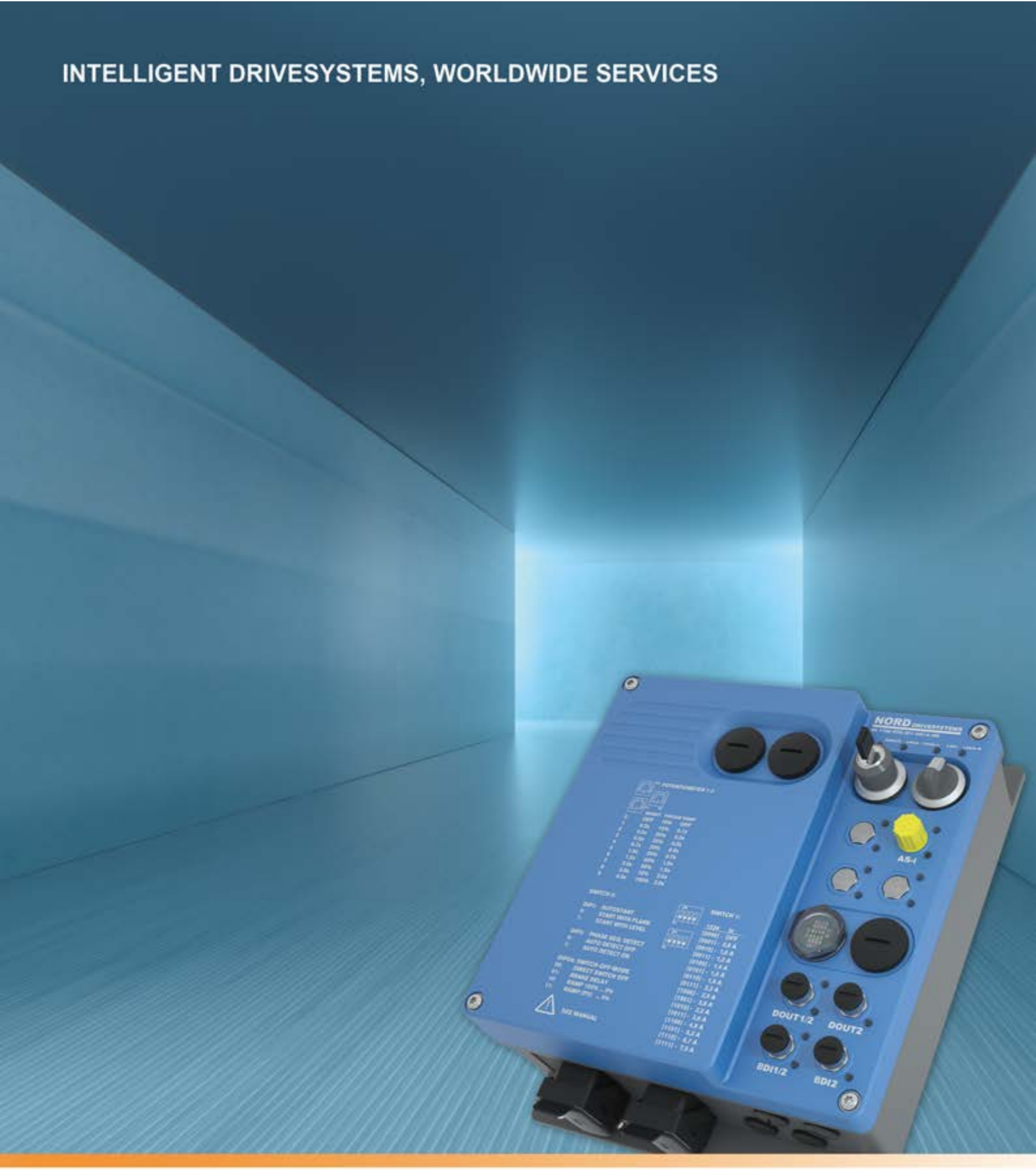
INTELLIGENT DRIVESYSTEMS, WORLDWIDE SERVICES



BU 0155 – en

NORDAC LINK (SK 155E-FDS / SK 175E-FDS)

Users Manual for Motor Starters as Field Distributors

NORD DRIVESYSTEMS

Documentation

Title:	BU 0155	
Order – No.:	6071502	
Series:	SK 1x5E-FDS	
Device series:	SK 155E-FDS, SK 175E-FDS	
Device types:	*SK 1x5E-FDS-301-340-xxx*	0.55 – 3.0 kW, 3~ 380-500 V

Version list

Title, Date	Order number	Device software version	Remarks
BU 0155, September 2016	6071502 / 3916	V 1.0 R0	First edition, for pilot series devices (field test)
BU 0155, July 2017	6071502 / 2817	V 1.0 R2	• Names of option slots on H1, H2 and H3 changed • Power connection plug and M12 plug connector Correction of various pin connections • Parameter P434, function 21 supplemented • Parameters P203, P570: Value range changed • Potentiometers P1 and P2: Setting values changed • DIP switch S1: Setting values changed • CE Declaration of Conformity supplemented • Various other corrections
BU 0155, April 2018	6071502 / 1618	V 1.0 R2	Among other things • General corrections • Adaptation of safety information • Revision of warnings and hazard notes • Inclusion of UL data • AS-interface – Supplementation of single slave "AXS" • Supplementation of connection accessories • Update of EU Declaration of Conformity

Table 1: Version list

Copyright notice

Publisher

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1 General

The SK 1x5E-FDS 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 3.0 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.

A typical feature of this frequency inverter series is their installation close to the motor, e.g. on the wall or on a machine frame.

All electrical connections (power connections and control connections) are made with plug connectors. This considerably simplifies the installation of the frequency inverter and opening the FI is not necessary.

In order to obtain access to all parameters, the internal RS232 interface (access via RJ12 connection) can be used. Access to the parameters is made e.g. via an optional SimpleBox or ParameterBox.

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.

The frequency inverter is configured according to the customer's individual requirements. Configuration is therefore performed at the factory. Retrofitting of options or conversions are not intended.

Information **The frequency inverter must not be opened.**

The frequency inverter must not be opened at any time during its service life. As in normal operation, all assembly, installation and commissioning is only carried out with the FI closed.

- Assembly is carried out via freely accessible mounting holes.
- Electrical connections are made exclusively with plug connectors..
- Operating settings are made by changing parameters or with DIP switches and potentiometers. Access to these elements or for connecting a parameterisation tool is via blank plugs. These blind plugs may only be removed for work associated with commissioning and must then be properly refitted.
- Diagnostic LEDs to indicate switching and operating states are externally visible.

1.1 Overview

This manual describes all of the possible functions and equipment. The configuration and functionality are limited according to the type of device. SK 175E-FDS frequency inverters have additional integrated characteristics for the maximum configuration.

Basic characteristics

- Wall mounting close to the motor.
- 5 digital inputs [a), b)]
- 2 digital outputs [b)]
- Separate temperature sensor input (TF+/TF-) [b)]
- Motor overload protection (I^2t triggering characteristic in accordance with EN 60947) → This means that a motor protection switch is not needed, merely an input fuse!
- Mains and motor phase failure monitoring
- Flux monitoring (minimum current monitoring)
- Automatic phase sequence detection
- Permissible ambient temperature -25 °C to 50 °C (please refer to the technical data)
- Integrated EMC mains filter for Class A limit values
- 2 x DIP switches and 3 x potentiometers for configuration
- Diagnostic LEDs (incl. signal status DIs/ DOs)
- RS232 / RS485 interface via RJ12 plug connector, alternatively USB (only RS232)
- 24 V DC control voltage
  - Must be provided via a plug connector, or
  - Can be provided by the FI (only with option –HVS).

    It is also possible to connect an external 24 V DC voltage supply via an optional plug connector in order to supply a high power peripheral (e.g. actuator).
- Integrated PLC (📖 BU 0550)

a) If necessary, individual inputs can be defined at the factory by use of certain optional modules.

b) Connection is only possible with optional plug connectors.

Additional features

There are two versions of the frequency inverters *(-ASI) with integrated AS interface* and *(-PBR) with integrated PROFIBUS DP*.

Differences between the individual versions (SK 155E-FDS / SK 175E-FDS) are summarised in the following table and are described in this manual.

Feature	155E-ASI	155E-PBR	175E-ASI	175E-PBR
Soft start function	x	x	x	x
Reversing function			x	x
AS interface (4I / 4O)	ASI		ASI	
PROFIBUS-DP (4I / 4O)		PBR		PBR

Table 2: Additional features

Optional features

The FI can be individually adapted to the drive task. For this, a comprehensive selection of interfaces, plug connections and control elements are available, which can be used during the manufacture of the FI according to the customer's requirements.

Depending on the configuration, the meaning of the individual LEDs, function or assignment of individual plug connectors or the function of control elements (e.g. switches) may differ. The possible combinations will be illustrated and explained in the course of this manual. The individual configuration of the FI can be identified using the type plate and can be compared with the details in the manual.

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**

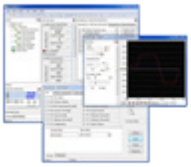
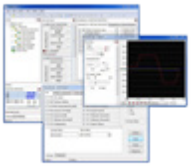
Use of unapproved accessories and options (e.g. options from other device series (SK CSX-0)) may result in defects of the interconnected components.

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

Standard version:

- IP65 version
- Operating instructions as PDF file on CD ROM including NORD CON, (PC parametrisation software)

Configurable options and accessories:

	Designation	Example	Description
Control and parametrisation options	**Handheld parametrisation units for temporary connection to the FI**		For commissioning, parametrisation and control of the FI. **SK PAR-3H, SK CSX-3H** (🕮 Section 3.2 "Control and parametrisation options ")
	NORD CON **MS Windows ® - based software**		For commissioning, parametrisation and control of the FI. See www.nord.com NORD CON (Free download)
Miscellaneous	**Internal fuse module**		Interface for protecting the individual device in the event of "Daisy Chain" wiring (looping through of mains voltage from one FI to the next). **SK CU4-FUSE** (🕮 TI 275271122) **SK CU4-FUSE-C** (🕮 TI 275271622)
Software (Free download)	**NORD CON** **MS Windows ® - based software**		For commissioning, parametrisation and control of the device. Refer to www.nord.com NORD CON
	ePlan macros		Macros for producing electrical circuit diagrams *In preparation*
	Device master data		Device master data / device description files for NORD field bus options NORD fieldbus files

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). Otherwise, there is a risk of serious injury or death from electric shock.

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

During operation, depending on their protection class, devices may have live bare components as well as 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. An optional mains connection outlet is also at mains voltage.

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.

Power plug connectors must not be pulled out when they are connected to the power supply. 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.

Metal components and the housing of power plug connectors may heat up to temperatures of more than 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)

The device is not approved for operation or maintenance work in potentially explosive environments (ATEX).

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

1) Texts are written in English.

Table 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 series comply with the standards and directives listed below.

Approval	Directive		Applied standards	Certificates	Code
CE (European Union)	Low Voltage	2014/35/EU	EN 60947-1 EN 60529 EN 60947-4-2 EN 50581	C310801	CE
	EMC	2014/30/EU			
	RoHS	2011/65/EU			
UL (USA)			UL 60947-1 UL 60947-4-2	E365221	c UL us LISTED IND.CONT.EQ. E365221
CSA (Canada)			C22.2 No.60947-1-13 C22.2 No.60947-4-2-14		
RCM (Australia)				In preparation	
EAC (Eurasia)	TR CU 004/2011, TR CU 020/2011		IEC 60947-1 IEC 60947-4-2	TC RU C-DE.A301.B.04007	EAC

Table 4: Standards and approvals

1.6.1 UL and cUL (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 ")

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 / cUL conditions according to the report

Information

“Use 60/75°C copper field wiring conductors.”

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

“Maximum ambient temperatur 50°C”

“The source shall be derived from a non-corner grounded type TN with max. Impulse Voltage of 4 kV and not exceeding 289 V phase to earth or from IT source with max. Impulse voltage of 6 kV not exceeding 500 V (or equivalent) or devices with the suffix –IT.”

Size	valid	description
1	generally valid	Only for use with Connectors from HARTING ELECTRIC GMBH & CO KG, LQ Mechatronic Systems GmbH and Intercontec Produkt GmbH: “Suitable For Use On A Circuit Capable Of Delivering Not More Than 5 000 rms Symmetrical Amperes, 500 Volts Maximum” “When Protected by class RK5 Fuses or faster. "Suitable For Use On A Circuit Capable Of Delivering Not More Than _____ rms Symmetrical Amperes, 500 Volts Max., When Protected by High-Interrupting Capacity, Current Limiting Class CA, CC, CF, G, J, T Fuses.” The short circuit rating (max. 65 000A) is based on the Connectors (Details listed below) and will be printed during production. Details listed in [1]. “Suitable For Use On A Circuit Capable Of Delivering Not More Than _____ rms Symmetrical Amperes, 500 Volt maximum” “When Protected by Circuit Breaker (inverse time trip type) in accordance with UL 489“ The short circuit rating (max. 10 000) is based on the Connectors (Details listed below) and will be printed during production. Details listed in [1].
	Motor group installation (Group fusing):	Only for use with Connectors from HARTING ELECTRIC GMBH & CO KG, LQ Mechatronic Systems GmbH and Intercontec Produkt GmbH: “Suitable for motor group installation on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 500 V max” “When Protected by class RK5 Fuses or faster, rated max. 30Amperes”, as listed below. “Suitable for motor group installation on a circuit capable of delivering not more than _____rms symmetrical amperes, 500 V max” “When Protected by High-Interrupting Capacity, Current Limiting Class CA, CC, CF, G, J, T Fuses, rated max. 30A”. The short circuit rating (max. 65 000 A) is based on the Connectors (Details listed below) and will be printed during production. Details listed in [1]. “Suitable for motor group installation on a circuit capable of delivering not more than _____rms symmetrical amperes, 500 V max” “When Protected by Circuit Breaker (inverse time trip type) in accordance with UL 489, rated max. 30 Amperes” The short circuit rating (max. 10 0000) is based on the Connectors (Details listed below) and will be printed during production. Details listed in [1].
	differing data cUL:	None differing data → equal to UL

1) (🕮 7.2)

Information

Connector optional

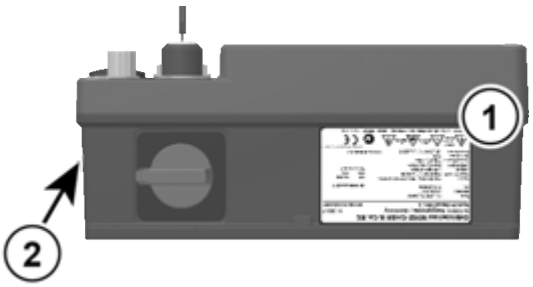
Cat. No.	manufactured by	rated voltage	rated current	Fuse size		SCCR, RMS
09 12 003 3051 (HAN Q3/0-M)	HARTING ELECTRIC GMBH & CO KG	600 V	17 – 41.5 A			65 kA
09 12 003 3151 (HAN Q3/0-F)	HARTING ELECTRIC GMBH & CO KG	600 V	17 – 41.5 A			65 kA
09 12 006 3041 (HAN Q4/2 M)	HARTING ELECTRIC GMBH & CO KG	600 V	11 – 25 A			65 kA
09 12 006 3141 (HAN Q4/2 F)	HARTING ELECTRIC GMBH & CO KG	600 V	11 – 25 A			65 kA
09 12 005 3001 (HAN Q5/0-M)	HARTING ELECTRIC GMBH & CO KG	600 V	11 – 16 A			65 kA
09 12 005 3101 (HAN Q5/0-F)	HARTING ELECTRIC GMBH & CO KG	600 V	11 – 16 A			65 kA
09 12 008 3001 (HAN Q8/0 M)	HARTING ELECTRIC GMBH & CO KG	600 V	10 – 18 A			65 kA
09 12 008 3101 (HAN Q8/0 F)	HARTING ELECTRIC GMBH & CO KG	600 V	10 – 18 A			65 kA
09 12 002 3051 (HAN Q2/0-M)	HARTING ELECTRIC GMBH & CO KG	600 V	19 – 47.5 A			65 kA
09 12 002 3151 (HAN Q2/0-F)	HARTING ELECTRIC GMBH & CO KG	600 V	19 – 47.5 A			65 kA
QPD W 3PE2.5…M25	PHOENIX CONTACT GMBH & CO. KG	600 V	10 – 15 A		J, T, CC	5 kA
QPD 4P M25 WHQM	PHOENIX CONTACT GMBH & CO. KG	600 V	8 – 12 A		J, T, CC	5 kA
P29036	AMPHENOL SINE SYSTEMS CORP	600 V	25 A	30 A	J, T, CC, CB: 30A	65 kA
P29039	AMPHENOL SINE SYSTEMS CORP	600 V	30 A	30 A	J, T, CC	65 kA

1.7 Type code / nomenclature

The type code of the field distribution FI describes the basic configuration features. The precise configuration of the FI is carried out according to the customer's specifications. A unique identification of the FI, including all equipment is only possible by means of the order number of the serial number of the FI.

1.7.1 Type plate

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



(1)

Type:	SK 1x5E-FDS-301-340-A HWR-HVS-…
Part No.:	5050601-100
ID:	27Q303614961

Version:	AAA	1.0R0

Type:	Type / designation
Part No.:	Order number
ID:	Identification number
Version:	Hardware / Software version

(2) Two additional plates which contain additional technical data regarding UL/cUL are attached to the right-hand side of the device.

First plate

This warning information is attached in general.

DANGER -The opening of the branch-circuit protective device may be an indication that a fault current has been interrupted.
To reduce the risk of fire or electrical shock, current-carrying parts and other components, of the controller should be examined and replaced if damaged. If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced.

Second plate

The second plate depends on the power plug connectors which are used.

Amphenol

SCCR: 65 kA, 500 V, BCP Fuse, Class CC, J, T
SCCR: 10 kA, 500 V, BCP CB

BCP Rating and further Short Circuit Rating
see manual

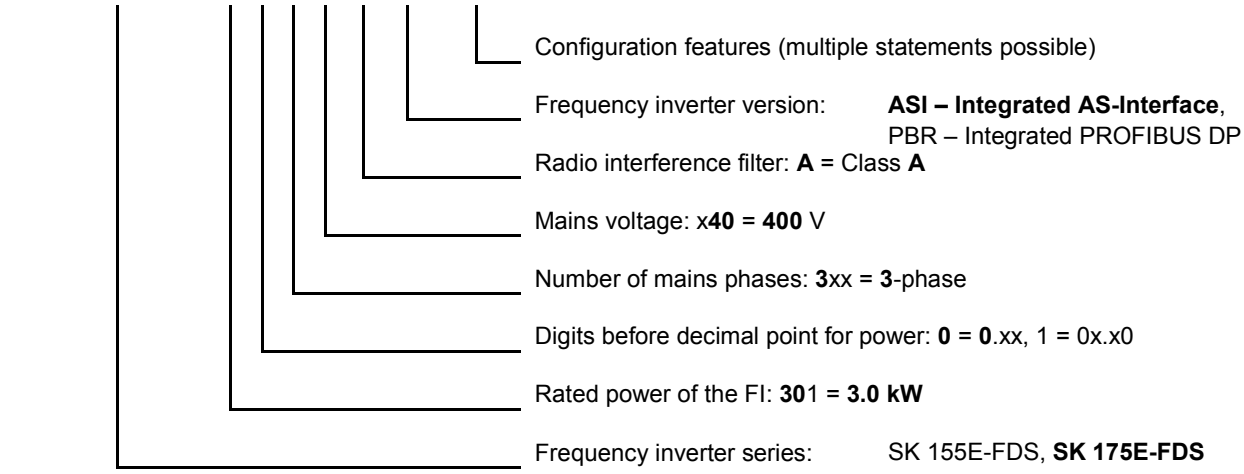
Suitable for group fusing

SCCR Group Installation:
same except BCP Fuse or CB rated max. 30 A

HARTING	**SCCR:** 65 kA, 500 V, BCP Fuse, Class CA, CC, CF, G, J, T **SCCR:** 5 kA, 500 V, BCP Fuse, Class RK5 or faster **SCCR:** 10 kA, 500 V, BCP CB BCP Rating and further Short Circuit Rating see manual Suitable for group fusing **SCCR Group Installation:** same except BCP Fuse or CB rated max. 30 A
Phönix	**SCCR:** 5 kA, 500 V, BCP Fuse, Class CC, J, T BCP Rating and further Short Circuit Rating see manual Suitable for group fusing **SCCR Group Installation:** same except BCP Fuse or CB rated max. 30 A

1.7.2 Field distribution type codes

SK 175E-FDS-301-340-A-ASI(-xxx)



Configuration code

	Meaning
-BWRN	Integrated brake rectifier for control of a 205 V DC brake
-HVS	Integrated 24 V DC mains unit
-HWR	Integrated brake rectifier for control of a 180 V DC brake
-USB	RS232 / RS485 interface USB port instead of the RJ12 connection **Note:** Parameterisation boxes cannot be connected to the USB port. In this case parameterisation and diagnosis is only possible with a PC using NORD CON software.

1.8 Version with protection class IP65

Motor Starters from the field distribution series SK 1x5E-FDS fulfil the following IP protection class:

- IP65

Information — **Cable routing**

For all versions, care must be taken that the cables and the cable glands comply at least with the protection class of the device and attention is paid to compliance with the installation regulations.

2 Assembly and installation

In principle: No options can be retrofitted. Accordingly, all options must be recorded by NORD prior to the manufacturing process for the device. The inverter must not be opened by the customer at any time. The inverter is mounted by means of externally accessible fastening lugs. Electrical connection of the mains, motor and signal cables is only possible using the relevant plug connectors. Optionally available control elements (e.g. switches) are mounted so as to be freely accessible. Opening of a defined blind plug is only necessary for the temporary connection of a diagnostic tool (ParameterBox (SK CSX-3H / SK PAR-3H)) or a PC with NORD CON-software (NORD control, parameterisation and diagnostic software).

Various configurations of the FI can also be made during commissioning via the integrated DIP switches or potentiometers. Access to these elements is also via the corresponding blank plugs.

2.1 Installation

The frequency inverters are intended for installation close to the motor and because of their protection class they do not require a control cabinet.

Distance from device: As protection against overheating, the devices require adequate ventilation and therefore must not be covered.

They can be mounted immediately next to each other.

The necessary spacing for connection cables must be taken into account.

Installation position:

- Vertical, i.e. the position of the cable connection (power connection) is at the bottom
- Horizontal, i.e. the position of the control elements and diagnostic LEDs is at the top

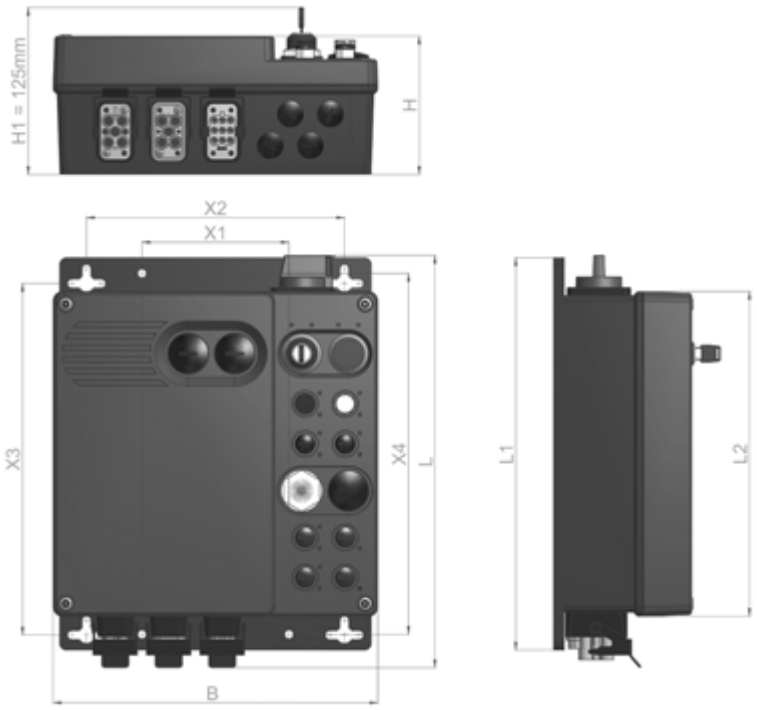
See the following illustrations.

Dimensions:

Power [kW]		Device type SK 1xxE-FDS-…		Size	Housing dimensions					Wall mounted				Weight [3] (approx.)
	to		to		B	H	L [1]	L1	L2	X1	X2	X3	⌀	
	3.0		301-340-…	1	243	104	312	294	243	110	193	263	5.5	3.0
					All dimensions in [mm]									[kg]

1) No maintenance switch: 307 mm
2) Depending on configuration approx. +/- 0.5 kg

Size 1



2.2 Option slots and equipment variants

The inverter is configured according to the customer's specifications. There are defined slots on the device for the selected options and equipment. Interdependencies of the selected options as well as the relevant indication devices (LEDs) or parameter settings are described later in this manual.

2.2.1 Option slots

The device is divided into 3 levels. Each of these levels is intended for the installation of certain options or option groups.

2.2.1.1 Connection level

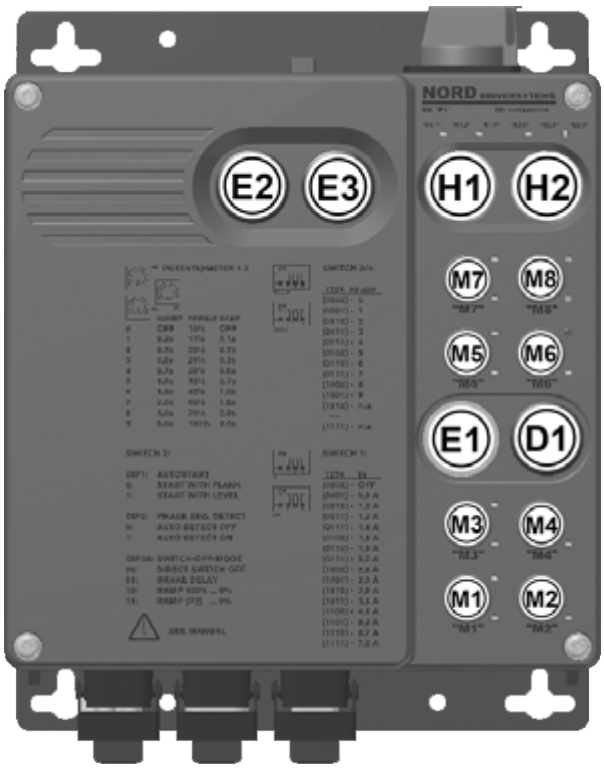
Position: bottom

The configuration and assignment of the power connections (mains and motor connections) depends on the customer's specification for the product.

This also applies for the additional option slots for the signal connections.

X1 = Power connection 1
… …
X3 = Power connection 3
Z1 =
… Additional signal connections
Z4 =

2.2.1.2 Control level



Position: front

The configuration and functions of the individual option slots are variable. They are directly influenced by the customer's specification, but are also indirectly dependent on the further features.

The meaning of the LEDs which are assigned for each option slot is also dependent.

D1 = Diagnostic opening
E1 = DIP switches
E2 = Potentiometers
E3 = DIP switches (PROFIBUS address) – only for device versions SK 1x5E-…-PBR
H1 = Control element 1
H2 = Control element 2
M1 =
… Signal connections
M8 =

2.2.1.3 Maintenance switch level

Position: top

The configuration and function of other option slots may be influenced by the maintenance switch.

H3 = Maintenance switch

2.2.2 Configuration variants

The field distributor is designed so that it can be configured according to the individual requirements of the drive application. Because of this, extensive interfaces are provided on the FI, which are exclusively implemented in the form of plug connectors. As with the equipment of the device, the arrangement of these interfaces also depends on the configuration of the FI and therefore differs greatly. Precisely one type of option can be selected for each option slot.

The following tables illustrate which features can typically be combined and what influence these have on the relevant option slots.

For the use of initiators or actuators, the associated parameters and the relevant factory settings can be read out.

2.2.2.1 Configurable options

The following integrated features can be configured. Selection of the options must be made when the frequency inverter is ordered. Subsequent changes to the configuration are not possible.

	Meaning
-BWRN	Integrated brake rectifier for control of a 205 V DC brake
-HVS	Integrated 24 V DC mains unit
-HWR	Integrated brake rectifier for control of a 180 V DC brake
-USB	RS232 / RS485 interface USB port instead of the RJ12 connection **Note:** Parameterisation boxes cannot be connected to the USB port. In this case parameterisation and diagnosis is only possible with a PC using NORD CON software.

2.2.2.2 Configuration of option slots on the control level

The option slots **M1** to **M8** are designed for M12 plug connectors. The configuration of the connections or functions for the individual option slots which are relevant for the frequency inverter is printed directly on the option slot.

Option slot	Option type		Function	Relevant parameters	Comments
M1	a	No option			
	b	Initiator 1 / 2	BDI1	P420[-09]	
			BDI2	P420[-10]	
M2	a	No option			
	b	Initiator 2	BDI2	P420[-10]	
M3	a	No option			
	b	Actuator 1 / 2	DOUT1	P434[-01]	
			DOUT2	P434[-02]	
M4	a	No option			
	b	Actuator 2	DOUT2	P434[-02]	
M5	a	No option			
	b	Initiator 3 / 4	DIN1	P420[-01]	
			DIN2	P420[-02]	
	c	Initiator 4 / 5	DIN2	P420[-02]	
			DIN3	P420[-03]	
	d	PROFIBUS DP (input)	PBR (Bus-In)		only SK 1x5E-FDS-…PBR
M6	a	No option			
	b	Initiator 4	DIN2	P420[-02]	
M7	a	No option			
	b	Initiator 3 / 4	DIN1	P420[-01]	
			DIN2	P420[-02]	
	c	PROFIBUS DP (output)	PBR (Bus-Out)		only SK 1x5E-FDS-…PBR
M8	a	No option			
	b	24 V DC supply [1)]	24VI		
	c	AS interface (“AUX“)	AUX		only SK 1x5E-FDS-…ASI
	d	AS-Interface	ASI		
	e	AS interface (“AXS“)	AXS		

1) The DC control voltage can also be supplied via **M8 c** (AUX), **M8 e** (AXS) or the option slots **X1** or **Z1** … **Z4** of the connection level.

The control elements for the FI are located at the option slots **H1** and **H2**.

The various types of control elements can be selected. Depending on the combination which is selected, these have an effect on the function of the individual digital inputs. These functions are taken into account in the factory settings of the relevant parameters for the specific frequency inverter.

Version	**Option slot H1** [1]		**Option slot H2** [2]		**Parameter function**		
	Type	Function	Type	Function	P420[-01]	P420[-02]	P420[-03]
0	-	/	-	/	{1}	{2}	{0}
1	I	L - A - R	-	/	{1}	{2}	{0}
2	I	L - A - R	IV	/ - Q	{1}	{2}	{7}
3	II	A - H	-	/	{1}	{0}	{0}
4	II	A - H	II	Off - On	{10}	{0}	{1}
5	II	A - H	I	L - Off - R	{10}	{2}	{1}
6	III	Q - A - H	-	/	{1}	{7}	{0}
7	III	Q - A - H	II	Off - On	{10}	{7}	{1}

Functions					
A	Automatic mode enabled	**H**	Manual mode enabled	**L**	Manual mode enabled, left
R	Manual mode enabled, right	**Off**	Manual mode not enabled	**On**	Manual mode enabled
				Q	Acknowledge fault

Operating option type	
I	Switch (left – centre – right), locking, switch or key switch version
II	Switch (centre – right), locking, switch or key switch version
III	Switch (left – centre – right), locking at centre and right, switch or key switch version
IV	Pushbutton

1) Influences the parameter functions of digital inputs DIN 1 / 2

2) Influences the parameter functions of digital inputs DIN 2 / 3

Plug connections for M12 plug connectors

Depending on the function, 5-pin M12 surface mounted plug connectors with coloured sockets or plug inserts are installed. The colours reflect the functional assignment of the plug connector and therefore enable easy identification on the FI. The same applies for the colour coding of the cover caps.

The following plug connectors may be used on the device, depending on the customer's specification.

Option slots M1 to M8

Function	Plug connectors							Option slot	
	Contact diagram	Contact assignments							
		1	2	3	4	5		No.	Colour
DIN1 / DIN2	 Socket, A-coded	24 V	DIN2	GND	DIN1	PE		M5, M7	black
DIN2 / DIN3		24 V	DIN3	GND	DIN2	PE		M5	black
DIN2		24 V		GND	DIN2	PE		M6	black
BDI1 / BDI2		24 V	BDI2	GND	BDI1	PE		M1	black
BDI2		24 V		GND	BDI2	PE		M2	black
DOUT1 / DOUT2		24 V	DOUT2	GND	DOUT1	PE		M3	black
DOUT2		24 V		GND	DOUT2	PE		M4	black
24VI	 Plug connectors, A-coded	24 V		GND				M8	black
ASI		ASI+		ASI-				M8	yellow
AUX		ASI+	GND	ASI-	24 V			M8	yellow
AXS		ASI+	GND	ASI-	24 V			M8	yellow
PBR (Bus IN) [1]	 Plug connectors, B-coded		PBR A		PBR B			M5	violet
PBR (Bus OUT) [1]	 Socket, B-coded	5 V	PBR A	GND	PBR B			M7	violet

1) The housing of the plug connector is internally wired to PE.

Information — **Connection material**

Connection material, e.g. T-connectors for connection of double initiators, for looping an external 24 V DC supply or an STO signal can be obtained commercially or can be obtained from NORD on request.

2.2.2.3 Configuration of option slots on the connection level

The connection level of the field distribution frequency inverter is divided into 2 areas.

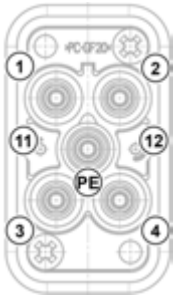
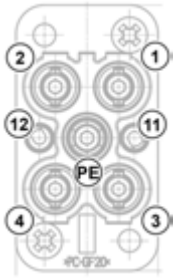
DANGER **Electric shock at X2**

An optional **mains connection outlet** (**LA**) on option slot **X2** can also not be switched off with a repair and maintenance switch (option slot **H3**). This may therefore still be at mains voltage.

- Do not touch any contacts.
- Disconnect the device from the mains (mains supply, option slot **X1**).

Area 1, option slots X1 to X3

Typical machinery plug connectors are used. These are primarily used to connect the mains and the motor cables. Certain plug connector versions also allow connection of a 24 V DC supply. The plug connectors are equipped with a detachable protective cap. **The mating plug connector is not included in the scope of supply.**

Option slot		Plug connector type	Function		Contact assignments
X1	a	HARTING Q4/2+ (plug)	Mains connection (supply) 4 mm² / 25 A (24 V DC: 1.5 mm²)	LE	 **1** L1 **2** L2 **3** L3 **4** N **PE** PE **11** 24 V DC **12** GND
	b	PHOENIX QPD-25 (plug)	Mains connection (supply) 2.5 mm² / 16 A	LE	 **1** L1 **2** L2 **3** L3 PE
X2	a	-	No function		**Option slot not occupied**
	b	HARTING Q4/2+ (socket)	Mains connection (output) 4 mm² / 25 A (24 V DC: 1.5 mm²)	LA	 **1** L1 **2** L2 **3** L3 **4** N **PE** PE **11** 24 V DC **12** GND

Option slot	Plug connector type		Function		Contact assignments
	c	PHOENIX QPD-25 (socket)	Mains connection (output) 2.5 mm² / 16 A	LA	 **1** L1 **2** L2 **3** L3 PE
	d	HARTING Q8/0+ (socket)	Motor connection 2 (output) 4 mm² / 16 A	MA2	 **1** U **3** W **4** BR- **5** TF+ **6** BR+ **7** V **8** TF- **PE** PE
X3	a	HARTING Q8/0+ (socket)	Motor connection 1 (output) 4 mm² / 16 A	MA	 **1** U **3** W **4** BR- **5** TF+ **6** BR+ **7** V **8** TF- **PE** PE

Area 2, option slots Z1 to Z4

The option slots M1 to M8 are designed for M12 plug connectors. No fixed functions are allocated to the option slots. **The mating plug connector is not included in the scope of supply.**

As the built-in plug connector cannot be adjusted during assembly, the use of **angled** cable plug connectors **is not recommended**.

Function	Plug connector [1]						Option slot	
	Contact diagram	Contact assignments						
		1	2	3	4	5	No.	Colour
24VO	 Socket, A-coded	24 V		GND			Z1 - Z4	black
24VI	 Plug connectors, A-coded	24 V		GND			Z1 - Z4	black

1) The housing of the plug connectors are internally wired to PE.

2.2.2.4 Configuration of the option slot for the maintenance switch level

DANGER **Electric shock at X2**

An optional **mains connection outlet** (**LA**) on option slot **X2** can also not be switched off with a repair and maintenance switch (option slot **H3**). This may therefore still be at mains voltage.

- Do not touch any contacts.
- Disconnect the device from the mains (mains supply, option slot **X1**).

Option slot **H3** is intended for equipment with an optional repair and maintenance switch. Depending on the project, various versions (e.g. lockable / non-lockable) may be installed.

The repair and maintenance switch disconnects the supply to the FI and therefore also the supply to the directly connected motor. For FI versions which are intended for looping the mains voltage, the daisy chain channel cannot be interrupted. The following devices are still supplied with power.

2.3 Electrical Connection

WARNING — **Electric shock**

Dangerous voltages may be present at the plug contacts for the power connections (mains cable, motor cable) even when the FI is not in operation.

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

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

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

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

Electrical connections are made exclusively with plug connectors.

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.

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.

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)").

When connecting the device, 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 (supply – "**LE**"): to option slot **X1**
4. Motor cable connection ("**MA**"): to option slot **X3**
5. Optional
   a. Mains cable connection (outlet – "**LA**"): to option slot **X2**, or
   b. Motor cable connection (2nd motor – "**MA2**"): to option slot **X2**

At least a 4-conductor motor cable must be used to connect **U-V-W** and **PE** to the plug connector.

Information **Connection cables**

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

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

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

Isolation from or connection to the mains must always be carried out for all the poles and synchronously.

In the normal version, the FI is configured for operation in TN or TT networks. With this, the mains filter has its normal effect and leakage current. A network which is earthed to neutral must be used.

In case of "Daisy Chain" wiring (looping of the mains voltage from one FI to the next) use of a fuse module type SK CU4-FUSE is recommended (🕮 Section 1.3 "Scope of delivery"). This enables protection of the individual device. This avoids a total failure of the entire line in case of a device fault.

Adaptation to IT networks – (from size **1**)

For operation in an IT network, the FI must be configured with modification of the integrated mains filter. Modification of the mains filter is performed at the factory and must be taken into account in the order. Configuration for IT networks reduces the EMC.

The insulation resistance of the frequency inverter must be taken into consideration when operating on an insulation monitor (🕮 Section 7.1 "General data Motor starter").

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

The motor cable must be connected properly.

Pre-assembled motor cables are available on request.

2.3.2.3 Electromechanical brake

The FI generates an output voltage which is supplied to the contacts (BR+ and BR-) of the motor plug connector for control of an electromechanical brake. The level of this DC voltage depends on the selected option. The following options are available:

Option "integrated brake rectifier"	Mains voltage (AC)	Brake coil voltage (DC)
-	-	No brake connection possible
HWR	400 V ~	180 V =
BWRN [1)]	400 V ~	205 V =

1) Mains connection side: N connection required!

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 of the control cables is made exclusively via M12 plug connectors. The plug connectors are permanently installed at the factory. These enable the use of straight connectors, and at option slots **M1** to **M8** angled (encapsulated) cable plug connectors. The use of cable plug connectors assembled by the customer must be checked in individual cases.

24 V DC control voltage

The FI requires a 24 V DC control voltage for operation. Depending on the device, this control voltage can be provided in various ways:

- Integrated switched mains unit (equipment code **–HVS**),
- External connection via M12 plug connector (option slot **M8**),
- External connection via M12 plug connector (option slots **Z1 - Z4**),
- External connection via power plug connector (option slot **X1**).

Frequency inverters with the option **–HVS** typically do not require an external 24 V DC connection. If however such a device also has an optional 24 V DC connection facility, this can be used without danger. In this case the external 24 V DC supply supports the integrated switched mains unit. In particular this covers the requirements of powerful actuators which are controlled by the FI.

Devices which are not equipped with the **–HVS** option must be supplied via an external 24 V DC voltage source.

Information — **Control voltage overload**

A control unit overload caused by impermissibly high currents may destroy the unit. Impermissibly high currents occur if the total current that is actually withdrawn exceeds the permissible total current.

24 V can be taken from several terminals as necessary. This also includes e.g. digital outputs or a control module connected via RJ12.

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

Device type	SK 155E	SK 175E
Frequency inverter with integrated mains unit, for SK 1x5E-FDS-…-ASI with option "-AUX" even if the supply is exclusively via the yellow cable.	380 mA	340 mA
Frequency inverter without a mains unit → external connection of the control voltage, for SK 1x5E-FDS-…-ASI with option "-AUX" even if the supply is exclusively via the black and yellow cable.	530 mA	490 mA
For SK 1x5E-FDS-…-ASI with option "-ASI"; supply is exclusively via the yellow cable	140 mA	100 mA

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

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 connection details

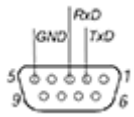
Meaning, Functions	Description / Technical data		
Contact (designation)	Meaning	Parameter No.	Function of factory setting
Digital outputs	Signalling of the operating statuses of the FI		
	according to EN 61131-2 24 V DC With inductive loads: Provide protection via free-wheeling diode!	Maximum load 50 mA	
DOUT1	Digital output 1	P434 [-01]	No function
DOUT2	Digital output 2	P434 [-02]	No function
Digital inputs	Actuation of device using an external controller, switch or similar. The factory settings of digital inputs DIN1 to DIN3 depend on the configuration of option slots H1 and H2.		
	DIN1-5 according to 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	
DIN1	Digital input 1	P420 [-01]	No function
DIN2	Digital input 2	P420 [-02]	No function
DIN3	Digital input 3	P420 [-03]	No function
BDI1	Digital input 4	P420 [-09]	No function
BDI2	Digital input 5	P420 [-10]	No function
PTC input	Monitoring of motor temperature using PTC		
	A shielded cable must be used.	In order to make the device operational, a temperature sensor must be connected. Alternatively, the function of the input can also be disabled. However, in this case thermal protection of the motor is no longer ensured.	
TF+	Thermistor input +	P425	On
TF-	Thermistor input -		
Control voltage source	Control voltage from the inverter, e.g. as power supply for accessories		
	24 V DC ± 25 %, short circuit-proof	Maximum load [1]	
VO / 24V	Voltage output	-	-
GND / 0V	Reference potential GND	-	-

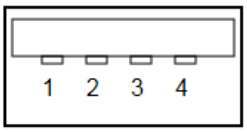
1) See "Total currents" information (📖 Section 2.3.3 "Electrical connection of the control unit")

Control voltage connection	Supply voltage for the FI		
	24 V DC ± 25 % 200 mA … 800 mA, depending on load of inputs and outputs and use of options	With option (-HVS): Automatic changeover between the external supply via the connection plug and internal mains unity if the connected control voltage is insufficient.	
24V	Voltage input	-	-
GND / 0V	Reference potential GND	-	-
Brake actuation	Connection and actuation of an electromechanical brake. The FI generates an output voltage for this, which depends on the mains voltage. The assignment of the correct brake coil voltage must be taken into account in the selection.		
	Connected loads: (📖 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	
BR+	Brake control	P107/114	0 / 0
BR-	Brake control		

AS Interface	Control of FI via the simple field bus level: Actuator/sensor interface		
	Electrical data: See 🕮 4.3.2 "Features and technical data"		
ASI+	ASI+	P480 …	-
ASI-	ASI-	P483	-

Communication interface		Device connected to different communication tools		
		24 VDC ± 20%	*RS 485* (For connecting a parametrisation box) 9600 … 38400 Baud *Terminating resistance* (1 kΩ) fixed *RS 232* (For connecting to a PC (NORD CON)) 9600 … 38400 Baud	
1	RS485 A+	Data cable RS485	P502… P513 [-02]	 1 - 2 - 3 - 4 - 5 - 6
2	RS485 B-	Data cable RS485		
3	GND	Reference potential of bus signals		
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		
	Length: approx. 3.0 m + approx. 0.5 m *Part number:* 275274604 Suitable for connection to a USB port in a PC or alternatively to a SUB-D9 connection. Details: 🕮 TI 275274604		

Communication interface		Connection of the FI to a PC (alternative to the RJ12 interface) for communication with NORDCON software		
		USB 2.0	*RS 232* 9600 … 38400 Baud	
1	+5V	Supply voltage	P502… P513 [-02]	
2	Data	Data cable		
3	Data +	Data cable		
4	GND	Bus signal reference potential		

3 Display, operation and options

WARNING **Electric shock**

Touching the circuit board below the transparent screw fitting on option slot **E1** can result in an electric shock which may cause serious or fatal injury.

- The screw fitting for option slot **E1** must only be opened when the frequency inverter is switched off.
- After switching off the frequency inverter wait for at least 5 minutes before opening the screw fitting.

The FI is equipped with LED indicator lights LED indicator lights are directly assigned to the option slots H1 and H2 as well as to M1 to M8. These are used to indicate the signal statuses of the relevant option slot. In addition, on option slot E1 there are further, externally visible LED indicator lights for status messages.

Alphanumeric display and control modules (📖 Section 3.2 "Control and parametrisation options ") can be used for simple commissioning by changing parameters. For more complex tasks, connection to a PC system can take place with the aid of the NORD CON parameterisation software.

Connection of such a parameterisation option is made via option slot D1. The screw cap must be removed for this. Communication is via RS 232 or RS 485 to an RJ12 connection (standard). Alternatively, a USB port can be installed as an alternative to the RJ12 connection. However, in this case it is only possible to connect a PC system for use of the NORD CON software.

The basic commissioning of the frequency inverter can be carried out without parameter changes, i.e. without programming aids. For this, 3 potentiometers (P1 – P3) are available on option slot E2 and two 4-pole DIP switch blocks (S1 and S2) on option slot E1.

For inverters with an integrated interface for PROFIBUS DP (SK 1xxE-FDS-…-PBR) there are two further 4-pole DIP switch blocks (S3 and S4) on option slot E3. These are used for addressing.

Information **Removing the blank plugs**

Access to the potentiometers and DIP switches is only possible by removing the corresponding blank plugs. The blind plugs may only be removed for commissioning work and must then be properly refitted. Care must be taken that no moisture or dirt enters the device!

3.1 Indicator lights

LED display	Use / Meaning
Yellow – Single colour – Static	Indication of the signal status ("ON" / "OFF") or the associated function of the IOs.
Red/Green – Single or dual colour – Static or dynamic	Indication of the operating statuses on the device or communication level.

H1 and H2

- With the use of **switch options** the LEDs indicate the switch settings (left/right). The LEDs do not illuminate if the switch is in the middle setting.
  (colour **yellow**)

M1 to M8

- With the use of **initiators or actuators**, the LEDs indicate their signal states (High / Low).
  (colour **yellow**)
  Option slots M1, M3, M5 and M7 are intended for double allocation.
  – Bottom LED: Signal state of the first input or output (e.g. DIN1)
  – Top LED: Signal state of the second input or output (e.g. DIN2)
  Option slots M2, M4, M6 and M8 are intended for single allocation.
  – Bottom LED: Signal state of the input or output (e.g. DIN2)
- With the use of **bus communication via the AS-interface**, the LEDs for option slot M8 indicate the operating status of the relevant slave.
  – Bottom LED: A- Slave
  – Top LED: B- Slave
  (colour **red / green**, dual)
- The lower LED of option slot M5 indicates the status for the PROFIBUS on the device if **bus communication via PROFIBUS DP**, is used.
  (colour **green**)

E1

Option slot E1 is closed with a transparent screw cap. The LED status indicator lights which are installed in this option slot act as diagnostic LEDs and are therefore always visible.

– Device status/Error: The LED indicates the operating status of the FI. (colour **red / green**, dual)

3.2 Control and parametrisation options

Various control options are available. These are installed in the option slots **H1** and **H2**. Selection of the required control options and their functionalities must be made in the order or in the configuration process (📖 Section 2.2.2.2 "Configuration of option slots on the control level"). Retrofitting is not possible.

Parametrisation units also provide a facility for accessing and changing the parametrisation of the frequency inverter.

Designation		Material number	Comments
Control and parametrisation units (handheld)			
SK CSX-3H	SimpleBox	275281013	📖 BU0040
SK PAR-3H	ParameterBox	275281014	📖 BU0040

3.2.1 Control and Parametrisation Boxes / Software

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

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

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

Figure 1: SimpleBox, handheld, SK CSX-3H

Figure 2: ParameterBox, handheld, SK PAR-3H

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

Connection

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

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

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 (e.g. refer to the motor type plate) can be set for the respective motor circuit via DIP switch **S1**, which has priority in the factory setting or the condition as delivered. If parameter **P130**=1 is set, 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 **S2** as well as potentiometers **P1** ... **P3** 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 commissioned in various ways:

a) Via the DIP switches and potentiometers which can be accessed via the option slots **E1** – **E3** for simple applications (e.g. conveyor applications).

b) By changing parameters with 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 when the device is switched off.

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

4.2.1 Connection

To establish basic operation capability, after the mechanical installation of the device on a suitable wall, the electrical connections must be made (🕮 Section 2.3.2 "Electrical connection of power unit").

For devices without an integrated 24 V DC mains unit (option "integrated mains unit": "HVS") it is also essential for the FI to be provided with a 24 V DC control voltage.

4.2.2 Configuration

The device can be configured for the majority of operating modes by setting potentiometers (P1-P3) and DIP switches (S1, S2). For extended functions or for diagnostic purposes it may be necessary to adjust or view individual parameters.

The basic steps for successful commissioning of the motor starter are listed below. 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 }
2nd	Rated motor current	S1-DIP1...4	-[1)]	P203	{ 3 }
3.	Locking time	P1	-[1)]	P570	{ 0.5 }
4.	Start voltage	P2	-[1)]	P210	{ 50 }
5.	Acceleration time	P3	-[1)]	P102	{ 1 }
6.	Run time			P103	{ 1 }
7.	Automatic starting	S2-DIP1	{ OFF }	P428	{ 0 }
8.	Motor overtemperature ***(SK 155E)***	S2-DIP2	{ OFF }	P580	{ 1 }
8.	Phase sequence detection ***(SK 175E)***	S2-DIP2	{ OFF }	P581	{ 0 }
9.	Switch-off mode	S2-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 5: Configuration - comparison of hardware and software adaptation

Information — **Permissible switch-on cycle**

To prevent damage to the device, minimum pause times between switch-on must be observed (🕮 Section8.4 "Switch-on cycle").

4.2.2.1 Parametrisation

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

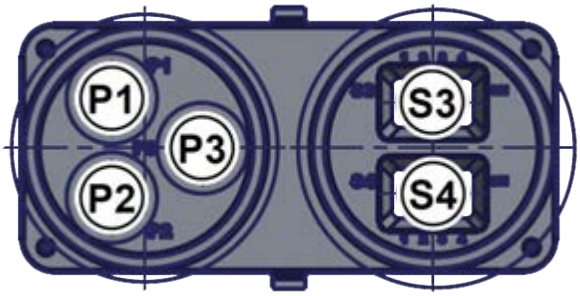
Parameter group	Parameter numbers	Functions	Comments
Basic parameters	P102 … P103	Start-up and shut-down time	Factory setting: Value of potentiometer **P3**
	P107	Brake reaction time	Factory setting: Value of potentiometer **P3** **P114** (brake release time): of setting (0), then the value of **P107** applies
	P108	Switch-off mode	Factory setting: Value of DIP switch **S2-DIP3/4**
	P130	Parameter source **P130**=0 → Potentiometer/ Switch **P130**=1 → Flash memory	**P130=0** (Factory setting): Potentiometers **(P1-P3)** and DIP switch **(S1, S2)** effective **P130=1:** Parameter settings effective
Motor data	P203	Rated motor current	Factory setting: Value of **S1-DIP1...4**
	P210	Start voltage	Factory setting: Value of potentiometer **P2**
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 **P1**

Table 6: Parameters and functions depending on P130

4.2.2.2 Potentiometers P1 to P3

Basic settings for the operation of the motor starter can be made using potentiometers **P1** to **P3** (option slot **E2**). These are latching and each one has 10 scale values. The potentiometers are provided with non-linear characteristic curves at the software side.

(For information regarding **S3** and **S4,** refer to 📖 Section 4.4.3.4 "Addressing")



Potentiometer P1

→ Locking time setting (see also **P570**)

Device type SK 175E-FDS-	**Scale value [s]**									
…301-…	0 [1]	0.2	0.3	0.5	0.7	1.0	1.5	2.0	3.0	5.0

1) Without locking time

Potentiometer P2

→ Starting torque setting (voltage) (see also **P210**)

Device type SK 1x5E-FDS-	**Scale value [%]**									
…301-…	10	15	20	25	30	35	40	50	70	100

Potentiometer P3

→ Start-up and shut-down time setting (see also **P102/P103**)

Device type SK 1x5E-FDS-	**Scale value [s]**									
…301-…	OFF [1]	0.1	0.2	0.3	0.5	0.7	1.0	1.5	2.0	3.0

1) Soft start disabled

4.2.2.3 DIP switches (S1, S2)

Setting of the motor current is made via DIP switch (**S1**).

The basic functionality of the motor starter is set using DIP switch (**S2**).

The DIP switches are located at option slot **E1**.

DIP switch (S1)

→ Nominal motor current setting

Device type SK 1x5E-FDS-	DIP switch setting (Setting according to the motor type plate)																
	0000	**0001**	**0010**	**0011**	**0100**	**0101**	**0110**	**0111**	**1000**	**1001**	**1010**	**1011**	**1100**	**1101**	**1110**	**1111**	
…301-…	OFF [1]	0.8	1.0	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	4.8	5.3	6.7	7.0	[A]

1) I^2t monitoring disabled

DIP switch (S2)

No. Bit	DIP switch (S2)	In the condition as delivered, all four DIP switches are in position "0" ("OFF").		
		DIP-No 4	*3*	
4/3 $2^{3/2}$	**Shut-off mode**	0	0	Shut-off mode 1 (factory setting)
		I	0	Shut-off mode 2
		0	I	Shut-off mode 3
		I	I	Shut-off mode 4
2 2^1	**Motor overtemperature *(SK 155E)***	0		Fault message (E002) and shut-off of the FI due to overtemperature
		I		Warning message (C002) due to overtemperature (factory setting)
	Phase sequence detection *(SK 175E)*	0		Phase sequence according to mains connection(factory setting)
		I		Phase sequence according to required direction of rotation, → automatic detection of phase sequence
1 2^0	**Automatic starting**	0		Enable with flank (factory setting)
		I		Enable with level **ATTENTION, drive can start off immediately!**

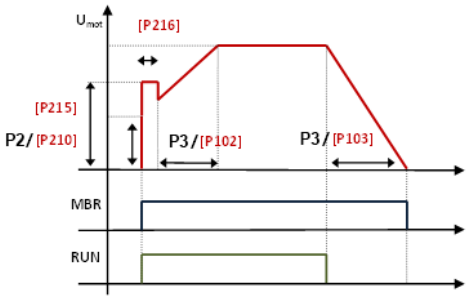
4.2.2.4 Overview of switch-off modes

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

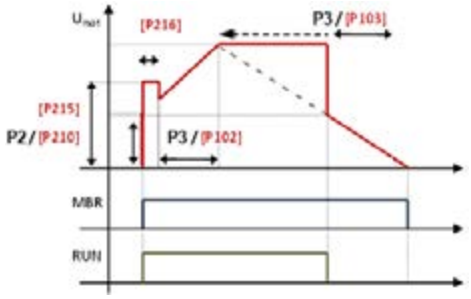
Parameter **P130** determines whether the switch-off mode should be set by means of hardware adaptation (DIP switch **(S1, S2)**, potentiometer **(P1-P3)**) or software adaptation (parametrisation of **P108**).

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

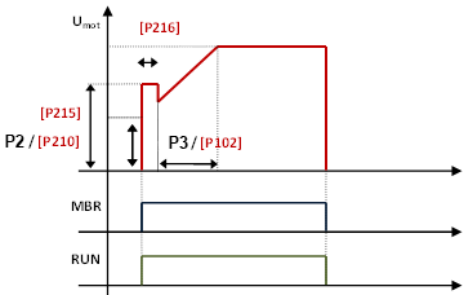
Other settings can be made by means of parameter adaptations if there is a need for further optimisation.

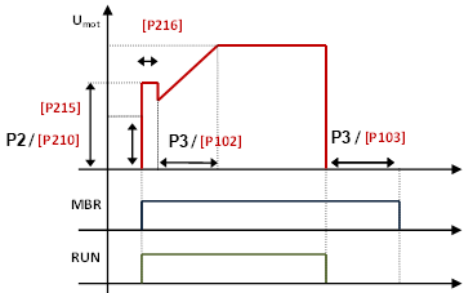
Switch-off mode 1	**DIP3/4**: OFF/OFF (Factory setting)	or	**P108** = 0
Switch on (Set enable)	1. **P2** and **P210** determine the starting voltage (starting torque) that is applied to the motor. 2. The brake opens. 3. **P3** and **P102** determine the duration for which the voltage is continuously increased until the full voltage (100 %) is reached.		
Switch off (Cancellation of release)	1. **P3** and **P103** determine the duration for which the voltage is continuously reduced from 100 % to 0 %. [1)] 2. 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)	1. **P2** and **P210** determine the starting voltage (starting torque) that is applied to the motor. 2. The brake opens. 3. **P3** and **P102** determine the duration for which the voltage is continuously increased until the full voltage (100 %) is reached.		
Switch off (Cancellation of release)	1. **P2** and **P210** determine the voltage (torque) to which the motor controller immediately drops. 2. **P3** 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 (**P2** or **P210**) to 0 % is used. [1)] 3. 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)	1. **P2** and **P210** determine the starting voltage (starting torque) that is applied to the motor. 2. The brake opens. 3. **P3** and **P102** determine the duration for which the voltage is continuously increased until the full voltage (100 %) is reached.		
Switch off (Cancellation of release)	1. The motor is switched off immediately (voltage "0 %") and runs down to a standstill. 2. 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)	1. **P2** and **P210** determine the starting voltage (starting torque) that is applied to the motor. 2. The brake opens. 3. **P3** and **P102** determine the duration for which the voltage is continuously increased until the full voltage (100 %) is reached.		
Switch off (Cancellation of release)	1. The motor is switched off immediately (voltage "0 %") and runs down to a standstill. 2. **P3** and **P103** determine the duration of the delay, during which the brake is not yet applied. 3. The brake is applied.		

4.3 AS Interface (AS-i)

This section is only relevant for device of type SK 1xxE-FDS-...-ASI.

4.3.1 The bus system

General information

The **A**ctuator-**S**ensor-**I**nterface (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
Standard slave 1 (Address 6)
A/B slave 1 (Address 7A)
A/B slave 2 (Address 7B)
Standard slave 2 (Address 8)

Not permissible
Standard slave 1 (Address 6)
Standard slave 2 (Address 7)
A/B slave 1 (Address 7B)
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 entire control voltage (including the control voltage for the device and any connected sensors) as well as only the AS interface can be supplied via this.

The power supply to the device and any connected sensors can also be provided by an internal mains unit (option "**-HVS**") via the "black two-conductor cable" (only possible with the plug connection option: ”**-AUX**“ or ”**-AXS**“ on option slot **M8**) or a combination of both.

The mains unit (option "**-HVS**") with the option ”**-AUX**“ or ”**-AXS**“ functions to reduce the load on the power supply. In contrast, with the option "**-ASI**" this depends on the voltage of the power which is supplied by the AS-i. Because of this, load reduction cannot be expected in all cases.

Option ”**-AUX**“ or ”**-AXS**“ (option slot **M8**): It is not strictly necessary to provide the supply via a protective extra-low voltage (**PELV** - **P**rotective **E**xtra **L**ow **V**oltage), but this is recommended.

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 indication (LED)
- Configuration by means of parametrisation
- 24 V DC supply for the integrated AS-i module and the frequency inverter

  The following options can be used.

  a. Device with integrated mains unit (FI option "**-HVS**") and plug connector option "**-ASI**"

     – Connect the yellow cable to supply the AS-i module
     – Supply of the inverter and the connected initiators or actuators by the integrated mains unit
       Note: If mains voltage is not present in the FI, the initiators for the AS-i master which are connected to it are not visible.

  b. Frequency inverter with integrated mains unit (FI option "**-HVS**") and plug connector option "**-AUX**" or "**-AXS**“

     – Connect the yellow cable to supply the AS-i module
     – Connect the black cable to supply the FI and the connected initiators
       Note: If the voltage of the black cable falls below the voltage of the integrated mains unit, the integrated mains unit takes over the power supply to the inverter. If the voltage of the black cable falls below approx. 16 V DC, the integrated mains unit takes over the power supply to the connected initiators or actuators also.

  c. Frequency inverters without mains unit (without FI option "**-HVS**") and with plug connector option "**-AUX**" or "**-AXS**“

     – Connect the yellow cable to supply the AS-i module
     – Connect the black cable to supply the inverter and the connected initiators or actuators

  d. Frequency inverters without mains unit (without device option "**-HVS**") and with plug connector option "**-ASI**"

     – Connect the yellow cable to supply the AS-i module and the FI
       Note: These variants result in a high current in the AS-i cable and only provide slight reserves for direct connection of initiators and actuators to the inverter.

- Connection to the FI

  – Via M12 system plug connector to option slot **M8**

Technical data for AS interface

Designation	Option slot M8: Frequency inverters with plug connector option ...		
	… "-ASI"	… "-AUX"	… "-AXS"
Power supply via AS-i (yellow cable)	24 – 31.6 V DC, ≤ 450 mA [1]	24 – 31.6 V DC, ≤ 25 mA [2]	
AUX supply (black cable)	*Connection not possible*	24 V DC ± 25 %, ≤ 800 mA	
Slave profile	S-7.A		S-7.0
I/O-Code	7		7
ID Code	A		0
External ID Code 1 / 2	7		F
Address	1A – 31A and 1B – 31B (Delivery condition: 0A)		1 – 31 (Delivery condition: 0)
Cycle time	Slave → Master ≤ 10 ms Master → Slave ≤ 21 ms		≤ 5 ms
Quantity of useful data (BUS I/O)	4I / 4O		4I / 4O

1) For power supply exclusively via the yellow AS-i cable

2) For the power supply to the inverter and any connected sensors or actuators via the integrated mains unit of the FI (option "-HVS") and/or via the black cable.

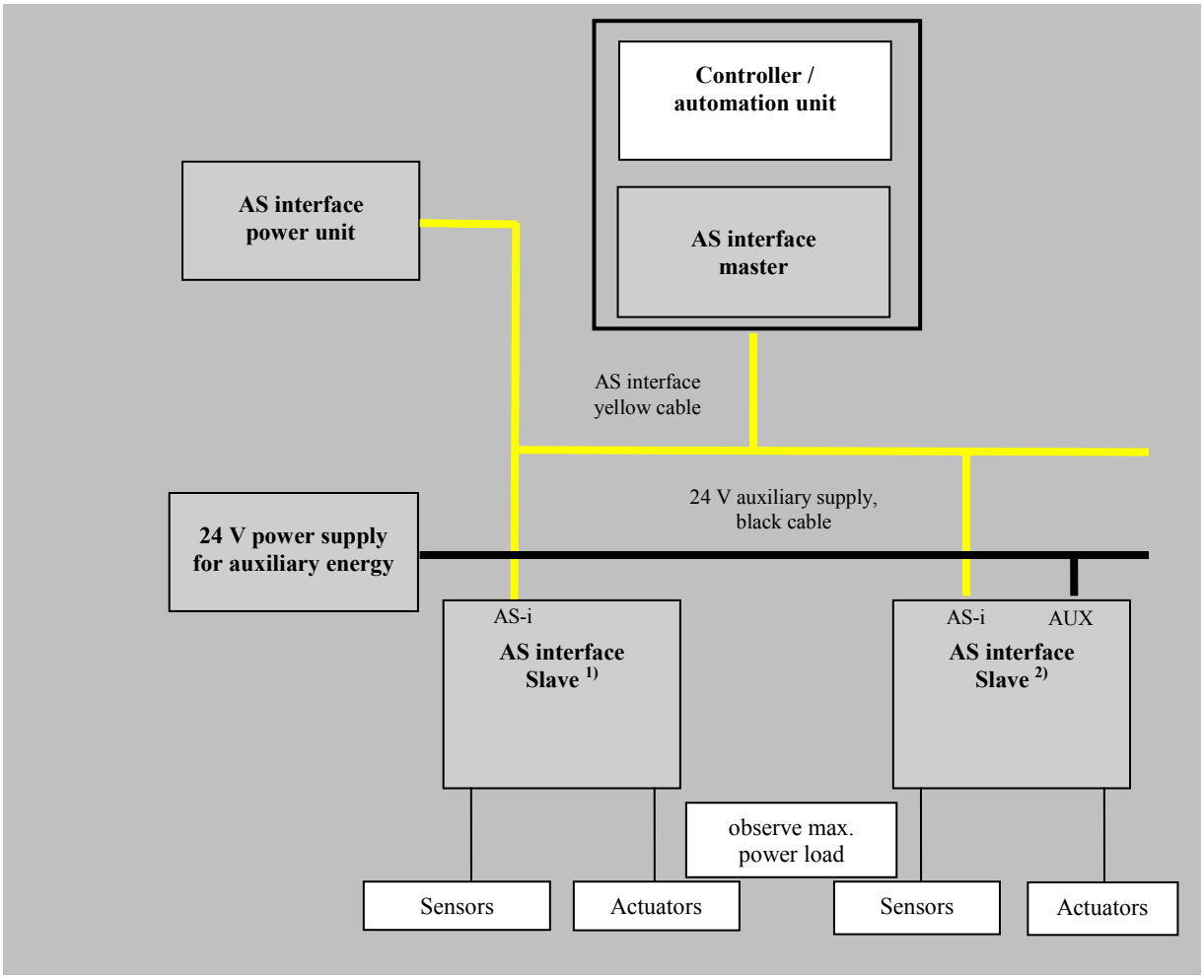
4.3.3 Bus structure and topology

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 1xxE-FDS-…ASI with "plug connector -ASI" a)
2)	SK 1xxE-FDS-…ASI with "plug connector “-AUX” a) or „-AXS“ a)

a) with or without an integrated mains unit (option "-HVS")

4.3.4 Commissioning

4.3.4.1 Connection

1. Connection of the AS interface cable (yellow) is via the plug connector "**-ASI**", "**-AUX**" or "**-AXS**" on option slot **M8**.
2. Connection of a two conductor cable for the auxiliary power supply ("black cable") is via the plug connector "**-AUX**" or "**-AXS**" on option slot **M8** (only if available). Preferably, the power supply should be via a PELV.

(📖 Section 2.3.3.1 "Control connection details")

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	• No AS interface voltage to the module • Connections not connected or exchanged
green ON	• Normal operation (AS interface active)
red ON	• No exchange of data – 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)]	• Peripheral error – Control unit in device not starting (AS-i voltage too low or control unit defective)

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

4.3.4.3 Configuration

The most important functionality is assigned via the arrays [-05] … [-08] of parameter (P420) and via the arrays [-04] … [-05] 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[-05…-08])
Bit 0	Enable right
Bit 1	Enable left
Bit 2	Acknowledge fault [1]
Bit 3	Release brake manually [2]

Status		Status
Bit 1	Bit 0	
0	0	Motor is switched off
0	1	Field of rotation right present at motor
1	0	Field of rotation left present at motor
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 [-04 … -05])
Bit 0	Fault (status bit 0)
Bit 1	Operation (status bit 1)
Bit 2 [1]	Initiator 1 status (BDI1)
Bit 3 [1]	Initiator 2 status (BDI2)

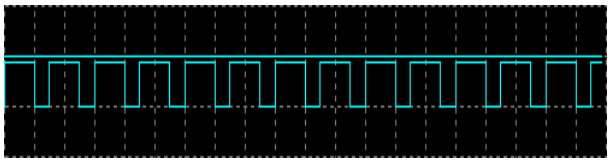
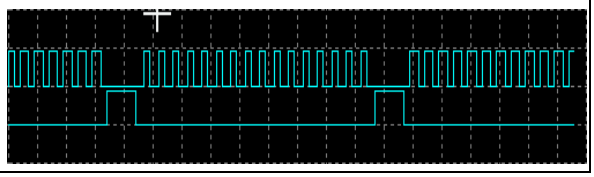
Status		Status
Bit 1	Bit 0	
0	0	Error active
0	1	Standby (motor stationary)
1	0	Warning (but motor running)
1	1	Run (motor running without warning)

1) Bits 2 and 3 are directly coupled to digital inputs BDI1 and BDI2.

Information — Error number output

Alternatively, the error number can also be transferred via the AS-i Out Bits 0 and 1 To do this, in ***AS-i Master*** *Parameter bit 1* (0-3) must be changed from the standard setting. As a result, the ***motor starter*** transfers the *BUS-OUT Bit 0* and then the *Strobe-Signal* to the *BUS-OUT Bit 1* and the *Count-Signal*. The Strobe signal is a cyclical signal, which marks the start of a new transfer cycle. The Count signal outputs the error number from the number of High flanks between each Strobe signal.

Example:

No error	Error number E016
	

Note: The bottom line shows the Strobe signal (Bit 0); the top line shows the Count signal (Bit 1).

Parallel actuation via the BUS and the digital inputs (BDI1, BDI2) 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).

Information — Manual / Automatic mode

If a digital output is parameterised to the function "Disable automatic operation" (see **P420**) the following must be noted for the implementation of the example above: Switch Control Element 1 (Switch **H1**) to manual mode. The programmed enabling direction can be selected with switch **H2**.

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)

Information

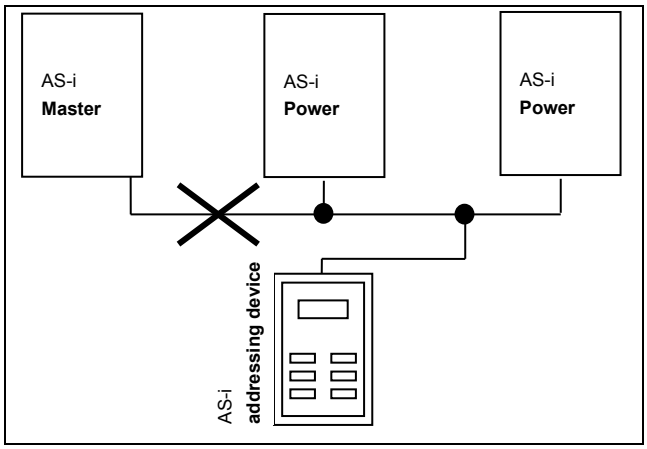
Special conditions for power supply exclusively via the yellow cable

- Also provide voltage supply of the device (**SK 1xxE-FDS-...-ASI**) via the yellow AS interface cable (note the power consumption of control level of the device (SK 1xxE-FDS-...-ASI) (450 mA))
- When using an addressing device
  - Do not use the internal voltage source of the addressing device
  - Battery-operated addressing devices do not supply the current that is necessary and are therefore not suitable
  - Use an addressing unit with a separate 24 V DC connection for an external power supply (example: Pepperl+Fuchs, VBP-HH1-V3.0-V1)

The options for addressing the AS-i slave with an addressing unit in practice are listed below.

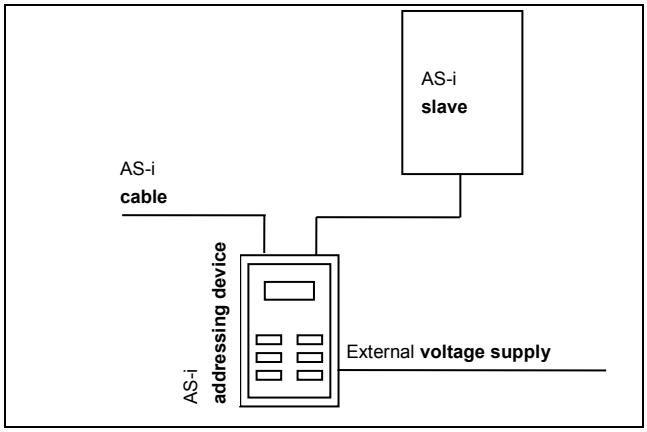
Version 1

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"

4.4 PROFIBUS DP

This section is only relevant for device of type **SK 1x5E-FDS-...-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 DIP switch **S3** and **S4** (option slot **E3**)
- PROFIBUS termination resistor via a commercially available M12 termination resistor is possible
- 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 M12 system connector

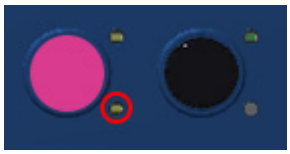
4.4.3 Commissioning

4.4.3.1 Connection

The PROFIBUS cable (purple) is made via the plug connector **PBR (Bus-In)** on option slot **M5** or **PBR (Bus-Out)** on option slot **M7**.

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. • 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	• 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[-05…-08])
Bit 0	Enable right
Bit 1	Enable left
Bit 2	Acknowledge fault [1]
Bit 3	Release brake manually [2]

Status		Status
Bit 1	Bit 0	
0	0	Motor is switched off
0	1	Field of rotation right present at motor
1	0	Field of rotation left present at motor
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 [-04 … -05])
Bit 0	Fault (status bit 0)
Bit 1	Operation (status bit 1)
Bit 2 [1]	Initiator 1 status (BDI1)
Bit 3 [1]	Initiator 2 status (BDI2)

Status		Status
Bit 1	Bit 0	
0	0	Error active
0	1	Standby (motor stationary)
1	0	Warning (but motor running)
1	1	Run (motor running without warning)

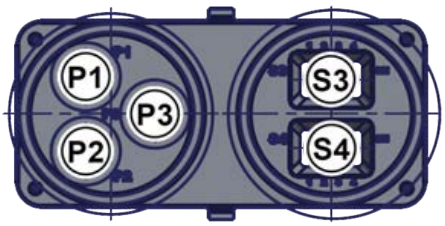
1) Bits 2 and 3 are directly coupled to digital inputs BDI1 and BDI2.

Parallel actuation via the BUS and the digital inputs (BDI1, BDI2) 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

Addressing of the motor starter is performed via two 4-pole DIP switch blocks (**S3 / S4**). These can be found on option slot **E3**.



Switch "S4" (x1)

- Setting of decimal number range from 0 to 9

Switch "S3" (x10)

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

Example

Switch **S3** = 4 (0100) (→ **4**x)
Switch **S4** = 2 (0010) (→ x**2**)

→ Resulting PROFIBUS address = **42**

DIP switch coding

S3 or **S4**	**Value**
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	/ [1]
…	
1111	

1) No function

The PROFIBUS address of the motor starter can be set within a range of 1 to 79 and 81 to 99 with the DIP 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**

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.

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. NORD CON software or control and parametrisation unit, see also (🕮 Section 3.2 "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.

Depending on the configuration of the inverter, the control voltage can be supplied via an optional plug connector. Alternatively, the inverter can be equipped with a mains unit (option: "-HVS"), which generates the necessary 24 V DC control voltage when connected to the mains voltage (see 🕮 Section 2.3.2 "Electrical connection of power unit").

Connections and possible priority switching with the potentiometers (**P1**…) and the DIP switches (**S1** and **S2**) are described in a suitable location and must be taken into consideration (note **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 order (**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.

Information — **SK PAR-3H ParameterBox**

The SK PAR-3H ParameterBox must have at least software version **4.6 R1**.

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, e.g. on/off switching behaviour
Motor data	(P2--)	Electrical settings for the motor (motor current or starting voltage (starting voltage))
Speed control	(P3--)	Settings for the integrated PLC
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-P3)** and DIP switches **(S1, S2)** 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		

Speed control

P350 PLC functionality	**P351** PLC setpoint selection	**P353** Bus status via PLC
P555 PLC integer setpoint	**P356** PLC long setpoint	**P360** PLC display value
P370 PLC status		

Control terminals

P400 Function Analogue input	**P420** Digital inputs	**P425** PTC resistor input
P427 Emerg. stop Fault	**P428** Automatic starting	**P434** Digital output
P499 Function DIP switch		

Additional parameters

P523 Factory setting	**P535** I²t motor	**P536** Current limit
P538 Mains voltage Monitoring	**P539** Output monitoring	**P550** Flash copy order
P553 PLC setpoints	**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 input
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	**P752** Changeover relay error	**P753** Bypass relay error
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 3: 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.

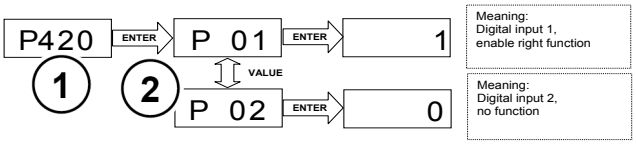
Array parameter display

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

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	*Reserved*		

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	… 9999, supervisor mode off	The supervisor parameters are not visible.

5.2.2 Basic parameters

P102	Acceleration time	RF
Setting range	0.00 ... 3.00 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	As long as parameter **P130**=0 is set, the acceleration time 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.	
	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).	

P103	Run-down time	RF
Setting range	0.00 ... 3.00 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	As long as parameter **P130**=0 is set, the run-down time 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.	
	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).	

P107	Brake reaction time	RF
Setting range	0.00 ... 3.00 s	Other applicable parameter(s): **P103, P108, P114, P130**
Factory setting	{ 0.00 }	
Description	Time delay for the application (closing) of an electro-magnetic brake after the run-down time has been reached (**P103**) or the enable removed. 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.	
Note	As long as parameter **P130**=0 is set and switch-off mode 4 (DIP switch **S2-DIP3/4**) is active, the application time of the brake is determined by potentiometer **P3**. In this case the parameter can only be read, but not changed. It then corresponds to the setting determined by the potentiometer.	
	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 point in time of stopping.	

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 **S2-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 **P3** (voltage drops). The brake is then applied in accordance with the time specified by **P107** or **P3**.
	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 **P2**. The time period (***X***) is determined by **P103** or potentiometer **P3**, 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 **P3**.
	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 **P3**.

P114	Brake release time	FL
Setting range	0.00 ... 3.00 s	Other applicable parameter(s): **P107**
Factory setting	{ 0.05 }	
Description	Time delay for releasing a magnetic brake after the release signal. This can be used to counteract load dropping at the point in time of starting off. Load dropping occurs if the time that the motor requires to magnetise is greater than the time that the brake needs to release (e.g. lifting gear).	
Note	If the release time of the brake is too long the motor operates against the brake, which is still applied. This can lead to a start-up current that is too high, which will make the starter shut off with an overcurrent error.	
Setting values	0 = release time corresponds to value in **P107**.	

P130	Parameter source	FL
Setting range	0 … 1	Other applicable parameter(s) **P550**
Factory setting	{ 0 }	
Description	Selection of whether the DIP switches **(S1, S2)** and potentiometers **(P1-P3)** have priority over the parameter setting.	
Note	• 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. They are determined by **(S1, S2)** and **(P1-P3)**.
	1	Flash memory	All settings at the device are determined by the parameters. **(S1, S2)** and **(P1-P3)** have no influence.

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	0.50 … 18.80 A	Other applicable parameter(s) **P130**
Factory setting	{ 3.00 }	
Description	The rated motor current is needed for I^2t 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 the DIP switch **S1-DIP1...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.	

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 **P2**. 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 ... 3.00 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 Speed control

P350	PLC functionality	FL
Setting range	0 … 1	Other applicable parameter(s) **P351**
Factory setting	{ 0 }	
Description	Activation of the integrated PLC	
Setting values	**Value**	**Meaning**
	0 Off	The PLC is not active, control of the device is via IOs or switch options (see option slot **H1** / **H2**)
	1 On	The PLC is active, device is actuated via the PLC, depending on **P351**.

P351	PLC setpoint selection	FL
Setting range	0 … 1	Other applicable parameter(s) **P350, P553**
Factory setting	{ 0 }	
Description	Selection of the source for the control word (**P553**) and main setpoint with active PLC functionality (**P350** = 1). This parameter is only adopted if the frequency inverter is in "Ready to start" status.	
Setting values	**Value**	**Meaning**
	0 STW = PLC	The PLC provides the control word
	1 STW = Invalid	The control word from the PLC is invalid

P353	Bus status via PLC	FL
Setting range	0 … 1	Other applicable parameter(s) **P350**
Factory setting	{ 0 }	
Description	Selects how the status word from the device is to be processed by the PLC.	
Setting values	**Value**	**Meaning**
	0 Off	The control word (STW) and the status word (ZSW) are processed by the PLC without change.
	1 Status word (ZSW) for the bus	The status word (ZSW) of the device is set by the PLC. In order to do this, the status word must be redefined in the PLC using process value "28_PLC_status_word".

P355	PLC integer setpoint	FL
Setting range	0000 … FFFF (hex)	
Arrays	[-01] … [-10]	
Factory setting	All Arrays: { 0 }	
Description	Data can be exchanged with the PLC via this INT array. This data can be used by the appropriate process variables in the PLC.	

P356	PLC long setpoint	FL
Setting range	0000 0000 … FFFF FFFF (hex)	
Arrays	[-01] … [-05]	
Factory setting	All Arrays: { 0 }	
Description	Data can be exchanged with the PLC via this DINT array. This data can be used by the appropriate process variables in the PLC.	

P360	PLC display value	RD
Display range	- 2 147 483.648 … 2 147 483.647	
Arrays	[-01] … [-05]	
Description	Display of PLC data. By means of the relevant process variables, the parameter arrays can be written by the PLC. The values are not saved!	

P370	PLC status		RD
Display range	0000 … FFFF (hex)	0000 0000 … 1111 1111 (bin)	
Description	Display of the actual PLC status.		
Display values	**Value (Bit)**	**Meaning**	
	0	P350=1	Parameter **P350** was set in the "Activate internal PLC" function
	1	PLC active	The internal PLC is active.
	2	Stop active	The PLC program is in "Stop" status.
	3	Debug active	The error checking of the PLC program runs.
	4	PLC error	The PLC has an error However, PLC User Errors 23.xx are not displayed.
	5	PLC halted	The PLC program has been halted (Single Step or Breakpoint).
	6	Scope Memory used	A function block uses the memory area for the oscilloscope function of the NORD CON software Because of this, the oscilloscope function cannot be used.

5.2.5 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 DIP switch S1) [-02] = Function Analogue input 2 (= value for P570 from potentiometer P1) [-03] = Function Analogue input 3 (= value for P210 from potentiometer P2) [-04] = Function Analogue input 4 (= value for P102 / 103 from potentiometer P3)				
Description	Display of the function of the relevant DIP switch **S1** or potentiometer **P1 … P3**, if the DIP switch or the relevant potentiometer is active.				
Note	If **P130**=1 is set, all DIP switches and potentiometers are disabled. "0" = "No function" is displayed in all arrays.				
Display values	**Value**	**Meaning**			
	0	No function	The DIP switch or potentiometer is not used.		
	1	Rated motor current	The DIP switch 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	… 6	*Reserved*		

P420	Digital inputs	RF
Setting range	0 … 13	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] = Digital input 3 (= value for digital input DIN3) [-04] = PTC input (= value for PTC input TF) [-05] = Bus In bit 0 (= value for Bus In bit 0) [-…] … [-08] = Bus In bit 3 (= value for Bus In bit 3)	
	[-09] = Bus digital input 1 (= value for bus digital input BDI1)	
	[-10] = Bus digital input 2 (= value for bus digital input BDI2)	
Factory setting	{ [-01] = * } { [-02] = * } { [-03] = * } { [-04] = 8 } { [-05] = 1 } { [-06] = 2 } { [-07] = 7 } { [-08] = 9 } { [-09] = 0 } { [-10] = 0 } *) The factory settings of the arrays [-01] … [-03] depend on the control elements which are used (configuration of option slots **S1** and **S2**), see 🕮 Section 2.2.2.2 "Configuration of option slots on the control level"	
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.	

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 [-05 ... -08])	High active Flank 0 →1 [1]
4	Enable left via bus	The drive runs with a left-hand direction of rotation. (only for array [-05 ... -08])	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 no longer present.	Flank 0 →1
8	PTC 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
10	Automatic mode disabled [2]	Remote control disabled, control only via digital IOs of the device.	High active
11	Block enable right	Direction of rotation right is blocked.	High active
12	Block enable left	Direction of rotation left is blocked.	High active
13	PLC stop	PLC program: execution stopped	High active

1) If, depending on parameter**P130**, Dip switch 2 (**S2**) or parameter **P428** is parameterised to "Automatic start", no flank is required. A "High Level" is sufficient.

2) If a digital input is parameterised to this function, the device cannot be enabled with "Enable right" or "Enable left" in automatic mode. For this the device must first be switched to "Manual mode".

P427	Emerg. stop Fault	FL
Setting range	0 … 1	Other applicable parameter(s): **P108, P130, P428**
Factory setting	{ 0 }	
Description	*Emergency stop fault* - 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 **S2-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 … 21	Other applicable parameter(s) **P130**
Arrays	[-01] = Digital output 1 (= value for digital input DO1) [-02] = Digital output 2 (= value for digital input DO2) [-03] = Mechanical brake (= value for mechanical brake MB) [-04] = Bus Out bit 0 (= value for Bus Out bit 0) [-05] = Bus Out bit 1 (= value for Bus Out bit 1)	
Factory setting	{ [-01] = 1 } { [-02] = 2 } { [-03] = 3 } { [-04] = 1 } { [-05] = 2 }	
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 are active.
2	Motor running	Drive operates.
3	Mechanical brake	A mechanical brake is controlled. "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
7	Status bus Dig In 2	Display of signal status of digital input 2 via bus
8	Status bus Dig In 3	Display of signal status of digital input 3 via bus
9	Status bus Dig In 4	Display of signal status of digital input 4 via bus
10	Status Manual / Auto	Operating status display Manual / Automatic mode (= 0 / 1)
11	Digital-In 3 status	Display of signal status of digital input 3
12	PLC Output Bit 0	Display of signal status of digital input 1 via PLC
13	PLC Output Bit 1	Display of signal status of digital input 2 via PLC
…	…	…
19	PLC Output Bit 7	Display of signal status of digital input 8 via PLC
20	Output via PLC	The output is set by the integrated PLC
21	Fault or manual operation	There is a fault or manual operation is enabled. (The function is Low –active.)

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 **(S2)**.	
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	*Reserved*
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

5.2.6 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	I²t motor	FL
Setting range	0 … 2	Other applicable parameter(s): **P108, P203, P427**
Factory setting	{ 1 }	
Description	*I²t motor shut-off class* – This determines how quickly the motor starter shuts off in the event of overcurrent. The rated current upon which the I²t 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 5	1.5x overcurrent for 60 s / 9 s [1]
	1 [2] Class 10A	1.5x overcurrent for 85 s / 12 s [1]
	2 Class 10	1.5x overcurrent for 170 s / 24 s [1]

1) 1. Value: cold motor
2. Value: warm motor with 100% load

2) Class 10A only for rated motor current ≤ 4 A

Detailed information: 🕮 Section 8.3 "Trigger classes (I²t)"

P536	Current limit	FL
Setting range	80 … 401 %	Other applicable parameter(s) **P203**
Factory setting	{ 401 }	
Description	Limitation of the starting current relative to the rated motor current (**P203**). If the current limit is exceeded the starting ramp is extended until the current limit is undershot.	
Setting values	401 % = The function is switched off	

P538	Mains voltage Monitoring	FL
Setting range	0 … 3	Other applicable parameter(s): **P108, P427**
Factory setting	{ 3 }	
Description	*Mains voltage monitoring* – 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 DIP switch**S1**) during normal operation (after completion of the acceleration time), this results in 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".

P553	PLC setpoints	FL
Setting range	0 … 12	Other applicable parameter(s) **P350, P351**
Arrays	[-01] = PLC-In Bit 1: [-…] … [-08] = PLC-In Bit 8:	
Factory setting	All Arrays: { 0 }	
Description	Assignment of functions for the various PLC control bits.	
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.	High active Flank 0 →1 [1]
2	Enable left	The drive runs with a left-hand direction of rotation.	High active Flank 0 →1 [1]
3	Enable right via bus	The drive runs with a right-hand direction of rotation.	High active Flank 0 →1 [1]
4	Enable left via bus	The drive runs with a left-hand direction of rotation.	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 no longer present.	Flank 0 →1
8	PTC 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
10	Automatic mode disabled	Remote control disabled, control only via digital IOs of the device.	High active
11	Enable right blocked	Direction of rotation right is blocked.	High active
12	Block enable left	Direction of rotation left is blocked.	High active

1) If, depending on parameter**P130**, DIP switch 2 (**S2**) or parameter **P428** is parameterised to "Automatic start", no flank is required. A "High Level" is sufficient.

P570	Locking time	RF
Setting range	0 … 25.00 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	As long as parameter **P130**=0 is set, the locking time 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.	
	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.	

P580	Error in the event of overtemp.		RF
Setting range	0 … 1	Other applicable parameter(s): **P108, P427**	
Factory setting	{ 1 }		
Description	*Fault shut-off due to overtemperature* – 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 **S2-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!	

5.2.7 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	Digital input status.		RD
Display range	0000 0000 0000 … 0111 1111 1111 (bin)	0000 … 07FF (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	Digital input 2	Switching status of digital input 2
2	Digital input 3	Switching status of digital input 3
3	PTC input	PTC resistor input switching status
4	Bus In Bit 0	Signal status Bus In Bit 0
5	Bus In Bit 1	Signal status Bus In Bit 1
6	Bus In Bit 2	Signal status Bus In Bit 2
7	Bus In Bit 3	Signal status Bus In Bit 3
8	Digital input 1 BUS	Switching status of Bus digital input 1
9	Digital input 2 BUS	Switching status of Bus digital input 2
10	STO input	Signal status STO input

P709	Potentiometer status		RD
Display range	0,0 … 100,0 %		
Arrays	[-01] = DIP switch S1	Actual value in % of 3.6 A (SK 1xxE-FDS-151-…), or Actual value in % of 7.5 A (SK 1xxE-FDS-301-…)	
	[-02] = Potentiometer P1	Actual value in % of 25.6 s	
	[-03] = Potentiometer P2	Current value in % of 100 % start voltage	
	[-04] = Potentiometer P3	Current value in % of 25.6 s	
Description	Display of the set values of DIP switch **S1** or potentiometer **P1** … **P3**, *relative to* the particular *end values of the scale* (in %)		

P711	Digital output status		RD
Display range	0000 0000 … 0111 1111 (bin)	00 … 7F (hex)	
Description	Display of switching status of the digital inputs		
Display values	Value (Bit)	Meaning	

0	Digital output 1	Switching status of digital output 1
1	Digital output 2	Switching status of digital output 2
2	Mechanical b.	Switching status of mechanical brake output
3	Bus / AS-i Out Bit0	Switching status of Bus Out Bit 1
4	Bus / AS-i Out Bit1	Switching status of Bus Out Bit 2
5	Bus / AS-i Out Bit2	Switching status of Bus digital input 1
6	Bus / AS-i Out Bit3	Switching status of Bus digital input 2

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]	not used		
	[-05] = Parameter data In 1	**Data during parameter transfer:** Order label (AK), Parameter number (PNU), Index (IND), Parameter value (PWE1 / PWE2)		
	[-06] = Parameter data In 2			
	[-07] = Parameter data In 3			
	[-08] = Parameter data In 4			
	[-09] = Parameter data In 5			
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	= Status word		
	[-02] = Bus - Actual value 1	Error number in high byte, warning number in low byte		
	[-03] = Bus - Actual value 2	Current current is relation to nominal current of device		
	[-04] = Bus - Actual value 3	Current effective current is relation to nominal current of device		
	[-05] = Parameter data Out 1	**Data during parameter transfer.**		
	[-06] = Parameter data Out 2			
	[-07] = Parameter data Out 3			
	[-08] = Parameter data Out 4			
	[-09] = Parameter data Out 5			
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	… 4	*Reserved*
5	SK 155E (AS-i)	Motor starters with soft-start function + integrated AS interface
6		*Reserved*
7	SK 175E (AS-i)	Motor starter with soft start and reversing function + integrated AS interface
8		*Reserved*
9	SK 155E (Profibus)	Motor starters with soft-start function + integrated PROFIBUS DP interface
10		*Reserved*
11	SK 175E (Profibus)	Motor starter with soft start and reversing function + 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, S2)**.		
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	

P752	Changeover relay error	RD
Display range	0 … 10	
Description	Display of the errors caused by a changeover relay (**E18.3**). The changeover relay performs the change of direction of the motor in reversing mode.	
Note	After the 10th error occurs the device is no longer operational and must be sent for repair. This parameter is only available for devices with reversing function (SK 175E-FDS).	

P753	Bypass relay error	RD
Display range	0 … 10	
Description	Display of the errors caused by a bypass relay (**E18.4**). The bypass relay bypasses the thyristor module after completion of the acceleration phase.	
Note	After the 10th error occurs the device is no longer operational and must be sent for repair. The parameter is only available for devices with soft start function (SK 155E-FDS, SK 175E-FDS).	

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.	

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 device is indicated by externally visible "device status" LEDs (📖 Section 3 "Display, operation and options").

SimpleBox - display

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

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

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

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

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

ParameterBox display

The ParameterBox displays the messages in plain text.

6.2 Diagnostic LEDs on device

The device generates operating status messages. These messages (warnings, errors, switching statuses, measurement data) can be displayed with parametrisation tools (🕮 Section 3.2 "Control and parametrisation 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**		
E001	**1.0**	**Overtemp. Thyristor** *"Thyristor module overtemperature"*	Temperature monitoring of the thyristor module Temperature monitoring is performed on the basis of a calculation model. The error message is triggered if the results exceed the permissible temperature range. • Check the ambient temperature • Reduce the motor load during the acceleration phase • Check the device for dirt
E002	**2.0**	**Overtemp. Motor PTC** *"Overtemperature motor thermistor "*	Motor temperature sensor (PTC) has triggered • Reduce motor load
E003	**3.0**	**I^2t overcurrent limit**	• Continuous motor overload
	3.3	**Thyristor overcurrent**	• Continuous motor overload during the acceleration phase
E004	**4.5**	**Overcurrent / short circuit in the brake rectifier** *Overcurrent / short circuit in the brake rectifier*	• Electromechanical brake defective • Electromechanical brake connected with impermissible electrical data → Check the connection data
E005	**5.1**	**Mains overvoltage**	Mains voltage is too high • See technical data (🕮 Section 7)
E006	**6.1**	**Mains undervoltage**	Mains voltage too low • See technical data (🕮 Section 7)
E007	**7.0**	**Mains phase error**	Error at terminal connection side • a network phase is not connected • network is non-symmetrical
E016	**16.0**	**Motor phase error**	A motor phase is not connected. • Check P539 • Check motor connection
	16.1	**Magnetisation current monitoring** *"Magnetisation current monitoring"*	Required exciting current not achieved at moment of switch-on. • Check P539 • Check motor connection
E018	**18.0**	**Reserved**	
	18.1	**Reserved**	
	18.2	**Reserved**	

	18.3	**Changeover relay sticking**	A relay which is relevant for implementation of the change of direction of the motor (reversing mode) is sticking or is defective. This error message can only be acknowledged by switching off the device. Each error which occurs is counted (**P752**). After the 10th error occurs the device is no longer operational and must be sent for repair. Only relevant for devices with reversing function (SK 175E-FDS).
	18.4	**Bypass relay sticking**	A relay which is relevant for bypassing the thyristor module (changeover from acceleration phase to normal motor operation) is sticking or is defective. This error message can only be acknowledged by switching off the device. Each error which occurs is counted (**P753**). After the 10th error occurs the device is no longer operational and must be sent for repair. Only relevant for devices with soft start function (SK 175E-FDS).
E020 E021	**20.0**	**Reserved**	System error in program execution, triggered by EMC interference. • Observe wiring guidelines • Use additional external mains filter. • FI must be very well earthed.
	20.1	**Watchdog**	
	20.2	**Stack overflow**	
	20.3	**Stack underflow**	
	20.4	**Undefined opcode**	
	20.5	**Protected Instruct.** *"Protected Instruction"*	
	20.6	**Illegal word access**	
	20.7	**Illegal Inst. Access** *"Illegal instruction access"*	
	20.8	**Program memory error** "*Program memory error*" (EEPROM error)	
	20.9	**Dual-ported RAM**	
	21.0	**NMI error** (Not used by hardware)	
	21.1	**PLL error**	
	21.2	**ADU error** "Overrun"	
	21.3	**PMI error** "Access Error"	
	21.4	**Userstack overflow**	

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** *"Overtemperature motor thermistor"*	Warning from motor temperature sensor (triggering threshold reached) • Reduce motor load
C003	**3.0**	**I^2t overcurrent limit**	Warning: I^2t 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)	• No mains voltage or wrong mains voltage • Devices without integrated mains unit (Option **–HVS**): No 24 V DC control voltage	• Check connections and supply cables • Check switches / fuses
Device does not react to enabling	• 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	• 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 S2-DIP1
Motor will not start in spite of enable being present	• Motor cables not connected • Brake not ventilating	• Check connections and supply cables
Device switches off without error message when load increases (increased mechanical load / speed)	• Mains phase missing	• Check connections and supply cables • Check switches / fuses
Motor rotating in wrong direction	• Motor cable: U-V-W interchanged	• Motor cable Switch 2 phases • Alternatively: – Swap parameter **P420** functions right / left enable

Table 7: FAQ operational problems

7 Technical data

7.1 General data Motor starter

Function	Specification
Motor overload monitoring	150 % for 9 s … 170 s, depending on shut-off class (**P535**)
Motor starter efficiency	> 98 %
Insulation resistance	> 5 MΩ
Operating / ambient temperature	-25°C … +50°C, depending on operating mode (📖 Section 7.2.1)
Storage and transport temperature	-25 °C … +60/70 °C
Long-term storage	(📖 Section 9.1)
Protection class	IP65
Max. installation altitude above sea level	*Up to 1000 m* No power reduction *1000...2000 m:* 0.25 %/ 100 m power reduction, overvoltage category 3 *2000...4000 m:* 0.25 % / 100 m power reduction, overvoltage category 2, external overvoltage protection required at mains input
Ambient conditions	*Transport (IEC 60721-3-2)* Mechanical: 2M2 *Operation (IEC 60721-3-3):* Mechanical: 3M6 Climatic: 3K3 (IP55) 3K3 (IP65)
Environmental protection	*EMC* (📖 Section 1.6) *RoHS* (📖 Section 1.6)
Protective measures against	Mains phase failure, motor phase failure Motor magnetisation monitoring
Motor temperature monitoring	I^2t 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	*Standard* RS232 (Single Slave) *Optional* AS-i on board (📖 Section 4.3) PROFIBUS DP on board (📖 Section 4.4
Electrical isolation	Control terminals
Connecting terminals, electrical connection	*Power unit* (📖 Section 2.3.2) *Control unit* (📖 Section 2.3.3)

7.2 Electrical data

The following tables contain the data which is relevant for UL.

Details of the UL/cUL approval conditions can be found in Section1.6.1 "UL and cUL (CSA) approval". Use of mains fuses which are faster than those stated is permissible.

7.2.1 Electrical data

Frequency inverter type	**SK 1x5E-FDS-…**		**-301-340-**			
Nominal motor power (4-pole standard motor)	400 V		3.0 kW			
	480 V		4 hp			
Mains voltage		**3 AC** 380 V – 20 % … 500 V + 10 %, 47 … 63 Hz				
Input current	rms		7.5 A			
	FLA		7.0 A			
Output voltage		**3 AC** 0 ... Mains voltage				
Output current	rms		7.5 A			
	FLA		7.0 A			
	LRA		49.0 A			
Max. continuous power / max. continuous current						
	S1-50°C		3.0kW / 7.5A			
		General fuses (AC) (recommended)				
	slow-blowing		7.5…16 A [1]			

		Isc [2] [A]			**UL fuses (AC) – permitted** [3]				
	Class	5 000	10 000	65 000					
Fuse	RK5	X				30 A			
	CA, CC, CF, J, T, G			x		30 A			
CB [4]	500 V		X			30 A			

1) Fuse size depending on size of connected motor, for group fuse, use the maximum size fuse 30 A
2) maximum permissible mains short circuit current. This may be reduced by the selected connection combination or maintenance switch
3) Note the current limitation due to the power plug connector which is used (📖)
4) "Inverse time trip type“ according to UL 489

8 Additional information

8.1 Electromagnetic compatibility (EMC)

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. *EC Declaration of Conformity*

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

2. *Technical documentation*

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

3. *EC Type test certificate*

   This method only applies to radio transmitter equipment.

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 8: 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 "Electromagnetic compatibility (EMC)").

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

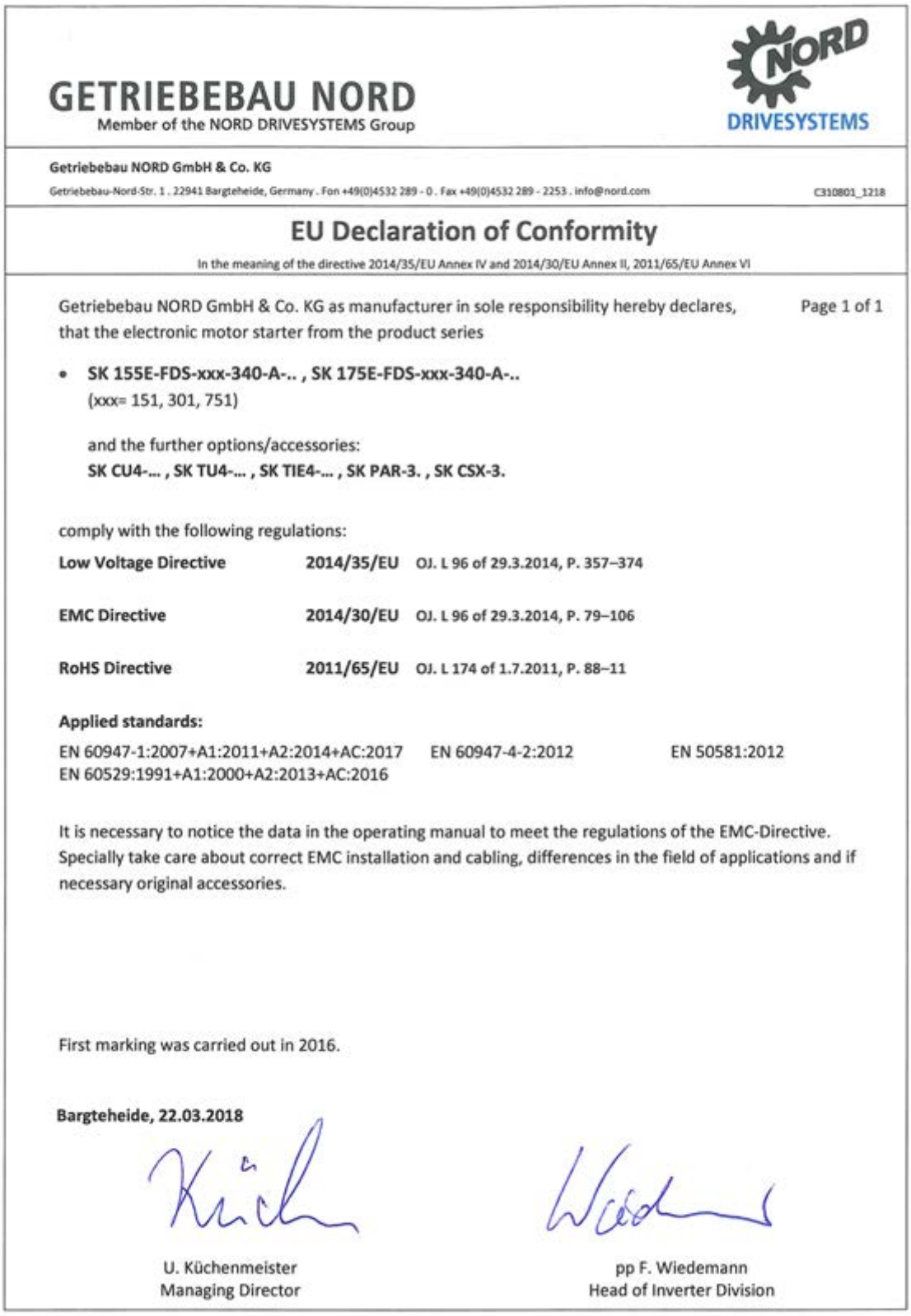
If a shielded motor cable is used, the shield of the motor cable must be connected to the motor.

Device version **Max. motor cable length, shielded**	**Conducted emissions 150 kHz - 30 MHz**	
	Class A	**Class B**
Standard configuration for operation on TN/TT networks (active integrated mains filter)	20 m	-

EMC overview of standards that are used in accordance with EN 60947-4-2 as checking and measuring procedures:		
Interference emission		
Cable-related emission (interference voltage)	EN 55011	A
		-
Radiated emission (interference field strength)	EN 55011	A
		-
Interference immunity EN 61000-6-1, EN 61000-6-2		
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 9: Overview according to product standard EN 60947-4-2

8.1.4 EU Declaration of Conformity



GETRIEBEBAU NORD
Member of the NORD DRIVESYSTEMS Group

DRIVESYSTEMS

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EU Declaration of Conformity

In the meaning of the directive 2014/35/EU Annex IV and 2014/30/EU Annex II, 2011/65/EU Annex VI

Getriebebau NORD GmbH & Co. KG as manufacturer in sole responsibility hereby declares, that the electronic motor starter from the product series

Page 1 of 1

- **SK 155E-FDS-xxx-340-A-.. , SK 175E-FDS-xxx-340-A-..**
  (xxx= 151, 301, 751)

  and the further options/accessories:
  SK CU4-... , SK TU4-... , SK TIE4-... , SK PAR-3. , SK CSX-3.

comply with the following regulations:

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. 88–11

Applied standards:

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

It is necessary to notice the data in the operating manual to meet the regulations of the EMC-Directive. Specially take care about correct EMC installation and cabling, differences in the field of applications and if necessary original accessories.

First marking was carried out in 2016.

Bargteheide, 22.03.2018

U. Küchenmeister
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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.

8.3 Trigger classes (I²t)

The devices support the following trigger classes according to product standard IEC 60947-4-2:

- 5
- 10A
- 10 (only for motors with rated current ≤ 4.0 A

The I²t-trigger classes also take into account the loads which occur under normal operation (less than 110 %). Because of this, the switch-off times differentiate between a motor which has been in operation for some time ("warm") motor and a "cold" motor which has just been started.

In addition, the trigger characteristic curves are subject to tolerances due to the relatively large measurement range.

The FI switches off immediately above an output current of 56 A. If the output current exceeds 9x the value of the rated motor current, switch-off is additionally accelerated (kink in the characteristic curves).

This results in the following characteristic curves:

Outline conditions

- Typical for ambient temperature 20°C,
- Tolerance range, incl. temperature influences,
- Immediate triggering for I > 56 A,
- Class 10 only for I_{nenn} ≤ 4 A

Legend

- A: Response time
- B: Overcurrent factor I/I_{nenn} (I_{nenn}= parameterised rated current)

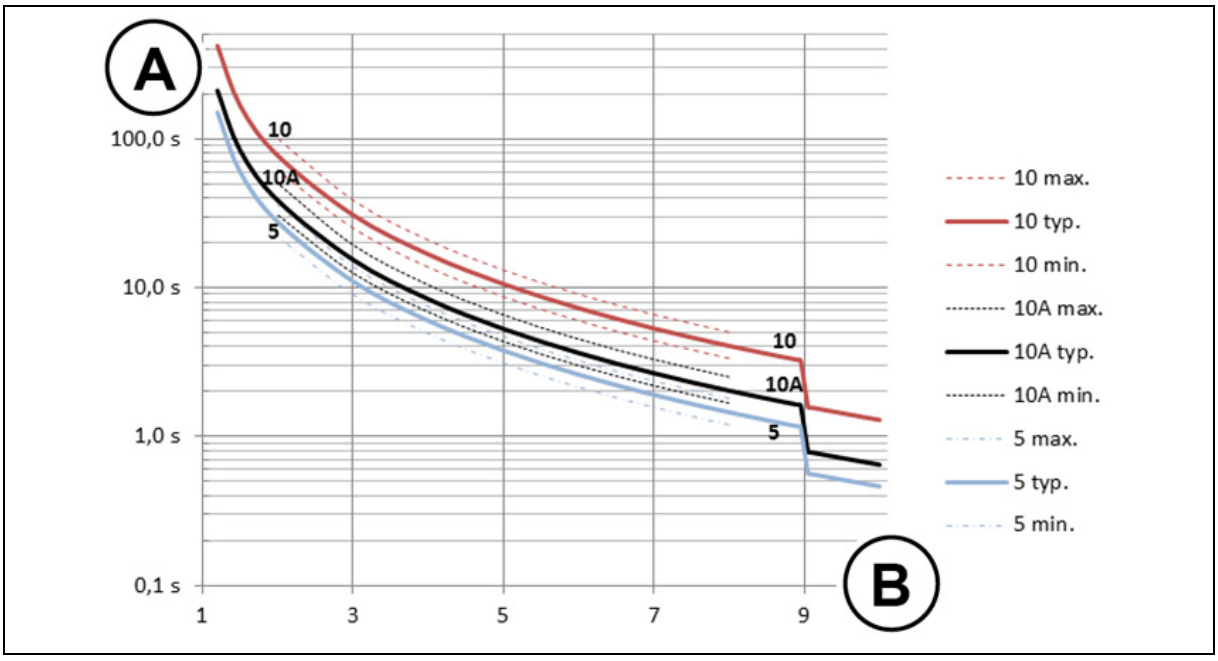


Figure 4: Trigger class curves

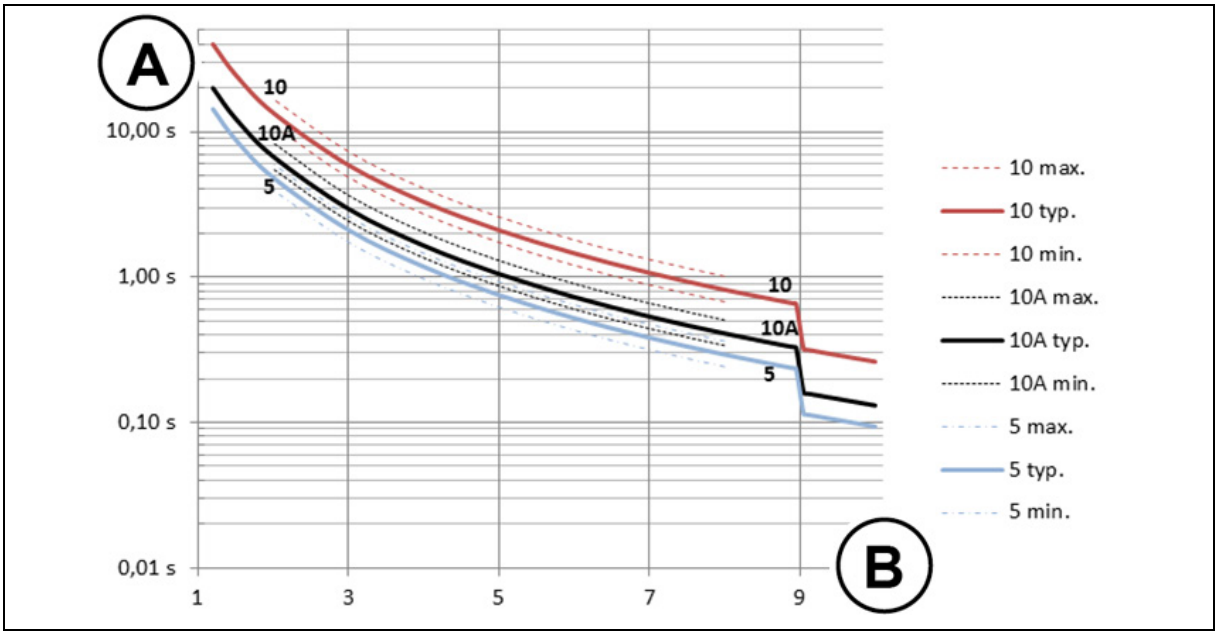


Figure 5: Trigger times for warm operating state (with previous: I = continuous I_{nenn})

8.4 Switch-on cycle

Depending on the version of the FI, various internal relays are used in the power circuit. Because of this, a switch-on block is integrated into the FI to protect the relays against overload during long acceleration phases and large motor currents.

The switch-on block is triggered by a timer, which starts immediately after the frequency inverter is switched on (enabled). The timer setting depends on the rated current of the motor and the acceleration time.

The maximum blocking time between two switch-on procedures is 1 second.

8.5 Connection accessories

The material for establishing the electrical connection is not included in the scope of delivery of the frequency inverter. However, it can be obtained from NORD or from other commercial sources.

8.5.1 Power connections - mating connectors

Parts lists for some of the mating connectors of the installed plug connectors (power connections, (📖 Section2.2.1.1 "Connection level")) are listed below.

Installed plug connector type: ***HARTING Q4/2+ (socket)***

Recommended products for mating connectors to the installed plug connector system

Hybrid plug connector HAN Q4/2 (pin)

Number	Designation	Manufacturer	Information
1 x	Sleeve housing, HAN-Compact	Harting	Straight cable outlet, M25 (19 12 008 0429)
1 x	Contact insert HAN Q4/2 (pin)	Harting	(09 12 006 3041)
4 x	Crimp contact Pin 4mm²	Harting	(09 32 000 6107)
2 x	Crimp contact Pin 0.75mm²	Harting	(09 15 000 6105)
1 x	HAN-Compact Half cable gland	Harting	M25 – 14…17mm (19 12 000 5158)

Installed plug connector type: ***HARTING Q4/2+ (plug connector)***

Recommended products for mating connectors to the installed plug connector system

Hybrid plug connector HAN Q4/2 (socket)

Number	Designation	Manufacturer	Information
1 x	Sleeve housing, HAN-Compact	Harting	Straight cable outlet, M25 (19 12 008 0429)
1 x	Contact insert HAN Q4/2 (socket)	Harting	(09 12 006 3141)
4 x	Crimp contact socket 4mm²	Harting	(09 32 000 6207)
2 x	Crimp contact socket 0.75mm²	Harting	(09 15 000 6205)
1 x	HAN-Compact Half cable gland	Harting	M25 – 14…17mm (19 12 000 5158)

Installed plug connector type: ***HARTING Q8/0+ (socket)***

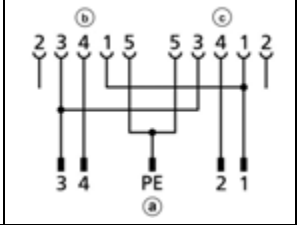
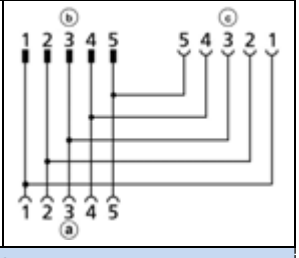
Recommended products for mating connectors to the installed plug connector system

Hybrid plug connector HAN Q8/0 (pin)

Number	Designation	Manufacturer	Information
1 x	Sleeve housing, HAN-Compact	Harting	Straight cable outlet, M25 (19 12 008 0429)
1 x	Contact insert HAN Q8/0 (pin insert)	Harting	(09 12 008 3001)
4 x	Crimp contact socket 1.5 mm²	Harting	(09 33 000 6104)
1 x	HAN-Compact Half cable gland	Harting	M25 – 14…17mm (19 12 000 5158)

8.5.2 M12 Y distributor

To create complex supply or communication lines we recommend the use of Y distributors. These are mounted directly on the relevant M12 plug connector of the field distributor and enable direct connection to the particular line.

Designation	Material number	connection	Option slot	Contact diagram
SK TIE4-M12-INI-YFF	275274525	Initiator	M1, M3, M5, M7	
SK TIE4-M12-POW-YMF	275274526	24 V DC	M8	

Connection	Meaning
(a)	Inverter side
(b), (c)	Supply cable (as input or output)

8.5.3 Motor cable

Pre-assembled cables for the motor connection are in preparation or are available on request.

9 Maintenance and servicing information

9.1 Maintenance Instructions

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

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.

9.2 Service notes

Out technical support is available to reply to technical queries.

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

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

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

Please remove all non-original parts from the device.

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

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

Information — **Reason for return**

Please note the reason for sending in the component/device and specify a contact for any queries that we might have.

You can obtain a return note from our web site (Link) or from our technical support.

Unless otherwise agreed, the device is reset to the factory settings after inspection or repair.

Information — **Possible Consequential Damage**

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

Contacts (Phone)

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

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

9.3 Abbreviations

AS-i (AS1)	AS Interface
ASi (LED)	Status LED - AS interface
ASM	Asynchronous machine, asynchronous motor
AUX	Auxiliary (voltage)
BDI	Bus digital input
BR + / BR -	Contacts for connecting a brake
BR (LED)	Status LED - PROFIBUS
DI (DIN)	Digital input
DS (LED)	Status LED - device status
DO (DOUT)	Digital output
I / O	Input / Output
EMC	Electromagnetic compatibility
FDS	Field distributor(**F**ield **D**istribution **S**ystem)
FI (switch)	Leakage current circuit breaker
GND	Ground reference potential
I/O	In / Out (Input / Output)
LED	Light-emitting diode
LPS	List of projected slaves (AS-I)
PBR	PROFIBUS
PDO	Process data object (PROFIBUS)
PE	Protective earth
PELV	Safety low voltage
PNU	Parameter number (PROFIBUS)
S	Supervisor Parameter, P003
SW	Software version, P707
TI	Technical information / Data sheet (Data sheet for NORD accessories)

Key word index

NORD DRIVESYSTEMS Group

Headquarters and Technology Centre
in Bargteheide, close to Hamburg

Innovative drive solutions
for more than 100 branches of industry

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parallel shaft, helical gear, bevel gear and worm gear units

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