisation of array [-03] cannot be changed. Arrays [-04 ... -07] are only active for SK 175E devices.		
Setting values	Value	Meaning	
	0	No function	The input is not used.
	1	Enable right	The drive runs with a right-hand direction of rotation. (only for array [-01 and -02]) High active Flank 0 → 1 ¹⁾
	2	Enable left	The drive runs with a left-hand direction of rotation. (only for array [-01 and -02]) High active Flank 0 → 1 ¹⁾
	3	Enable right via bus	The drive runs with a right-hand direction of rotation. (only for array [-04 ... -07]) High active Flank 0 → 1 ¹⁾
	4	Enable left via bus	The drive runs with a left-hand direction of rotation. (only for array [-04 ... -07]) High active Flank 0 → 1 ¹⁾
	5	Disable voltage (coast to stop)	Drive runs down to a standstill. Low active
	6	Emergency stop	Drive switches to "Switch-on block" after switching off (termination of selected switch-off mode). Low active
	7	Fault acknowledgement	Acknowledge fault message. Acknowledgement only possible if the cause of the message is not longer present. Flank 0 → 1
	8	PTC resistor input	For evaluating a PTC signal. High active
	9	Release the brake	The brake is released manually (signal "high") or automatically (signal "low") High active

1) If DIP switch 1 (S1) or parameter **P428** are parametrised to "Automatic Start-up" depending on parameter **P130**, no flank is required. A "High Level" is sufficient.

P427	Emerg. stop Fault		FL
Setting range	0 ... 1	Other applicable parameter(s): P108, P130, P428	
Factory setting	{ 0 }		
Description	<i>Emergency stop fault</i> - decision as to how the motor starter should react in the event of an error.		
Setting values	Value	Meaning	
	0	Off	An error leads to immediate motor starter shut-off (motor runs down to a standstill and brake, if present, is applied immediately)
	1	On	With errors E2.0 , E3.0 , E5.1 , E6.1 the drive is run down in the selected switch-off mode before the motor starter shuts off with an error message.

P428		Automatic starting	RF
Setting range	0 ... 1	Other applicable parameter(s): P130, P428	
Factory setting	{ 0 }		
Description	Decision as to whether the motor starter should react to an enable signal.		
Note	As long as parameter P130=0 is set, the automatic start-up is determined via DIP switch S1-DIP1 . In this case the parameter can only be read, but not changed. It then corresponds to the setting that is determined by the DIP switch.		
Setting values	Value	Meaning	
	0 Off	The device expects a flank (signal change "low → high") at the digital input which has been parametrised to "Enable" in order to start the drive. If the device is switched on with an active enable signal (mains voltage on), it immediately switches to "Switch-on block".	
	1 On	The device expects a signal level ("high") at the digital input which has been parametrised to "Enable" in order to start the drive. NOTICE! Danger of injury! Drive starts up immediately!	

P434		Digital output function	RF
Setting range	0 ... 9	Other applicable parameter(s): P130	
Arrays	[-01] = Dig.1/Bus.bit 0 outp (= value for digital output DO1 or Bus Out bit 0) [-02] = Dig.2/Bus.bit 1 outp (= value for digital output DO2 or Bus Out bit 1) [-03] = Mechanical brake (= value for mechanical brake MB)		
Factory setting	{ [-01] = 1 }	{ [-02] = 2 }	{ [-03] = 3 }
Description	Assignment of functions for the various digital outputs.		
Note	In order to modify the parameter values, P130=1 must be set. Otherwise the settings of P434 can only be read. Non-permissible settings are ineffective and are not saved. The parametrisation of array [-03] cannot be changed.		
Setting values	Value	Meaning	
	0 No function	The output is not used.	
	1 Error / Warning	Error or warning is active.	
	2 Motor running	Drive operates.	
	3 Mechanical brake	A mechanical brake is actuated (terminals 79/80). "High Signal" = brake releases	
	4 Digital-In 1 status	Display of signal status of digital input 1	
	5 Digital-In 2 status	Display of signal status of digital input 2	
	6 Status bus Dig In 1	Display of signal status of digital input 1 via bus ¹⁾	
	7 Status bus Dig In 2	Display of signal status from digital input 2 via Bus ¹⁾	
	8 Status bus Dig In 3	Display of signal status from digital input 3 via Bus ¹⁾	
	9 Status bus Dig In 4	Display of signal status from digital input 4 via Bus ¹⁾	
	10 Remote control active	The device is controlled via the Bus	

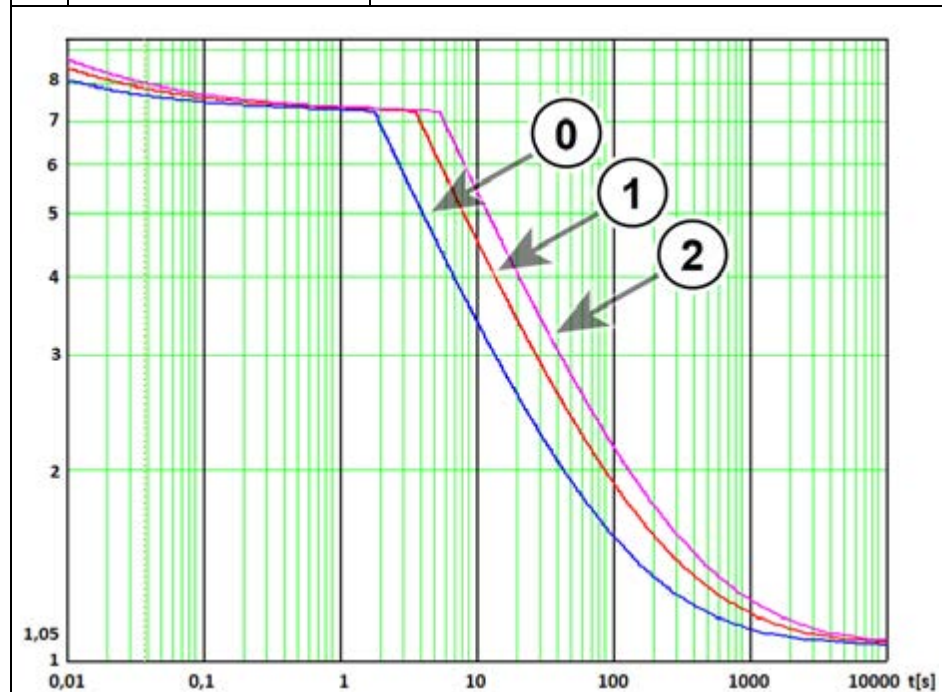
1) Only SK 175E via integrated AS interface or PROFIBUS DP

P499	Function DIP switch		RD
Display range	0 ... 6	Other applicable parameter(s): P108, P130, P428, P570	
Arrays	[-01] = Function DIP switch 1 (= value for P428) [-02] = Function DIP switch 2 (= value for P581) [-03] = Function DIP switch 3 (= value for P108 (bit 0)) [-04] = Function DIP switch 4 (= value for P108 (bit 1))		
Description	Display of functions of DIP switch (S1).		
Note	If P130=1 is set, all DIP switches are inactive. "0" = "No function" is displayed in all arrays.		
Display values	Value	Meaning	
	0	No function	The DIP switch is not used
	1	Automatic starting	The DIP switch supplies the value for P428
	2	Phase sequence detection	The DIP switch supplies the value for P581
	3 - 4	<i>reserved</i>	
	5	Switch-off mode bit 0	The DIP switch supplies the value for P108 – bit 0
	6	Switch-off mode bit 1	The DIP switch supplies the value for P108 – bit 1

5.2.5 Additional parameters

P523	Factory setting		RM
Setting range	0 ... 1	Other applicable parameter(s): P550	
Factory setting	{ 0 }		
Description	Reset all motor start parameters to the factory settings.		
Note	The setting is not permanent until the values from the RAM have been transferred to the Flash memory (see P550).		
Setting values	Value	Meaning	
	0	No change	This function is not implemented.
	1	Load factory setting	All parameters are reset to the factory settings. The display then jumps back to a value of "0".

P535	I ² t motor		FL
Setting range	0 ... 2	Other applicable parameter(s): P108, P203, P427	
Factory setting	{ 1 }		
Description	I ² t motor shut-off class – This determines how quickly the motor starter shuts off in the event of overcurrent. The rated current upon which the I ² t monitoring is based is determined by P203 . The shut-off takes place almost immediately as of 7.2 times the rated current. (Error E3.0)		
Note	The three selectable motor shut-off classes are based on curves that are defined in EN 60947-4-2.		
Setting values	Value	Meaning	
	0	Class 10A	1.5 times overcurrent for 120 s
	1	Class 10	1.5 times overcurrent for 240 s
	2	Class 20	1.5 times overcurrent for 360 s



P538	Mains voltage Monitoring		FL
Setting range	0 ... 3	Other applicable parameter(s): P108, P427	
Factory setting	{ 3 }		
Description	<i>Mains voltage monitoring</i> – Selection of variant of mains monitoring (terminals L1-L2-L3) by the device.		
Note	For reliable operation of the device, the power supply must meet a certain quality. If there is a brief interruption of a phase or the voltage supply exceeds a particular limit value, the device outputs an error. If the monitoring is disabled, mains errors can lead to undefined operating behaviour.		
Setting values	Value	Meaning	
	0	Switched off	No monitoring of the supply voltage.
	1	Phase error	Phase errors lead to error message (E7.0)
	2	Mains voltage	Overvoltage and undervoltage in the supply network lead to an error message (E5.1, E6.1)
	3	Phase err. + mains voltage	Combination of settings 1 and 2. → Phase errors or mains errors lead to an error message (E5.1, E6.1, E7.0)
P539	Output monitoring		FL
Setting range	0 ... 3	Other applicable parameter(s): P203	
Factory setting	{ 3 }		
Description	Selection of output monitoring variant (terminals U-V-W) by the device.		
Setting values	Value	Meaning	
	0	Switched off	No monitoring of the output voltage
	1	Motor phases only	Phase errors (asymmetries of measured output current) lead to error message (E016).
	2	Magnetisation only	If the measured output current is less than 20 % of the rated motor current (P203 or potentiometer P1) during normal operation (after completion of the acceleration time), this leads to error message (E016).
	3	Motor phase + Magnet.	Combination of settings 1 and 2. → Phase and magnetisation errors lead to error message (E016).
P550	Flash copy order		RM
Setting range	0 ... 1		
Factory setting	{ 0 }		
Description	Transfer the modified parameter settings to the (non-volatile) Flash memory of the device.		
Note	Parameter changes initially only affect the volatile RAM memory, and are lost when the device is switched off. In order to retain the parameter changes permanently, they must be transferred to the Flash memory. A maximum of 100 copy processes can be guaranteed.		
Setting values	Value	Meaning	
	0	No change	This function is not implemented.
	1	RAM -> Flash	Copying process starts. The device then carries out an automatic "RESET". Parameter P550 is reset to "0".

P570	Locking time		RF
Setting range	0 ... 25.50 s	Other applicable parameter(s): P102, P103, P108, P130	
Factory setting	{ 0.50 }		
Description	The locking time determines the period of time during which the motor is not powered after the end of the run-down time and before the acceleration time started in the event of a change of rotating direction (reversing).		
Note	<p>As long as parameter P130=0 is set, the locking time is determined via potentiometer P2. In this case the parameter can only be read, but not changed. It then corresponds to the setting determined by the potentiometer.</p> <p>If the locking time is insufficient, the motor may still be rotating at the end of the run-down time. Starting in the opposite direction of rotation would result in the motor being subjected to excessive loads (thermal, mechanical) because of the counter-current braking that occurs as a result.</p>		
P580	Error in the event of overtemp.		RF
Setting range	0 ... 1	Other applicable parameter(s): P108, P427	
Factory setting	{ 1 }		
Description	<i>Fault shut-off due to overtemperature</i> – selection of whether an over temperature error (PTC) should lead to a warning or a fault shut-off.		
Setting values	Value	Meaning	
	0	Off	Warning (C002) due to overtemperature
	1	On	Fault message (E002) and shut-off of device due to overtemperature
P581	Phase sequence detection		RF
Setting range	0 ... 1	Other applicable parameter(s): P130, P428	
Factory setting	{ 0 }		
Description	Analysis of phase sequence of supply network by the device and automatic adaptation of rotary field of motor to the required direction of rotation.		
Note	As long as parameter P130=0 is set, phase sequence detection is determined via the DIP switch S1-DIP2. In this case the parameter can only be read, but not changed. It then corresponds to the setting that is determined by the DIP switch.		
Setting values	Value	Meaning	
	0	Off	The direction of rotation of the motor is determined by the direction of rotation of the supply network.
	1	On	The direction of rotation of the motor is determined by the enable direction.
P582	Manual brake release		RF
Setting range	0 ... 1	Other applicable parameter(s): P420	
Factory setting	{ 0 }		
Description	Definition of conditions for releasing a connected electro-mechanical brake		
Note	DANGER! With certain drive tasks (e.g. lifting gear) it can be dangerous to release of the brake without the drive running (risk of raised load falling)!		
Setting values	Value	Meaning	
	0	Off	The brake is only released if the motor is enabled.
	1	On	The brake is released even if the motor has not been enabled (e.g. if a drive is to be moved for revision work). → Pay attention to note!

5.2.6 Information

P700		Current operating status	RD
Display range	0.0 ... 25.4		
Arrays	[-01] = Current error	Current active error message (not acknowledged)	
	[-02] = Current warning	Current existing warning	
	[-03] = Reason for switch-on block	Current existing reason for an active switch-on block	
Description	Display of current messages about operating status		
Display values	📖 Section 6 "Operating status messages"		

P707		Software version	RD
Display range	0.0 ... 9999.0		
Arrays	[-01] = Software version	Version number (e.g.: V1.0)	
	[-02] = Software revision	Revision number (e.g.: R1)	
	[-03] = Special version	Special version of the hardware/software (e.g: 0.0). The value "0" stands for "Standard Version".	
Description	Display of software version (firmware version) of device		

P708		Status of digital in.	RD
Display range	0000 0000 ... 0111 1111 (bin)	0000 ... 007F (hex)	
Description	Display of switching status of the digital inputs		
Display values	Value (Bit)	Meaning	
	0	Digital input 1	Switching status of digital input 1
	1	Switch input 2	Switching status of digital input 2
	2	PTC resistor input	PTC resistor input switching status
	3	Bus In Bit 0	Bus In signal status In bit 0 (SK 175E-... only)
	4	Bus In Bit 1	Bus In signal status In bit 1 (SK 175E-... only)
	5	Bus In Bit 2	Bus In signal status In bit 2 (SK 175E-... only)
	6	Bus In Bit 3	Bus In signal status In bit 3 (SK 175E-... only)

P709		Potentiometer status	RD
Display range	0.0 ... 100.0 %		
Arrays	[-01] = Potentiometer P1	Current value in % of 9.5 A (BG1) or 23,5 A (BG2)	
	[-02] = Potentiometer P2	Current value in % of 25.6 s	
	[-03] = Potentiometer P3	Current value in % of 100% start voltage	
	[-04] = Potentiometer P4	Current value in % of 25.6 s	
Description	Display of set values of potentiometer P1 ... P4 , <i>in relation to the respective scale end values (in %)</i>		

P711		Digital output status	RD
Display range	0000 ... 0111 (bin)	00 ... 07 (hex)	
Description	Display of switching status of the digital inputs		
Display values	Value (Bit)	Meaning	
	0	Dig.1/Bus. bit 0	Switching status of digital output 1 or Bus Out Bit 1 ¹⁾
	1	Dig.2/Bus. bit 1	Switching status of digital output 2 or Bus Out Bit 2 ¹⁾
	2	Mechanical b.	Switching status of mechanical brake output

1) Bus Out Bit only for devices SK 175E-....
The display for DOUT and Bus Out are "or"-ed when doing this.

P716	Current frequency	RD	
Display range	- 70 ... + 70 Hz		
Description	Display of current output frequency		
Note	The value is calculated from the mains frequency and the selected direction of rotation when enabling takes place. In the switched-off condition (drive not enabled) a value of "Zero" is output.		
P718	Mains frequency	RD	
Display range	- 70 ... + 70 Hz		
Description	Display of current mains frequency		
P719	Current current	RD	
Display range	0.0 ... 999.9 A		
Description	Display of current output current		
P720	Effective current	RD	
Display range	-999.9 ... + 999.9 A		
Description	Display of current measured effective current		
Display values	Value	Meaning	
	-999.9 ... - 0.1	Generator current	
	0 ... + 999.9	Motor current	
P721	Reactive current	RD	
Display range	-999.9 ... + 999.9 A		
Description	Display of current measured reactive current		
P722	Current voltage	RD	
Display range	0 ... 500 V		
Description	Display of current AC voltage present at the output terminals		
P723	Voltage -d	RD	S
Display range	-500 ... + 500 V		
Description	Display of current voltage component Ud		
Note	The value is typically "0".		
P724	Voltage -q	RD	S
Display range	-500 ... + 500 V		
Description	Display of current voltage component Uq		
Note	The value is typically the same as that of parameter P722 .		
P725	Current cos phi	RD	
Display range	0.00 ... 1.00		
Description	Display of current calculated cos phi value		
P726	Apparent power	RD	
Display range	0.00 ... 99.99 kVA		
Description	Display of current calculated apparent power		
Note	The calculation is based on motor data (P203).		
P727	Mechanical power	RD	
Display range	-99.99 ... + 99.99 kW		
Description	Display of current calculated effective power at motor		

P728	Present Mains voltage		RD	
Display range	0 ... 1000 V			
Description	Display of current supply voltage present at the input terminals			
P732	Phase U current		RD	
Display range	0.0 ... 999.9 A			
Description	Display of currently measured voltage of phase U			
Note	Because of the measuring procedure, the value of P719 can deviate in spite of symmetrical output currents.			
P733	Phase V current		RD	
Display range	0.0 ... 999.9 A			
Description	Display of currently measured voltage of phase V			
Note	Because of the measuring procedure, the value of P719 can deviate in spite of symmetrical output currents.			
P734	Phase W current		RD	
Display range	0.0 ... 999.9 A			
Description	Display of currently measured voltage of phase W			
Note	Because of the measuring procedure, the value of P719 can deviate in spite of symmetrical output currents.			
P740	Bus In process data		RD	S
Display range	0000 ... FFFF _(hex)	-32768 ... + 32767 _(dec)		
Arrays	[-01] = Control word [-02] = ... [-04] [-05] = Parameter data In 1 [-06] = Parameter data In 2 [-07] = Parameter data In 3 [-08] = Parameter data In 4 [-09] = Parameter data In 5	not used	Data during parameter transfer: Order label (AK), Parameter number (PNU), Index (IND), Parameter value (PWE1 / PWE2)	
Description	Display of process and parameter data that is directed at the device and transmitted via the bus.			

P741		Bus Out process data		RD	S
Display range	0000 ... FFFF (hex)			-32768 ... + 32767 (dec)	
Arrays	[-01] = Bus status word [-02] = Bus - Actual value 1 [-03] = Bus - Actual value 2 [-04] = Bus - Actual value 3 [-05] = Parameter data Out 1 [-06] = Parameter data Out 2 [-07] = Parameter data Out 3 [-08] = Parameter data Out 4 [-09] = Parameter data Out 5	= Status word Error number in high byte, warning number in low byte Current current is relation to nominal current of device Current effective current is relation to nominal current of device		<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Data during parameter transfer. </div>	
Description	Display of process and parameter data that is transmitted by the device via the bus.				
P743		Device type		RD	
Display range	0.25 ... 11.00 kW				
Description	Display of nominal device output (e.g.: 3.00 = device with 3.0 kW nominal output)				
P744		Configuration		RD	
Display range	0 ... 11				
Description	Displays the configuration of the device				
Display values	Value		Meaning		
	0-2	reserved			
	3	SK 135E	Motor starter with soft start and reversing function		
	4-6	reserved			
	7	SK 175E (AS-i)	Like SK 135E + with integrated AS Interface		
	8-10	reserved			
	11	SK 175E (Profibus)	Like SK 135E + with integrated PROFIBUS DP Interface		
P749		Status of DIP switch		RD	
Display range	0000 0000 ... 1111 1111 (bin)	00 ... FF (hex)	0 ... 255 (dec)		
Description	Display of switch status of DIP switch (S1).				
Display values	Value (Bit)		Meaning		
	0	DIP switch 1	Switching status of DIP switch element 1		
	1	DIP switch 2	Switching status of DIP switch element 2		
	2	DIP switch 3	Switching status of DIP switch element 3		
	3	DIP switch 4	Switching status of DIP switch element 4		
P762		Phase U voltage		RD	
Display range	0 ... 500 V				
Description	Display of current voltage of phase U				
Note	The value of P722 can differ because of the measuring procedure, in spite of having symmetrical output voltages.				

P763	Phase V voltage	RD	
Display range	0 ... 500 V		
Description	Display of current voltage of phase V		
Note	The value of P722 can differ because of the measuring procedure, in spite of having symmetrical output voltages.		
P764	Phase W voltage	RD	
Display range	0 ... 500 V		
Description	Display of current voltage of phase W		
Note	Because of the measuring procedure, the value of P72 can deviate in spite of symmetrical output voltages.		
P780	Device ID	RD	
Display range	0 ... 9 and A ... Z (char)		
Arrays	[-01] = ... [-12]		
Description	Display of the serial number (12-digit) of the device.		

6 Operating status messages

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

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

Start disabled, "Not Ready" → (P700 [-03])

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

Display is only possible with the NORD CON software or the ParameterBox.

Warning messages → (P700 [-02])

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

Error messages → (P700 [-01])

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

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

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

6.1 Display of messages

LED displays

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

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

SimpleBox - display

The SimpleBox displays an error with its number and the prefix "E". In addition, the current fault can be displayed in array element [-01] of parameter (P700). The last error messages are stored in

parameter P701. Further information on inverter status at the time that the error occurs can be found in parameters P702 to P706 / P799.

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

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

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

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

ParameterBox display

The ParameterBox displays the messages in plain text.

6.2 Diagnostic LEDs on device

The device generates operating status messages. These messages (warnings, errors, switching statuses, measurement data) can be displayed with parameterisation tools (📖 Section 3.1 "Control and parameterisation options") (Parameter group **P7xx**).

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

Diagnostic LEDs

LED			Status signal ¹⁾		Meaning
Name	Colour	Description			
DS	red/ green	Device status	Off		Device not ready for operation • no control voltage
			green on		Device is switched on (running)
			flashing green	0.5 Hz	Device ready for switching on
				4 Hz	Device is in switch-on block
			red/ green Alternating	4 Hz	Warning
				0.5 Hz	Device not ready for switching on • 24 V DC supply is present, but mains voltage is not
flashing red		Error, flashing frequency corresponds to error number			
ASi	red/ green/ yellow	Status AS-i			Details (📖 Section 4.3.4.2)
BR	green	Status PBR			Details (📖 Section 4.4.3.2)

1) Signal status = specification of LED colour + flashing frequency (switch-on frequency per second), example "flashing red, 2 Hz" = red LED switches on and off 2 x per second

6.3 Messages

Error messages

Display in the SimpleBox / ControlBox		Fault Text in the ParameterBox	Cause • Remedy
Group	Details in P700 [-01] / P701		
E002	2.0	Overtemp. Motor PTC <i>"Overtemperature motor thermistor "</i>	Motor temperature sensor (PTC) has triggered • Reduce motor load
E003	3.0	I²t overcurrent limit	• Continuous overload at motor
E005	5.1	Mains overvoltage	Mains voltage is too high • See technical data (📖 Section 7 "Technical data")
E006	6.1	Mains undervoltage	Mains voltage too low • See technical data (📖 Section 7 "Technical data")
E007	7.0	Mains phase error	Error at terminal connection side • a network phase is not connected • network is non-symmetrical
E016	16.0	Motor phase error	A motor phase is not connected. • Check P539 • Check motor connection
	16.1	Magnetisation current monitoring <i>"Magnetisation current monitoring"</i>	Required exciting current not achieved at moment of switch-on. • Check P539 • Check motor connection
E020	20.0	Reserved	System error in program execution, triggered by EMC interference. • Observe wiring guidelines • Use additional external mains filter. • FI must be very well earthed.
E021	20.1	Watchdog	
	20.2	Stack overflow	
	20.3	Stack underflow	
	20.4	Undefined opcode	
	20.5	Protected Instruct. <i>"Protected Instruction"</i>	
	20.6	Illegal word access	
	20.7	Illegal Inst. Access <i>"Illegal instruction access"</i>	
	20.8	Program memory error <i>"Program memory error"</i> (EEPROM error)	
	20.9	Dual-ported RAM	
21.0	NMI error (Not used by hardware)		
	21.1	PLL error	

21.2	ADU error "Overrun"
21.3	PMI error "Access Error"
21.4	Userstack overflow

Warning messages

Display in the SimpleBox / ControlBox		Warning Text in the ParameterBox	Cause • Remedy
Group	Details in P700 [-02]		
C002	2.0	Overtemp. Motor PTC <i>"Overtemperature motor thermistor"</i>	Warning from motor temperature sensor (triggering threshold reached) • Reduce motor load
C003	3.0	I²t overcurrent limit	Warning: I ² t limit e.g. output current > nominal current of motor Reaching 1.3 times the nominal motor current for the duration of 60 s. • Continuous motor overload

Switch-on block messages

Display in the SimpleBox / ControlBox		Reason: Text in the ParameterBox	Cause • Remedy
Group	Details in P700 [-03]		
I000	0.1	Disable voltage from IO	If the "disable voltage" function is parametrised, input (P420 / P480) is Low • "Set High" input • Check signal cable (broken cable)
	0.3	Disable voltage from bus	• Bus operation (P509): control word Bit 1 is "Low"
	0.5	Enable on start	Enable signal (control word, Dig I/O or Bus I/O) was already applied during the initialisation phase (after mains "ON", or control voltage "ON"). • Only issue enable signal after completion of initialisation (i.e. when the FI is ready) • Activation of "Automatic Start" (P428) With 3-phase devices: One phase is missing or not connected.
I006	6.0	Mains voltage error	• Mains voltage failure

6.4 FAQ operational problems

Fault	Possible cause	Remedy
Device will not start (all LEDs off)	<ul style="list-style-type: none"> No mains voltage or wrong mains voltage No 24 V DC control voltage 	<ul style="list-style-type: none"> Check connections and supply cables Check switches / fuses
Device does not react to enabling	<ul style="list-style-type: none"> Control elements not connected Right and left enable signals present simultaneously Enable signal present before device ready for operation (device expecting a 0 → 1 flank) Restart inhibit is active Blocking time for reversing is active 	<ul style="list-style-type: none"> Reset enable Change over P428 if necessary: "0" = device expects a 0→1 flank for enable / "1" = device reacts to "Level" → Danger: Drive can start up independently! Check control connections Check P130 Check DIP switch S1-DIP1
Motor will not start in spite of enable being present	<ul style="list-style-type: none"> Motor cables not connected Brake not ventilating 	<ul style="list-style-type: none"> Check connections and supply cables
Device switches off without error message when load increases (increased mechanical load / speed)	<ul style="list-style-type: none"> Mains phase missing 	<ul style="list-style-type: none"> Check connections and supply cables Check switches / fuses
Motor rotating in wrong direction	<ul style="list-style-type: none"> Motor cable: U-V-W interchanged 	<ul style="list-style-type: none"> Motor cable Switch 2 phases Alternatively: <ul style="list-style-type: none"> – Swap parameter P420 functions right / left enable

Table 13: FAQ operational problems

7 Technical data

7.1 General data Motor starter

Function	Specification
Motor overload monitoring	150 % for 120 s ... 360 s, depending on shut-off class (P535)
Motor starter efficiency	> 98 %
Insulation resistance	> 5 MΩ
Operating / ambient temperature	-25°C ... +60°C, according to operating mode (📖 Section 7.2 "Electrical data") ATEX: -20...+40°C (chapter 2.4)
Storage and transport temperature	-25°C ... +60/70°C
Long-term storage	(📖 Section 9 "Maintenance and servicing information")
Protection class	IP55, optionally IP66 and IP69K (📖 Section 1.9 "Version in protection class IP55, IP66, IP69K")
Max. installation altitude above sea level	<i>Up to 1000 m</i> No power reduction <i>1000...2000 m:</i> 0.25 %/ 100 m power reduction, overvoltage category 3 <i>2000...4000 m:</i> 0.25 % / 100 m power reduction, overvoltage category 2, external overvoltage protection required at mains input
Ambient conditions	<i>Transport (IEC 60721-3-2)</i> Mechanical: 2M2 <i>Operation (IEC 60721-3-3):</i> Mechanical: 3M7 Climatic: 3K3 (IP55) 3K4 (IP66) IP69K
Environmental protection	<i>EMC</i> (📖 Section 8.1 "Electromagnetic compatibility (EMC)") <i>RoHS</i> (📖 Section 1.6 "Standards and approvals")
Protective measures against	Mains phase failure, Motor magnetisation monitoring motor phase failure
Motor temperature monitoring	I ² t motor, PTC / bimetallic switch
Soft start (if available)	Phase section, two-phase
Wait time between two mains switch on cycles	60 s for all devices in normal operating cycle
Interfaces	<i>Standard</i> RS232 (Single Slave) <i>Optional</i> AS-i on board (📖 Section 4.3 "AS Interface (AS-i)") PROFIBUS DP on board (📖 Section 4.4 "PROFIBUS DP")
Electrical isolation	Control terminals
Connecting terminals, electrical connection	<i>Power unit</i> (📖 Section 2.3.2 "Electrical connection of power unit") <i>Control unit</i> (📖 Section 2.3.3 "Electrical connection of the control unit")

7.2 Electrical data

The following table lists the electrical data for Motor Starters. The details based on measurement series for the operating modes are for orientation purposes and may deviate in practice. The measurement series were made at the rated speed with 4-pole NORD standard motors

The following factors have a particular influence on the determined limiting values:

Wall-mounting

- Installation location
- Influence from adjacent devices
- Additional air currents

and also with

Motor Assembly

- Type of motor used,
- Size of motor used



Information

Information about current and power

The powers stated for the operating modes are only a rough categorisation

The current values are more reliable details for the selection of the correct motor starter / motor combination!

The following tables include the data relevant for UL, among other things (see section 1.6.1 "UL and CSA approval").

7.2.1 Electrical data

Device type	SK 1x5E...	-301-340-	-751-340-			
	Size	1	2			
Nominal motor power (4-pole standard motor)	400 V	3.0 kW	7.5 kW			
	480 V	4 hp	10 hp			
Mains voltage	3 AC 200 V ... 500 V ± 10 %, 47 ... 63 Hz					
Input current	rms	7.5 A	16.0 A			
	FLA	7.5 A	16.0 A			
Output voltage	3 AC 0 ... Mains voltage					
Output current ¹⁾	rms	7.5 A	16.0 A			
	FLA	7.5 A	16.0 A			
	LRA	52.2 A	112.0 A			
Motor-mounted (ventilated)						
Max. continuous power / max. continuous current						
S1-50°C		3.0kW / 7.5A	7.5kW / 16.0A			
Max. permissible ambient temp. with nominal output current						
S1		50°C	50°C			
S3 70 % ED 10 min		60°C	60°C			
S6 70 % ED 10 min (100 % / 20 % Mn)		60°C	60°C			
Wall mounting (unventilated)						
Max. continuous power / max. continuous current						
S1-50°C		3.0kW / 7.5A	7.5kW / 16.0A			
S1-60°C		2.2kW / 5.5A	5.5kW / 12.5A			
Max. permissible ambient temp. with nominal output current						
S1		50°C	50°C			
S3 70 % ED 10 min		60°C	60°C			
S6 70 % ED 10 min (100 % / 20 % Mn)		60°C	60°C			
General fuses (AC) (recommended)						
slow-blowing		7.5...16 A ²⁾	16...32 A ²⁾			
Class		Isc ³⁾ [A]		UL fuses (AC) – permitted		
		65 000	100 000			
Fuse	RK5		x	30 A	30 A	
	CC, J, R, T, G, L		x	30 A	30 A	
CB ⁴⁾	480 V)		x	30 A	30 A	

1) FLA (S1-50 °C)

2) Fuse size depending on size of connected motor

3) Maximum permissible mains overload current

4) "Inverse time trip type" according to UL 489

8 Additional information

8.1 Electromagnetic compatibility (EMC)

If the device is installed according to the recommendations in this manual, it meets all EMC directive requirements, as per the EMC product standard EN 60947-4-2.

8.1.1 General Provisions

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. *EU 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. *EU Type test certificate*

This method only applies to radio transmitter equipment.

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

The manufacturer can certify that his equipment meets the requirements of the EMC directive in the relevant environment with regard to their EMC behaviour in power drives. The relevant limit values correspond to the basic standards EN 61000-6-2 and EN 61000-6-4 for interference immunity and interference emissions.

8.1.2 EMC evaluation - EN 55011-1 (environmental standard)

The limits are defined in dependence on the basic environment in which the product is operated in this standard. A distinction is made between 2 environments, whereby the **1st environment** describes the non-industrial **living and business area** without its own high-voltage or medium-voltage distribution transformers. The **2nd environment**, on the other hand, defines **industrial areas** which are not connected to the public low-voltage network, but have their own high-voltage or medium-voltage distribution transformers. The limits are subdivided into **classes A and B**.

Limit class in accordance with EN 55011	B	A
Operation permissible in		
1. Environment (living environment)	X	-
2. Environment (industrial environment)	X	X ¹⁾
Note required in accordance with EN-61800-3	-	2)
Sales channel	Generally available	Limited availability
EMC situation	No requirements	Installation and start-up by EMC expert
1) Device used neither as a plug-in device nor in moving equipment		
2) "The drive system is not intended for use in a public low-voltage network that feeds residential areas".		

Table 14: EMC - Limit class in accordance with EN 55011

8.1.3 EMC of device

NOTICE

EMC Interference to the environment

This device produces high frequency interference, which may make additional suppression measures necessary in domestic environments (📖 Section 8.1.3 "EMC of device").

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

The device is exclusively intended for commercial use. It is therefore not subject to the requirements of the standard EN 61000-3-2 for radiation of harmonics.

The limit value classes are only achieved if

- the wiring is EMC-compliant
- the length of shielded motor cable does not exceed the permissible limits




The shielding of the motor cable must be attached at both sides in the motor terminal box and the housing of the device in the event of wall mounting.

Device type Max. motor cable, shielded	Conducted emissions 150 kHz - 30 MHz	
	Class A	Class B
Device motor-mounted	+	+
Device wall-mounted	100 m	10 m

EMC overview of standards that are used in accordance with EN 60947-4-2 as checking and measuring procedures:		
<i>Interference emission</i>		
Cable-related emission (interference voltage)	EN 55011	B -
Radiated emission (interference field strength)	EN 55011	B -
<i>Interference immunity EN 61000-6-1, EN 61000-6-2</i>		
ESD, discharge of static electricity	EN 61000-4-2	6 kV (CD), 8 kV (AD)
EMF, high frequency electro-magnetic fields	EN 61000-4-3	10 V/m; 80 – 1000 MHz
Burst on control cables	EN 61000-4-4	1 kV
Burst on mains and motor cables	EN 61000-4-4	2 kV
Surge (phase-phase / phase-ground)	EN 61000-4-5	1 kV / 2 kV
Cable-led interference due to high frequency fields	EN 61000-4-6	10 V, 0.15 – 80 MHz
Voltage fluctuations and drops	EN 61000-2-1	+10 %, -15 %; 90 %
Voltage asymmetries and frequency changes	EN 61000-2-4	3 %; 2 %

Table 15: Overview according to product standard EN 60947-4-2

8.1.4 EU Declaration of Conformity


<p style="font-size: 24px; font-weight: bold; margin: 0;">GETRIEBEBAU NORD</p> <p style="margin: 0;">Member of the NORD DRIVESYSTEMS Group</p>																
<p>Getriebebau NORD GmbH & Co. KG</p> <p style="font-size: 8px;">Getriebebau-Nord-Str. 1 · 22941 Bargteheide, Germany · Fon +49(0)4532 289 - 0 · Fax +49(0)4532 289 - 2253 · info@nord.com C310800_0918</p>																
<p style="font-size: 18px; font-weight: bold; margin: 0;">EU Declaration of Conformity</p> <p style="font-size: 10px; margin: 0;">In the meaning of the EU directives 2014/35/EU Annex IV, 2014/30/EU Annex II and 2011/65/EU Annex VI</p>																
<p>Getriebebau NORD GmbH & Co. KG as manufacturer in sole responsibility hereby declares, Page 1 of 1 that the electronic motor starter of the product series</p> <ul style="list-style-type: none"> • SK 105E-xxx-340-B-.. , SK 115E-xxx-340-B-.. , SK 125E-xxx-340-B-.. , SK 135E-xxx-340-B-.. SK 145E-xxx-340-B-.. , SK 155E-xxx-340-B-.. , SK 165E-xxx-340-B-.. , SK 175E-xxx-340-B-.. (xxx= 301 or 751) <p>and the further options/accessories:</p> <p style="padding-left: 20px;">SK CU4-... , SK TU4-... , SK TI4-... , SK TIE4-... , SK PAR-3. , SK CSX-3.</p> <p>comply with the following regulations:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">Low Voltage Directive</td> <td style="width: 20%;">2014/35/EU</td> <td>OJ. L 96 of 29.3.2014, P. 357–374</td> </tr> <tr> <td>EMC Directive</td> <td>2014/30/EU</td> <td>OJ. L 96 of 29.3.2014, P. 79–106</td> </tr> <tr> <td>RoHS Directive</td> <td>2011/65/EU</td> <td>OJ. L 174 of 1.7.2011, P. 88–110</td> </tr> </table> <p>Applied standards:</p> <table style="width: 100%; border: none;"> <tr> <td>EN 60947-1:2007+A1:2011+A2:2014+AC:2017</td> <td>EN 60947-4-2:2012</td> <td>EN 50581:2012</td> </tr> <tr> <td>EN 60529:1991+A1:2000+A2:2013+AC:2016</td> <td></td> <td></td> </tr> </table> <p>It is necessary to notice the data in the operating manual to meet the regulations of the EMC-Directive. Specially take care about correct EMC installation and cabling, differences in the field of applications and if necessary original accessories.</p> <p>First marking was carried out in 2014.</p> <p>Bargteheide, 02.03.2018</p> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: center;">  <p>U. Küchenmeister Managing Director</p> </div> <div style="text-align: center;">  <p>pp F. Wiedemann Head of Inverter Division</p> </div> </div>		Low Voltage Directive	2014/35/EU	OJ. L 96 of 29.3.2014, P. 357–374	EMC Directive	2014/30/EU	OJ. L 96 of 29.3.2014, P. 79–106	RoHS Directive	2011/65/EU	OJ. L 174 of 1.7.2011, P. 88–110	EN 60947-1:2007+A1:2011+A2:2014+AC:2017	EN 60947-4-2:2012	EN 50581:2012	EN 60529:1991+A1:2000+A2:2013+AC:2016		
Low Voltage Directive	2014/35/EU	OJ. L 96 of 29.3.2014, P. 357–374														
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RoHS Directive	2011/65/EU	OJ. L 174 of 1.7.2011, P. 88–110														
EN 60947-1:2007+A1:2011+A2:2014+AC:2017	EN 60947-4-2:2012	EN 50581:2012														
EN 60529:1991+A1:2000+A2:2013+AC:2016																

8.2 Operation on the FI circuit breaker

Leakage current of ≤ 20 mA is expected during operation of the motor starter. It is suitable for operation on the FI circuit breakers for the protection of persons.

9 Maintenance and servicing information

9.1 Maintenance Instructions

NORD motor starts are *maintenance free* during proper operation ( Section 7 "Technical data").

Dusty environments

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

Long-term storage

The device must be connected to the 24 V DC power supply at regular intervals.

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

If a device is going to be stored for longer than one year, it must be connected for 30 minutes via its 24 V DC supply only prior to making the normal mains connection.

Information

Accessories

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

9.2 Service notes

Out technical support is available to reply to technical queries.

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


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


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

Please remove all non-original parts from the device.

No guarantee is given for any attached parts such as power cables, switches or external displays.

Please back up the parameter settings before sending in the device.

 Information	Reason for return
	<p>Please note the reason for sending in the component/device and specify a contact for any queries that we might have.</p> <p>You can obtain a return note from our web site (Link) or from our technical support.</p> <p>Unless otherwise agreed, the device is reset to the factory settings after inspection or repair.</p>

 Information	Possible Consequential Damage
	<p>In order to rule out the possibility that the cause of a device fault is due to an optional module, the connected optional modules should also be returned in case of a fault.</p>

Contacts (Phone)

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

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

9.3 Abbreviations

AS-i (AS1)	AS Interface	I/O	In / Out (Input / Output)
ASi (LED)	Status LED - AS Interface	LED	Light-emitting diode
ASM	Asynchronous machine, asynchronous motor	LPS	List of projected slaves (AS-I)
AUX	Auxiliary (voltage)	P1 ...	Potentiometer 1 ...
BR (LED)	Status LED - PROFIBUS	PBR	PROFIBUS
DI (DIN)	Digital input	PDO	Process data object (PROFIBUS)
DS (LED)	Status LED - device status	PELV	Safety low voltage
DO (DOUT)	Digital output	PNU	Parameter number (PROFIBUS)
I / O	Input /Output	S	Supervisor Parameter, P003
EMC	Electromagnetic compatibility	S1 ...	DIP switch
FI (switch)	Leakage current circuit breaker	SW	Software version, P707
GND	Ground reference potential	TI	Technical information / Data sheet (Data sheet for NORD accessories)

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