BU 2100 – en

EtherNet/IP bus interface

Supplementary manual options for NORD - Frequency Inverters

NORD DRIVESYSTEMS

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1 Introduction

1.1 General

1.1.1 Documentation

Name: **BU 2100**

Material number **6082102**

Series: **Field bus system Ethernet/IP™**

1.1.2 Document History

Issue	Order number	Software version	Remarks
BU 2100, May 2013	**6082102**/ 2213	V 1.1 R0	First issue
BU 2100, October 2016	**6082102**/ 4116	V 1.3 R2	Adaptation to the technical status October 2016
BU 2100, November 2017	**6082102**/ 4517	V 1.3 R2 (SK TU3) V 1.3 R4 (SK xU4)	• Extended range of functions of parameter **P151** • Various corrections
BU 2100, August 2019	**6082102**/ 3419	V 1.3 R1 (SK TU3) V 1.3 R5 (SK TU4) V 1.3 R4 (SK CU4)	• Various corrections

1.1.3 Copyright notice

1.1.4 Publisher

Getriebebau NORD GmbH & Co. KG

Getriebebau-Nord-Straße 1

22941 Bargteheide, Germany

http://www.nord.com/

Tel.: +49 (0) 45 32 / 289-0

Fax: +49 (0) 45 32 / 289-2253

1.1.5 About this manual

This manual is intended to assist you in the setup of bus interfaces Ethernet/IP™ from Getriebebau NORD GmbH & Co. KG in a field bus system. It is intended for all qualified electricians who plan, install and set up the field bus system (🕮 Section 2.2 "Selection and qualification of personnel"). The information in this manual assumes that the qualified electricians who are entrusted with this work are familiar with the technology of the field bus system and programmable logic controllers (PLC).

This manual only contains information and descriptions of bus interfaces and frequency inverters manufactured by Getriebebau NORD GmbH & Co. KG. It does not contain any descriptions of the controllers and the necessary software for other manufacturers.

Ethernet/IP™ is a registered trademark.

1.2 Other applicable documents

This manual is only valid in combination with the Technical Information for the bus interface which is used and the operating instructions for the relevant frequency inverter. Only these documents contain all of the information that is required for safe commissioning of the bus interface module and the frequency inverter. A list of the documents can be found in 🕮 Section 9.3 "Documents and software".

The "Technical Information“ (TI) for the bus interface and the manuals (BU) for the NORD frequency inverters can be found under www.nord.com.

1.3 Presentation conventions

1.3.1 Warning information

Warning information for the safety of the user and the bus interfaces are indicated as follows:

DANGER

This warning information warns against personal risks, which may cause severe injury or death.

WARNING

This warning information warns against personal risks, which may cause severe injury or death.

CAUTION

This warning information warns against personal risks, which may cause slight or moderate injuries.

NOTICE

This warning warns against damage to material.

1.3.2 Other information

Information

This information shows hints and important information.

1.3.3 Text markings

The following markings are used to differentiate between various types of information:

Text

Type of information	Example	Marking
Instructions	1st 2nd	Instructions for actions whose sequence must be complied with are numbered sequentially.
Bullet points	•	Bullet points are marked with a dot.
Parameters	**P162**	Parameters are indicated by the prefix "P", a three-digit number and bold type.
Arrays	[-01])	Arrays are indicated by square brackets.
Factory settings	{ 0,0 }	Factory settings are indicated by curly brackets.
Software descriptions	**"Cancel"**	Menus, fields, buttons and tabs are indicated by quotation marks and bold type.

Numbers

Type of information	Example	Marking
Binary numbers	100001b	Binary numbers are indicated by the suffix "b"
Hexadecimal numbers	0000h	Hexadecimal numbers are indicated by the suffix "h"

Symbols used

Type of information	Example	Marking
Cross-reference	🕮 Section 4 "NORD system bus"	Internal cross-reference A mouse click on the text calls up the stated point in the document.
	🕮 Supplementary manual	External cross-reference
Hyperlink	http://www.nord.com/	References to external websites are indicated in blue and underlined. A mouse click calls up the website.

Type designations

Designation	Description
SK 1x0E	Series SK 180E frequency inverters
SK 2xxE	Series SK 200E frequency inverters
SK 2x0E-FDS	Series SK 250E-FDS frequency inverters
SK 5xxE	Series SK 500E frequency inverters
SK 54xE	SK 540E and SK 545E frequency inverters

1.3.4 List of abbreviations

Abbreviations used in this manual

Abbreviation	Meaning
AG	Absolute encoder
Bus module	Bus module
DHCP	Dynamic Host Configuration Protocol, communication protocol for managing IP addresses in a network
DIN	Digital input
DIP	Dual In-Line Package (= double row housing), compact switch block
DLR	Device Level Ring, EtherNet/IP option for ring topologies
DO	Digital output
EDS	Electronic Data Sheet
EMC	Electromagnetic compatibility
I / O	Input/Output
FI	Frequency inverter
IP	Internet protocol
I/O	Input, Output
IW	Actual value
PDO	Process Data Object
PZD	Process data
SDO	Service Data Object
PLC	Programmable Logical Controller
STW	Control word
SW	Setpoint
TCP	Transmission Control Protocol
UCMM	Unconnected Message Manager, function of an EtherNet/IP- bus participant for the transmission and reception of Explicit Messages
USS	Universal serial interface
ZSW	Status word

2 Safety

2.1 Intended use

EtherNet/IP bus interfaces from Getriebebau NORD GmbH & Co. KG are interfaces for EtherNet/IP field bus communication, which may only be used in the following frequency inverters from Getriebebau NORD GmbH & Co. KG.

Bus interface	Frequency inverters
SK TU4-EIP	Series SK 180E SK 200E SK 250E-FDS SK 5xxE
SK TU4-EIP-C	
SK CU4-EIP	
SK CU4-EIP-C	
SK TU3-EIP	SK 500E series

EtherNet/IP bus interfaces from Getriebebau NORD GmbH & Co. KG are used for communication by the frequency inverter with a PLC in a EtherNet/IP field bus system provided by the operator.

Any other use of the bus interfaces is deemed to be incorrect use.

2.2 Selection and qualification of personnel

The bus interface may only be installed and started up by qualified electricians. These must possess the necessary knowledge with regard to the technology of the field bus system, as well as configuration software and the controller (bus master) which are used.

In addition, the qualified electricians must also be familiar with the installation, commissioning and operation of the bus interfaces and the frequency inverters as well as all of the accident prevention regulations, guidelines and laws which apply at the place of use.

2.2.1 Qualified personnel

Qualified personnel includes persons who due to their specialist training and experience have sufficient knowledge in a specialised area and are familiar with the relevant occupational safety and accident prevention regulations as well as the generally recognised technical rules.

These persons must be authorised to carry out the necessary work by the operator of the system.

2.2.2 Qualified electrician

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.
- Emergency treatment of injured persons.

2.3 Safety information

Only use bus interfaces and frequency inverters from NORD DRIVESYSTEM Group for their intended purpose, 🕮 Section 2.1 "Intended use".

To ensure safe operation of the bus interface, observe all of the instructions in this manual, and in particular the warning information in the other applicable documents, 🕮 Section 9.3 "Documents and software".

Only commission bus interfaces and frequency inverters in their technically unchanged form and not without the necessary covers. Take care that all connections and cables are in good condition.

Work on and with bus interfaces and frequency inverters must only be carried out by qualified personnel, 🕮 Section 2.2 "Selection and qualification of personnel".

3 EtherNet/IP basics

3.1 Features

EtherNet/IP (Ethernet Industrial Protocol) is an open communication protocol for industrial automation systems, which uses the basic technology of Ethernet TCP/IP and the CIP (Common Industrial Protocol) application protocol. EtherNet/IP based on the OSI model (Open Systems Interconnection Model = Reference model for network protocols as layer architecture), whereby the EtherNet/IP adaptation to the CIP technology is made in the three upper layers (5…7) and the CIP adaptation to the EtherNet/IP technology is made in the four lower layers (1…4).

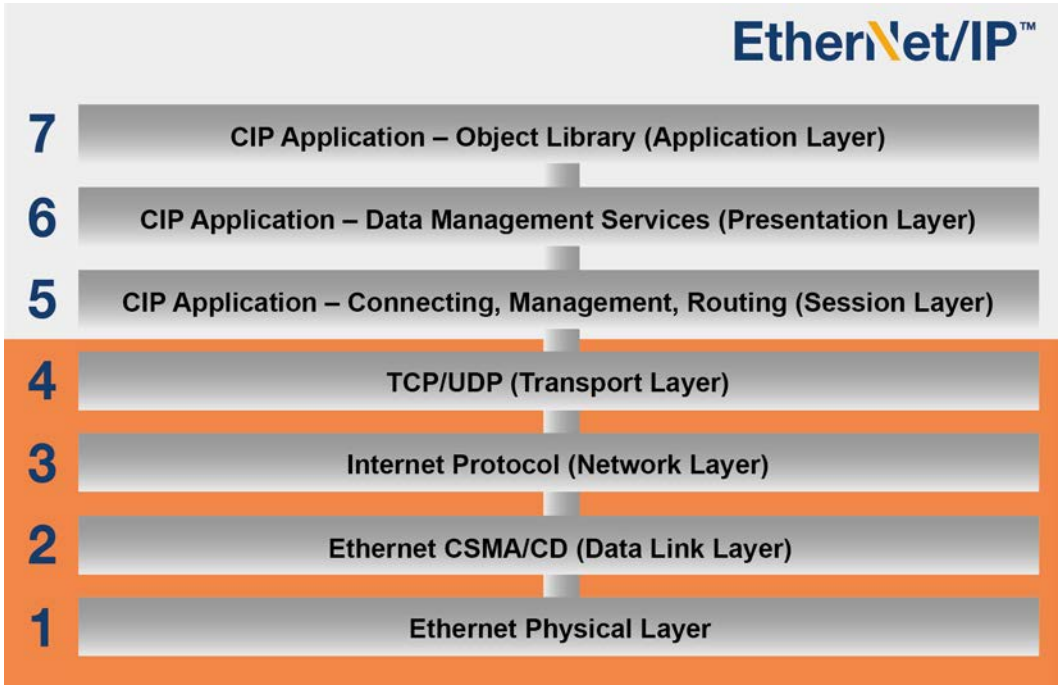

Figure 1: EtherNet/IP adaptation to the OSI layer model

Layer	OSI description	EtherNet/IP adaptation
1	Physical layer, defines the hardware, coding, speed etc. of data transfer	Technology according to standard IEEE 802.3: Definition of the physical media, framework format for data communication, CSMA/CD (Carrier Sense Multiple Access/Collision Detection data communication rules = Multiple access with carrier checks and collision detection).
2	Link layer, defines the communication physics (access method in the field bus and data backup).	Technology according to standard IEEE 802.3: Access procedure according to CSMA/CD which regulates the behaviour of devices in the field bus system.
3…4	The allocation layer (Network) takes over the routing of the data packages to the next bus participant, the transport layer (Transport) allocates the data packages to an application.	TCP/IP (Transmission Control Protocol/Internet Protocol) and TCP/UDP (Transmission Control Protocol/User Datagram Protocol)
5…7	CIP application layers (object oriented), define the interface to the application program with the application-orientated commands.	

EtherNet/IP is managed by the association of users and manufacturers, ODVA (Open DeviceNet Vendors Association).

EtherNet/IP® and CIP® are registered trademarks of the ODVA.

EtherNet/IP is an object oriented field bus system according to CIP, which operates with the Producer/Consumer method. In contrast to conventional transmission/reception methods, in which messages are addressed to particular recipients, with the Consumer/Producer method the field bus participants determine whether they are to process a message on the basis of the Connection ID which is contained in the data telegram.

EtherNet/IP devices can be integrated into an EtherNet/IP field bus system without configuration, however they must be provided with a unique IP address.

Performance description

Possible number of bus participants	255
Transfer rate	100 MBit (Switched Ethernet, Full Duplex)
Supported functions	UCMM, DLR
Supported connection types	• Explicit Messaging Connection (parameter data) • I/O Connection (process data): 1 Exclusive Owner, 2 Listen Only
Wiring	Standard Ethernet cable CAT 5 or better
Cable length	Max. 100 m between 2 devices

3.2 Topology

EtherNet/IP supports the following topologies:

3.2.1 Linear topology

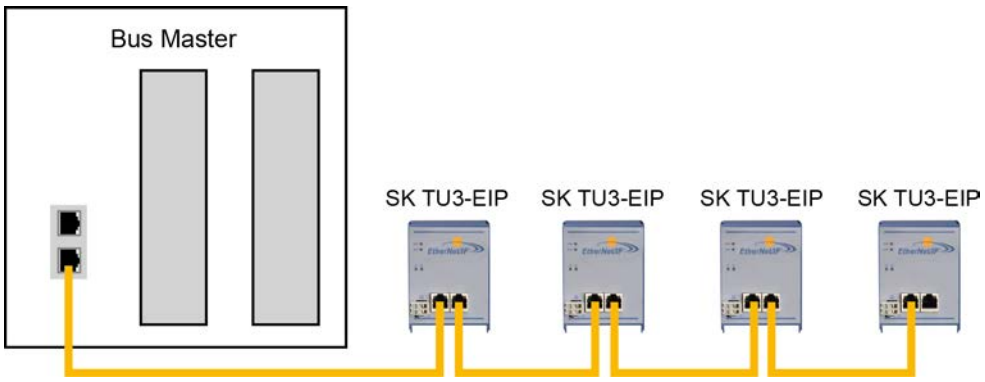

Figure 2: EtherNet/IP linear topology (example)

Advantages: Requires less cable material, can be extended at the end of the line with little effort.

Disadvantages: If the line is interrupted (device failure or defective cable) the field bus participants which are connected behind the interruption are no longer accessible.

3.2.2 Star topology

Star topology requires a central switch (in the control cabinet).

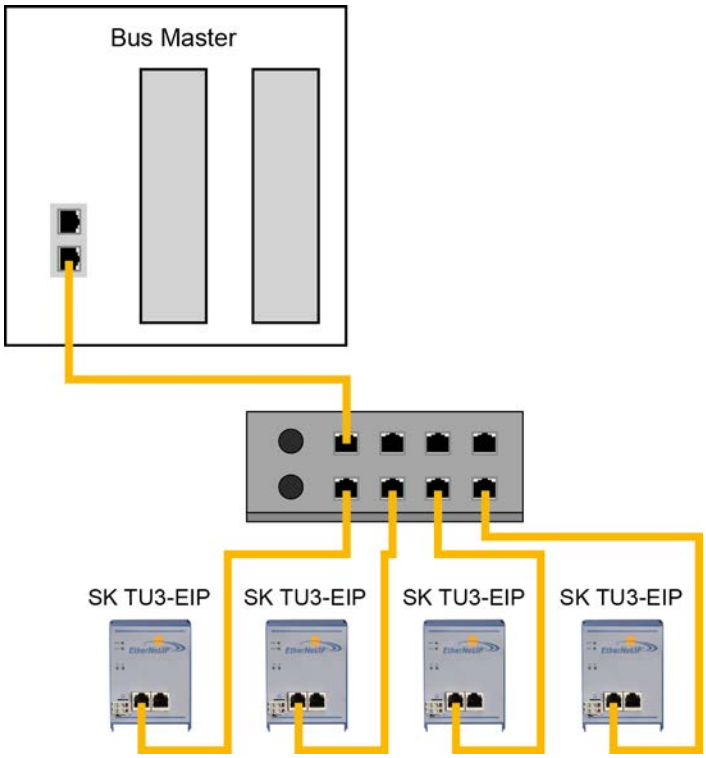

Figure 3: EtherNet/IP star topology (example)

Advantages: Failure of a device has no effect on other bus participants; can be extended with little effort, simple troubleshooting and remedy of faults.

Disadvantages: Network operation is not possible if there are problems with the switch.

3.2.3 Ring topology

With a ring topology, one line is closed to form a ring, in order to provide media redundancy.

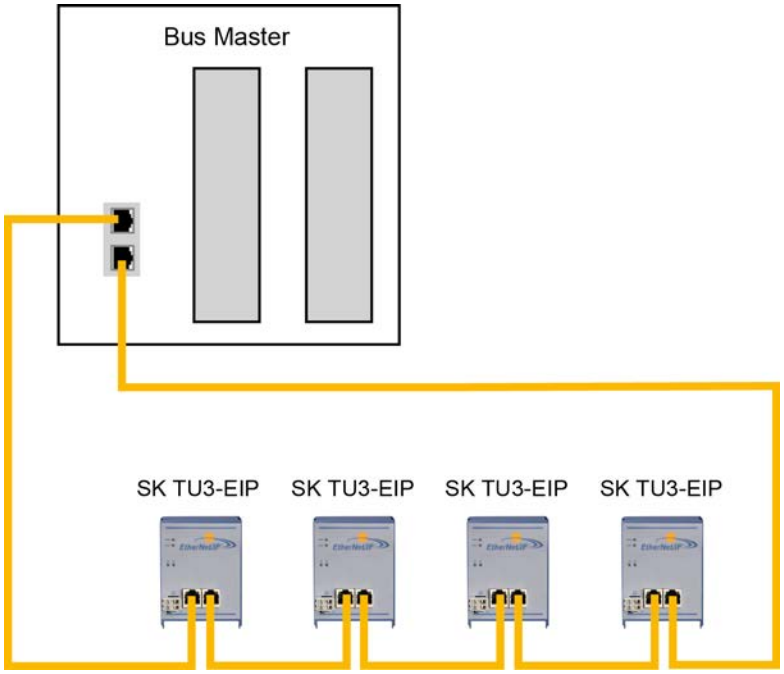

Figure 4: EtherNet/IP ring topology (example)

Advantages: No external switch required for bus participants with DLR option (Device Level Ring). Communication continues even if one cable is defective.

Disadvantages: High load states result in bottlenecks.

3.3 Bus protocol

The data which are to be communicated via the EtherNet/IP field bus are embedded in standard Ethernet frames.

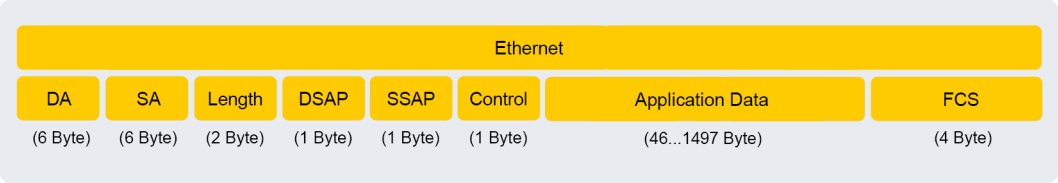

Figure 5: Ethernet telegram (minimum frame length 64 Byte)

Designation	Description
DA	Destination Address = Destination address of the Ethernet frame
SA	Source Address = source address of the Ethernet frame
Length	Information about the length of the application data
DSAP	Destination Service Access Point
SSAP	Source Service Access Point
Control	Type of LLC frame (Logical Link Control Frame)
Application Data	Useful load (min. 46 Byte, max. 1497 Byte)
FCS	Checksum for the Ethernet frame

Data communication (Network Layer and Transport Layer)

A connection between the transmitting and receiving bus participants must be established (via Unconnected Message Manager UCMM) for the exchange of application data. A connection which has been established is used to transmit so-called "Explicit Messages" (data which is necessary for configuration, diagnosis and management) or "I/O Messages" (real time I/O data, also known as "Implicit Messages").

CIP protocol (Application Layer)

The CIP application layer defines the exchange of I/O Messages and Implicit Messages. Communication between two field bus participants is carried out according to a connection-oriented communication model via a point-to-point connection. The data exchange is by means of objects, which are entered in the object index of the field bus device.

In the CIP protocol, each field bus participant receives an object library. CIP objects are subdivided into classes, instances and attributes. A class consists of objects which define the system components of a field bus participant. An instance is a particular object within a class. All instances of a class have the same attributes, but individual attribute values.

See 🕮 Section 6 "Data transmission" for detailed information.

4 NORD system bus

Communication between the bus interface and frequency inverters from Getriebebau NORD GmbH & Co. KG is carried out via a separate NORD system bus. The NORD system bus is a CAN field bus; communication is via the CANopen protocol.

One or more frequency inverters in the field bus system can be accessed via a bus interface.

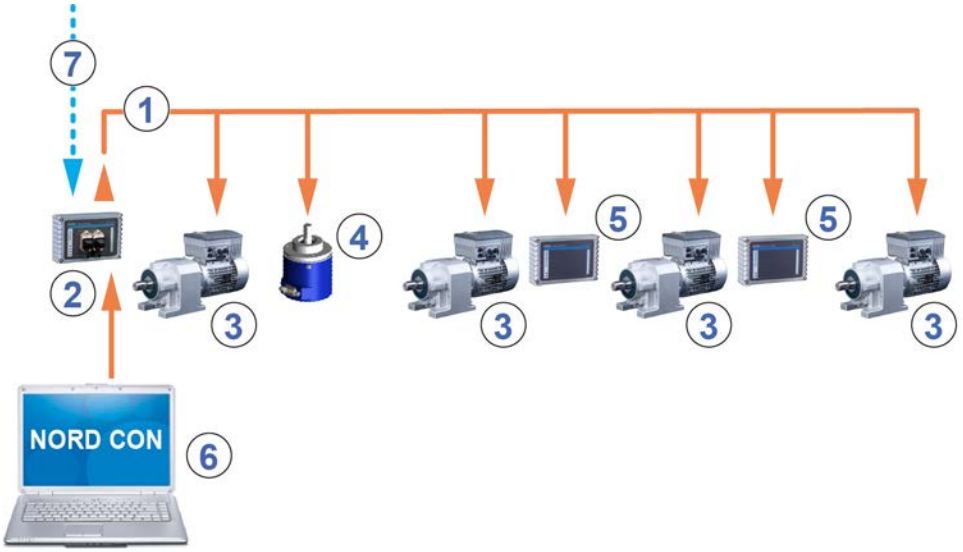

Figure 6: Example of the structure of a NORD system bus

Item	Description
1	NORD system bus (CAN field bus)
2	SK TU4 bus interface
3	Frequency inverter
4	Absolute encoder
5	Input/output extension SK TU4-IOE
6	NORD CON computer (on Windows® based PC, on which the NORD CON parameterisation and control software is installed)
7	Field bus

4.1 NORD system bus participants

Possible number of bus nodes on a system bus:

	Decentralised frequency inverters		Central frequency inverters	
	SK 1x0E	SK 2xxE	SK 500–535E	SK 54xE
Frequency inverter	4	4	8	8
Input/output extensions	8	8	—	16
CANopen encoder	4	4	8	8
Bus interface	1	1	1	1
NORD CON computer	1	1	1	1

All participants on the NORD system bus must be assigned a unique address (CAN ID). The address of the bus interface is pre-set at the factory and cannot be changed. Connected IO extensions must be assigned to the frequency inverters (🕮 Technical Information/Data Sheet of the relevant IO extension). Depending on the device, the addresses of the frequency inverter and the connected absolute encoder can be set via the parameter **P515 CAN address** or via the DIP switches.

If absolute encoders are used, these must be assigned directly to a frequency inverter. This is carried out using the following equation:

Absolute encoder address = CAN ID of the frequency inverter + 1

This results in the following matrix:

Device	FI 1	AG1	FI 2	AG2	…
CAN-ID	32	33	34	35	…

The termination resistor must be activated on the first and last participant in the system bus (🕮 Frequency inverter manual) The bus speed of the frequency inverter must be set to "250 kBaud" (**P514 CAN baud rate**) This also applies to any absolute encoders which are connected.

Information **SK 5xxE series, SK 511E and above**

Setup of a system bus with SK 5xxE series devices is only possible for SK 511E devices and above and is made via their RJ45 sockets. It must be noted that the RJ45 sockets must have a 24 V DC supply in order to enable communication via the system bus (🕮 Frequency inverter manual).

4.2 Access to parameters and control options

Communication by NORD control devices (SimpleBox and ParameterBox) and the NORD CON software with the bus interfaces and the frequency inverters on the NORD system bus is carried out via the USS protocol (🕮 Manual BU 0050)

Information **Access to bus interface parameters**

- Access to bus interface parameters is only possible via the NORD CON software or the ParameterBox, not however via the SimpleBox (SK CSX-3...).
- Access to the parameters of a SK TU4 is possible via the NORD system bus by connection to a frequency inverter or also directly by connection to the RJ12 interface of the SK TU4.
- Access to the parameters of a SK CU4 is only possible via the NORD system bus (CANopen) by connection to a frequency inverter.

4.2.1 Access via the NORD SimpleBox

By connection of the SimpleBox (🕮 Manual BU 0040) to a frequency inverter a **point-to-point USS bus communication** is established. The SimpleBox only communicates with the frequency inverter to which it is connected.

4.2.2 Access via the NORD ParameterBox

Access via the ParameterBox (🕮 Manual BU 0040) can be obtained by several methods:

- Connection of the ParameterBox to a frequency inverter for **point-to-point USS bus communication**. The ParameterBox only communicates with the frequency inverter to which it is connected.
- Connection of the ParameterBox to a frequency inverter for **USS communication** with a maximum of 6 participants (5 devices plus ParameterBox). This requires an installed USS bus:
  - Wired,
  - Termination resistors set,
  - USS bus participants addressed.
- Connection of the ParameterBox to a bus interface or frequency inverter for **system bus communication (CANopen)** with a maximum of 6 participants (5 devices plus ParameterBox).

  This requires an installed system bus:
  - Wired,
  - Termination resistors set,
  - System bus participants addressed, USS addresses set to the factory setting ("0"). If the ParameterBox detects an active system bus, a USS address is automatically assigned to all of the participants which are detected.

  Communication is via the USS protocol. The CANopen interface of the bus interface or the device with which the ParameterBox is connected acts as a gateway.

4.2.3 Access via NORD CON software

Access via the NORD CON software (📖 Manual BU 0000) can be obtained by several methods:

- Connection of the NORD CON computer to a frequency inverter for **point-to-point USS bus communication**. The NORD CON software only communicates with the frequency inverter to which it is connected.
- Connection of the NORD CON computer to a frequency inverter for **USS communication** with a maximum of 32 participants (31 devices plus ParameterBox). This requires an installed USS bus:
  - Wired,
  - Termination resistors set (only for RS485 connection. This is not necessary for an RS232 connection).

Information **USS address**

It is not necessary to set a USS address.

- Connection of the NORD CON computer to a bus interface or frequency inverter for **system bus communication (CANopen)** with a maximum of 32 participants (31 devices plus NORD CON). This requires an installed system bus:
  - Wired,
  - Termination resistors set,
  - System bus participants addressed, USS addresses set to the factory setting ("0"). If the NORD CON software detects an active system bus, a USS address is automatically assigned to all of the participants which are detected.

  Communication is via the USS protocol. The CANopen interface of the bus interface or the device with which the NORD CON software is connected acts as a gateway.

4.3 SK TU3-EIP bus interface to the NORD system bus

With software version V1.3 R0 and above, up to 8 SK 5xxE frequency inverters can be connected to an SK TU3-EIP bus interface and these can be accessed via the gateway function of the bus interface on the NORD system bus. For this, the following conditions must be fulfilled:

- The SK TU3-EIP bus interface must be connected to frequency inverter FI1.
- The SK TU3-EIP bus interface at frequency inverter FI1 must support the gateway function (with software version V1.3 R0 and above). All other participating frequency inverters only need to support the CAN system bus.
- The gateway function requires the CANopen protocol (standard for SK 54xE frequency inverters, must be set for all other SK 5xxE frequency inverters).
- The same baud rate must be set on all participating frequency inverters (this can be freely selected providing that no input/output extensions are connected to the system bus).
- On all participating frequency inverters, parameter **P513 Telegram timeout time** must be set to "600 ms".
- On all participating frequency inverters, parameter **P512 USS address** must be set to "0" (factory setting).
- The following system bus addresses must be set on the participating frequency inverters (Parameter **P515 CAN address**).

Frequency inverter	System bus address
FI 1	32
FI 2	34
FI 3	36
FI 4	38
FI 5	40
FI 6	42
FI 7	44
FI 8	46

If the NORD CON computer is connected to frequency inverter FI1, all of the other participating devices on the NORD system bus are detected automatically. If the NORD CON computer is connected to a different participating frequency inverter, the following restrictions apply:

- The bus interfacer is not detected.
- For frequency inverters with software version lower than V2.1: The status display only functions for frequency inverters FI1...FI4; the status of all other frequency inverters is displayed as "Not ready".
- The status of frequency inverter FI1 is permanently displayed as "Not ready".

Response times for process data communication via the NORD system bus

Number of connected frequency inverters	Update cycle
8	10 ms
7	8.75 ms
6	6.5 ms
5	5.25 ms
4…1	5 ms[1]

[1] Due to the fact that the system bus cycle can be set Parameter **P153**, Array [-02]) the shortest possible cycle for process data is

5 ms for each frequency inverter.

4.4 Remote maintenance

NORD bus interfaces are designed for remote maintenance via the field bus system. Devices which are connected to the bus interface and the NORD system bus (frequency inverters, I/O extensions) from Getriebebau NORD GmbH & Co. KG can also be accessed via LAN or Internet for maintenance purposes.

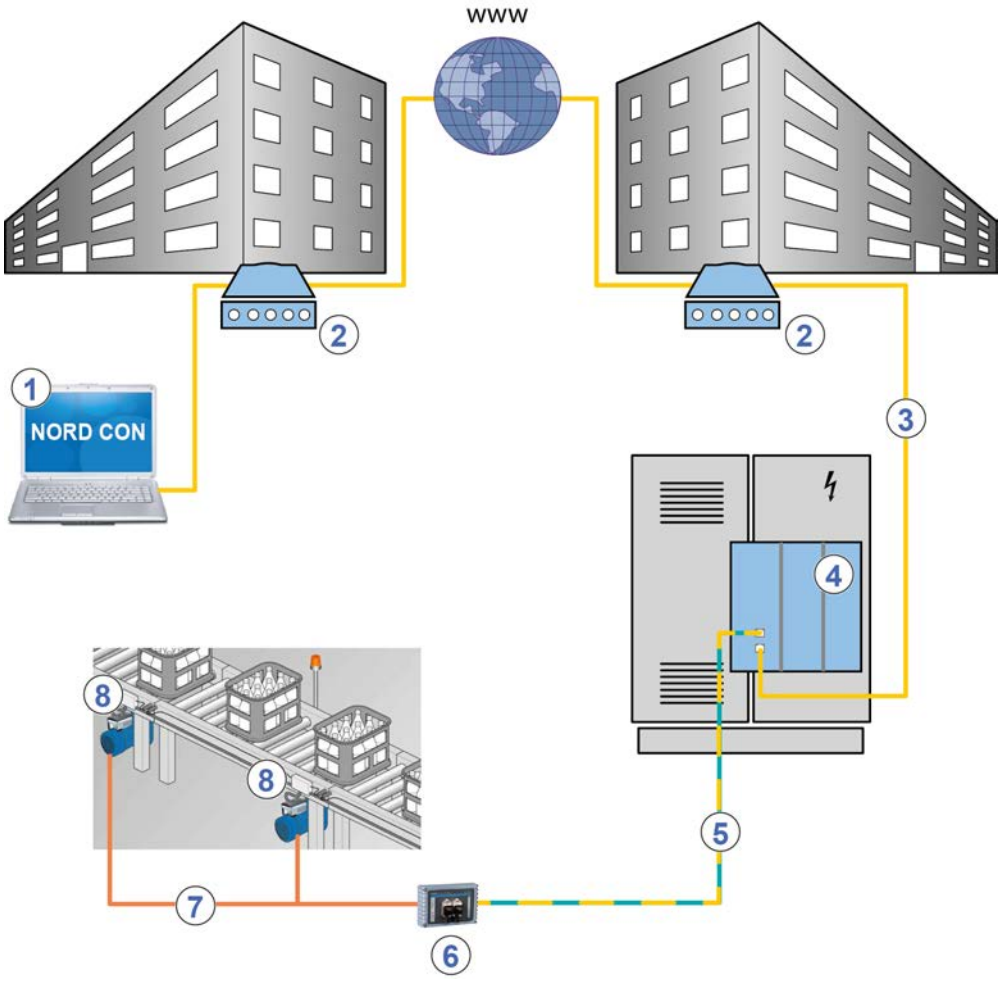

Figure 7: Remote maintenance via Internet (schematic diagram)

Item	Description
1	NORD CON software
2	Modem
3	LAN
4	Field bus gateway or bus master (PLC)
5	Field bus
6	Bus interface
7	NORD system bus
8	NORD- frequency inverter

5 Initial setup

The bus interface must be set up in order to commission the field bus system. This consists of the following work:

Type of work	Description 🕮
Connect the bus interface to the frequency inverter	Section 5.1 "Connecting the bus interface"
Configure the control project	Section 5.2 "Integration into the bus master"
Assign the bus address	Section 5.2 "Integration into the bus master"
Make the required parameter settings	Section 7 "Parameters"

An example of the procedure for setting up the field bus system can be found at the end of this section (🕮 Section 5.3 "Example: Commissioning the EtherNet/IP bus module").

Detailed information about EMC compliant installation can be found in the Technical Information TI 80_0011 under www.nord.com

5.1 Connecting the bus interface

Information — **Bus address via DIP switch**

Before connecting the bus interface, read the information for setting the bus address in the technical information and in this manual (🕮 Section 5.2.4 "EtherNet/IP field bus address"). If the bus address is set with the DIP switches, this must be carried out before the bus interface is connected, as the DIP switches are no longer accessible after this.

Connection of the bus interface to the frequency inverter and the EtherNet/IP field bus is described in the corresponding technical information:

Bus interface	Frequency inverter	Documentation
SK TU3-EIP	SK 5xxE series	Technical Information/Data Sheet TI 275900150
SK TU4-EIP	SK 1x0E and SK 2xxE series	Technical Information/Data Sheet TI 275281119
SK TU4-EIP-C		Technical Information/Data Sheet TI 275281169
SK CU4-EIP		Technical Information/Data Sheet TI 275271019
SK CU4-EIP-C		Technical Information/Data Sheet TI 275271519

5.2 Integration into the bus master

The bus master must first be configured for communication with the bus interface (PLC project of the bus master). The configuration must be produced with a software system for EtherNet/IP field bus systems.

5.2.1 Installing the device description file

The bus master needs a device description file so that the bus interface and the frequency inverter can be identified by the bus master during the bus scan.

The current device description file which is necessary for detection of the EtherNet/IP bus interface and the frequency inverter can be downloaded from our website www.nord.com, directly under the link NORDAC_Options.

The file contains a description of the device characteristics of the bus interface and the parameters of the bus interface and the connected frequency inverters.

File	Bus interface	Frequency inverters
TU3_EIP.eds	SK TU3-EIP	SK 5xxE series
		SK 54xE series
TU4_EIP.eds	SK CU4-EIP SK CU4-EIP-C SK TU4-EIP SK TU4-EIP-C	SK 2xxE series
		SK 5xxE series
		SK 54xE series
		SK 180E series

Information **Number of connected frequency inverters**

As delivered, the device description file is set to a connected frequency inverter (FI1) If several frequency inverters are connected, these must be set in the configuration software after installation of the device description file.

5.2.2 Automatic device detection

In order that the bus interface and the connected frequency inverters can be automatically detected by the bus master in bus scan, the following settings must be made in the configuration software after installation of the device description file:

- Enter the bus interface in the EtherNet/IP field bus system
- Specify the characteristics (Assembly, IP address) of the bus interface

5.2.3 Data format of process data

For the cyclic transfer of process data for the bus interface and the frequency inverter, the data format must be specified in the configuration project. For detailed information about process data, please refer to 📖 Section 6 "Data transmission".

5.2.4 EtherNet/IP field bus address

In order for the bus interface and the connected frequency inverters to be detected by the bus master, an IP address must be assigned to the bus interface. The settings can be made by three different methods

1. **Setting the IP address via DHCP or BOOTUP mode**
   Set parameter **P165 Addressing mode** to "DHCP" or "BOOTP" (📖 Section 7.1.2 "EtherNet/IP standard parameters"), then set up the bus interface in the EtherNet/IP configuration software.

Information — **Parameter and DIP switch settings**

- On setting parameter **P165** to the value "0" the IP address from the settings in parameters **P160 IP address**, **P161 IP subnet mask** and **P164 IP gateway** is adopted.
- All DIP switches for setting the IP address must be in the "OFF" position.

2. **Setting the IP address via parameters in the NORD CON software**, as described below.

Information — **Parameter and DIP switch settings**

- Parameter **P165** must be set to the value "0".
- All DIP switches for setting the fourth byte of the IP address must be in the "OFF" position.

3. **Setting the fourth byte of the IP address via DIP switches**
   Set the fourth byte of the IP address with the DIP switches on the bus interface (📖 Technical Information/Data Sheet)

Information — **Parameter settings**

- If the fourth byte of the IP address is set with the DIP switches, the setting of parameter **P165** is irrelevant.
- The complete IP address results from the settings of parameters **P160** (Array [-01]…[-03]), **P161** and **P164**.

Setting the IP address via parameters in the NORD CON software (Item 2.)

The following bus interface parameters must be set in the NORD CON software:

- **P165 addressing mode**
- **P160 IP address**
- **P161 IP subnet mask**
- **P164 IP gateway** (if gateway function configured)

Requirement

- The EtherNet/IP field bus system has been installed and commissioned according to the manufacturer's instructions.
- A NORD CON computer is available (📖 BU 0000).

Procedure

1. Open the entry for the bus interface in the tree directory of the NORD CON software, call up the standard parameter **P165 Addressing mode**, select the setting "0" and save this with "**ENTER**".
2. Call up the standard parameter **P160 IP address**, enter the IP address and save with "**ENTER**".
3. Call up the standard parameter **P161 IP subnet mask**, enter the IP subnet mask and save with "**ENTER**".
4. Call up the standard parameter **P164 IP gateway**, enter the IP address for the gateway function and save with "**ENTER**".
5. Restart the bus interface (switch the power supply off and on again) so that the parameter settings are read in.

5.3 Example: Commissioning the EtherNet/IP bus module

The following example contains an overview of the necessary steps for commissioning the bus interface in a EtherNet/IP field bus system. The example does not include any details of application-specific settings (motor data, control parameters, etc.).

Example:
Via a bus interface, 3 frequency inverters are to be independently controlled in positioning operation with a single speed and a single position specification.

Device type	Name	Connected motor	Characteristics
Bus interface SK TU4-EIP	BusBG[1]		
SK 2x5E frequency inverter	FI 1	4-pole/n=1390 rpm/50 Hz	Motor with CANopen absolute encoder AG1
SK 2x5E frequency inverter	FI 2	4-pole/n=1390 rpm/50 Hz	Motor with CANopen absolute encoder AG2
SK 2x5E frequency inverter	FI3[1]	4-pole/n=1390 rpm/50 Hz	Motor with CANopen absolute encoder AG3

[1] The bus interface and frequency inverter FI3 are physically the last participants on the NORD system bus.

Communication	Step		Explanation
NORD system bus	1	**Before connecting the bus interface to the frequency inverter:** Set the termination resistors.	Set DIP switch 1 (of 12) on the bus interface to the "ON" position.
			Set DIP switch S2 on frequency inverter FI3 to the "ON" position.
			All other DIP switches (termination resistors) must be in the "OFF" position.
	2	Set up system bus.	A 24 V supply is required! (🕮 Technical Information for the bus interface)
	3	Set the system bus address of the frequency inverter	Preferably with the DIP switches (🕮 BU 0200):
			FI1 Address "32"
			FI2 Address "34"
			FI3 Address "36"
			AG1 Address "33"
			AG2 Address "35"
			AG3 Address "37"
			The address of the bus interface is pre-set and cannot be changed.
	4	Set the system bus baud rate.	Set "250 kBaud" on FI1 to FI3 as well as on AG1 to AG3.

Communication	Step		Explanation
	5	Set the parameters for system bus communication.	Set the following parameters on each frequency inverter:
			P509 3 (system bus)
			P510, [-01] 0 (Auto)
			P510, [-02] 0 (Auto)
			P543, [-01] 1 (actual frequency)
			P543, [-02] 10 (curr. Pos. Inc. LowWord)
			P543, [-03] 15 (cur. Pos. Inc. HighWord
			P546, [-01] 1 (set point frequency)
			P546, [-02] 23 (setp. Pos. Inc. LowWord)
			P546, [-03] 24 (set. Pos. Inc. HighWord)
EtherNet/IP field bus	6	Set up the bus interface for field bus communication.	🕮 Sections 5.1 "Connecting the bus interface" to 5.2 "Integration into the bus master"
			Set the following parameters on the bus interface (🕮 Section 7.1.1 "NORD standard parameters"):
			P151 200 ms (Timeout external bus)
NORD system bus	7	Set the parameters for system bus monitoring.	Set the following parameters on each frequency inverter (🕮 BU 0200)
			P120, [-01] 1 (Auto) or 2 (monitoring active immediately)
	8	Check the system bus communication.	Check the display of the following information parameters on all frequency inverters (🕮 BU 0200):
			P748 "System bus status"
			P740, [-01] "Control word"“ (047Eh = "Ready for switch-on"[1])
			P740, [-02] "Setpoint 1"
			P741, [-01] "Status word" (0B31h = "Ready for switch-on")
			P741, [-02] "Actual value 1"
			Check the display of the following bus interface information parameters (🕮 Section 7.1.3 "NORD information parameters"):
			P173 "Module status"
EtherNet/IP field bus	9	Check the field bus communication.	Check the display of the following bus interface information parameters (🕮 Section 7.1.3 "NORD information parameters"):
			P173 "Module status"
			P740 "Process data Bus In"
			P177 "Process data Bus Out"

[1] On condition that the PLC has already sent the control word. Otherwise "0h" is displayed in the parameter.

6 Data transmission

6.1 Introduction

With the data communication between the frequency inverter (via the bus interface) and the bus master (PLC) process data and parameter data are exchanged.

The process data are communicated after the establishment of an I/O Connection and the parameter data are communicated after establishment of an Explicit Message Connection.

6.1.1 Process data

- Process data are the control word and up to 5 setpoints, as well as the status word and up to 5 actual values. Control words and setpoints are communicated from the bus master to the frequency inverters. Status words and actual values are communicated from the frequency inverters to the bus master.
- Process data are necessary to control the frequency inverter.
- The transfer of process data is carried out cyclically with priority between the bus master and the frequency inverters.
- In the PLC the process data are stored directly in the I/O area.
- Process data are not saved in the frequency inverter.

📖 Section 6.2 "Transfer of process data".

6.1.2 Parameter data

- Parameter data are the setting values and device data for the bus interface and the connected frequency inverter.
- Transfer of the parameter data is carried out cyclically without priority.

6.2 Transfer of process data

In the process data area (PZD), control words and setpoints are transferred from the master to the frequency inverter and in return, status words and actual values are sent from the frequency inverter to the master. The structure of the PZD area is always the same in terms of the sequence of its elements (words), however, dependent upon direction of data Master → Slave / Slave → Master, it is labelled differently. Each word has a length of 16 Bit. To communicate 32 Bit values (e.g. position values), 2 words are required (e.g setpoint 1 and setpoint 2).

Exchange of process data between bus interface and the EtherNet/IP bus master is carried out via I/O Connections. After establishment of an "Exclusive Owner" connection, setpoints and actual values can be exchanged. In addition, two "Listen Only" connections are available, via which the current actual values of the frequency inverter can be "tapped".

6.2.1 Assembly Object

The process data (without protocol information) are communicated with the aid of the I/O Message Object. Assignment of the relevant setpoints and actual values is performed via the Assembly Object. The following table contains defined configurations (instances).

Instance	Data length	Description	Bus interface	Length
100	12 Byte	STW + SW1 + SW2 + SW3 + SW4 + SW5	SK TU3-EIP SK CU4-EIP SK TU4-EIP	Fixed
101	12 Byte	ZSW + IW1 + IW2 + IW3 + IW4 + IW5	SK TU3-EIP SK CU4-EIP SK TU4-EIP	Fixed
102	96 Byte	8 frequency inverters (for each frequency inverter: STW + SW1 + SW2 + SW3 + SW4 + SW5)	SK TU3-EIP	Variable
103	96 Byte	8 frequency inverters (for each frequency inverter: ZSW + IW1 + IW2 + IW3 + IW4 + IW5)	SK TU3-EIP	Variable
110	50 Byte	Bus interface outputs + 4 frequency inverters (for each frequency inverter: STW + SW1 + SW2 + SW3 + SW4 + SW5)	SK CU4-EIP SK TU4-EIP	Variable
111	50 Byte	Bus interface inputs + 4 frequency inverters (for each frequency inverter: ZSW + IW1 + IW2 + IW3 + IW4 + IW5)	SK CU4-EIP SK TU4-EIP	Variable

The data length (50 Byte) to be communicated for instances 110 and 111 can be truncated in the PLC program of the bus master:

Description	Truncated length
One frequency inverter with STW, SW1, SW2, SW3 plus bus interface inputs and outputs	10 Byte
One frequency inverter with STW, SW1, SW2, SW3, SW4, SW5 plus bus interface inputs and outputs	14 Byte
One frequency inverter with STW, SW1, SW2, SW3, SW4, SW5 plus bus interface inputs and outputs	26 Byte

Information **Truncation of data length**

The bytes to be truncated must be removed from the end in the protocol

Digital inputs/outputs – Bus interface SK xU4-EIP

The SK TU4-EIP bus interface has 8 digital inputs and 2 digital outputs, the SK CU4-EIP bus interface has 2 digital inputs, which can be accessed via instances 110 and 111 of the assembly object.

Inputs: If a 16 Bit word (status word ZSW) is transferred, the inputs are in the Low byte. The "Valid Flag" for the inputs is in the High byte in Bit 15. The inputs are only valid if Bit 15 is set to "1".

Instance 111									
High byte		Low byte							
Bit 15	Bit 14…8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Valid Flag	Reserved	DIN8	DIN7	DIN6	DIN5	DIN4	DIN3	DIN2	DIN1

Outputs: The outputs can be set by the transfer of a 16 bit word (setpoint SW).

Instance 110								
High byte	Low byte							
Bit 15…8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved						DO2	DO1

6.2.2 Control word

The control word (STW) is the first word of a process data telegram which is sent from the bus master to the frequency inverter (order telegram) To switch the drive unit to standby, the frequency inverter must be set to "Ready for switch-on" status by transfer of the first control command "047Eh" ("10001111110b").

Bit	Designation	Value	Control command	Priority[1]
0	Ready for operation	0	Reverse with brake ramp, with voltage enabled at f=0 Hz (ready for operation)	**3**
		1	Set the frequency inverter to standby.	**5**
1	Disable voltage	0	Switch off the frequency inverter output voltage (the frequency inverter goes into the status "Switch-on block").	**1**
		1	Cancel "Disable voltage"	—
2	Emergency stop	0	Emergency stop with programmed emergency stop time. At f = 0 Hz voltage enable (the FI goes into "Switch-on block" status	**2**
		1	Cancel operating condition "Emergency stop"	—
3	Enable operation	0	Block voltage: Switch off the frequency inverter output voltage (the frequency inverter goes into the status "Ready for switch-on").	**6**
		1	Enable output voltage Acceleration of the frequency inverter to the present setpoint.	**4**
4	Enable pulses	0	Acceleration encoder is set to zero; at f = 0 Hz no voltage enable (FI remains in "Operation enabled" status).	—
		1	Enable acceleration encoder	
5	Enable ramp	0	Freeze the setpoint currently provided by the acceleration encoder (maintain frequency).	—
		1	Enable setpoint on acceleration encoder	
6	Enable setpoint	0	Set the selected setpoint on the acceleration encoder to 0	—
		1	Activate the selected setpoint on the acceleration encoder.	
7	Acknowledge the error (0→1)	0	With the switch from 0 to 1, inactive errors are acknowledged.	**7**
		1	**Note:** If a digital input has been programmed for the "ack.fault" function, this bit must not permanently be set to 1 via the bus, as otherwise, flank evaluation would be prevented.	
8	Start function 480.11	0		—
		1	Bus bit 8 of the control word is set 🕮 Parameter **P480** in the frequency inverter manual.	
9	Start function 480.12	0		—
		1	Bus bit 9 of the control word is set 🕮 Parameter **P480** in the frequency inverter manual.	
10[2]	Control data valid	0	The transmitted process data are invalid.	—
		1	The bus master transfers valid process data	
11[3]	Rotation right is on	0		—
		1	Switch on rotation right.	
12[3]	Rotation left is on	0		—
		1	Switch on rotation left (priority).	
13	Reserved			
14	Parameter set Bit 0 On	0	<table><tr><th>Bit 15</th><th>Bit 14</th><th>it activates the parameter set</th></tr><tr><td>0</td><td>0</td><td>Parameter set 1</td></tr><tr><td>0</td><td>1</td><td>Parameter set 2</td></tr><tr><td>1</td><td>0</td><td>Parameter set 3</td></tr><tr><td>1</td><td>1</td><td>Parameter set 4</td></tr></table>	—
		1		
15	Parameter set Bit 1 On	0		
		1		

[1] If several control bits are set simultaneously, the priority stated in this column applies.

[2] The telegram is only interpreted as valid by the frequency inverter and the setpoints which are communicated via the field bus are only set if control bit 10 is set to 1.

[3] If Bit 12 = 0, "rotational direction right ON" applies.
If Bit 12 = 1, "rotational direction left ON" applies, irrespective of Bit 11.

6.2.3 Status word

The status word (ZSW) is the first word of a process data telegram which is sent from the frequency inverter to the bus master (response telegram). With the status word, the status of the frequency inverter is reported to the bus master. As the response to the control word command "047Eh" the frequency inverter typically responds with "0B31h" ("101100110001b") and therefore indicates the status "Ready for switch-on".

Bit	Meaning	Value	Status message
0	Ready to start	0	
		1	Initialisation completed, charging relay switched on, output voltage disabled
1	Ready for operation	0	No switch-on command present, or there is a fault, of the command "Disable voltage" or "Emergency stop" is present, or the status is "Switch-on block".
		1	There is a switch-on command and there is no fault. The inverter can be started with the command "Enable operation"
2	Operation enabled	0	
		1	The output voltage is enabled; ramp of the frequency inverter up to the existing setpoint
3	Fault	0	
		1	Drive unit defective and therefore "Not ready for operation". After acknowledgement, the frequency goes into status "Switch-on block".
4	Voltage enabled	0	"Disable voltage" command present.
		1	
5	Emergency stop	0	"Emergency stop" command present.
		1	
6	Starting disabled	0	
		1	With the command "Standby" the frequency goes into status "Ready for switch-on".
7	Warning active	0	
		1	Drive operation continues, no acknowledgement necessary
8	Setpoint reached	0	Actual value does not correspond to the setpoint With use of POSICON: Setpoint position not reached.
		1	Actual value matches the setpoint (setpoint reached) With use of POSICON: setpoint position has been reached
9	Bus control active	0	Control on local device active
		1	The master has been requested to take over control.
10	Start function 481.9	0	
		1	Bus bit 10 of the status word is set 🕮 Parameter **P481** in the frequency inverter manual.
11	Rotation right is on	0	
		1	The frequency inverter output voltage has a right-hand rotation field.
12	Rotation left is on	0	
		1	The frequency inverter output voltage has a left-hand rotation field.
13	Start function 481.10	0	
		1	Bus bit 13 of the status word is set 🕮 Parameter **P481** in the frequency inverter manual.
14	Parameter set Bit 0 ON	0	
		1	
15	Parameter set Bit 1 On	0	
		1	

Bit 15	Bit 14	parameter set, that is active
0	0	Parameter set 1
0	1	Parameter set 2
1	0	Parameter set 3
1	1	Parameter set 4

6.2.4 Frequency inverter status machine

The frequency inverter passes through a status machine. The changes between various states are triggered automatically or by control commands in the process data control word. The present status is returned in the process data status word.

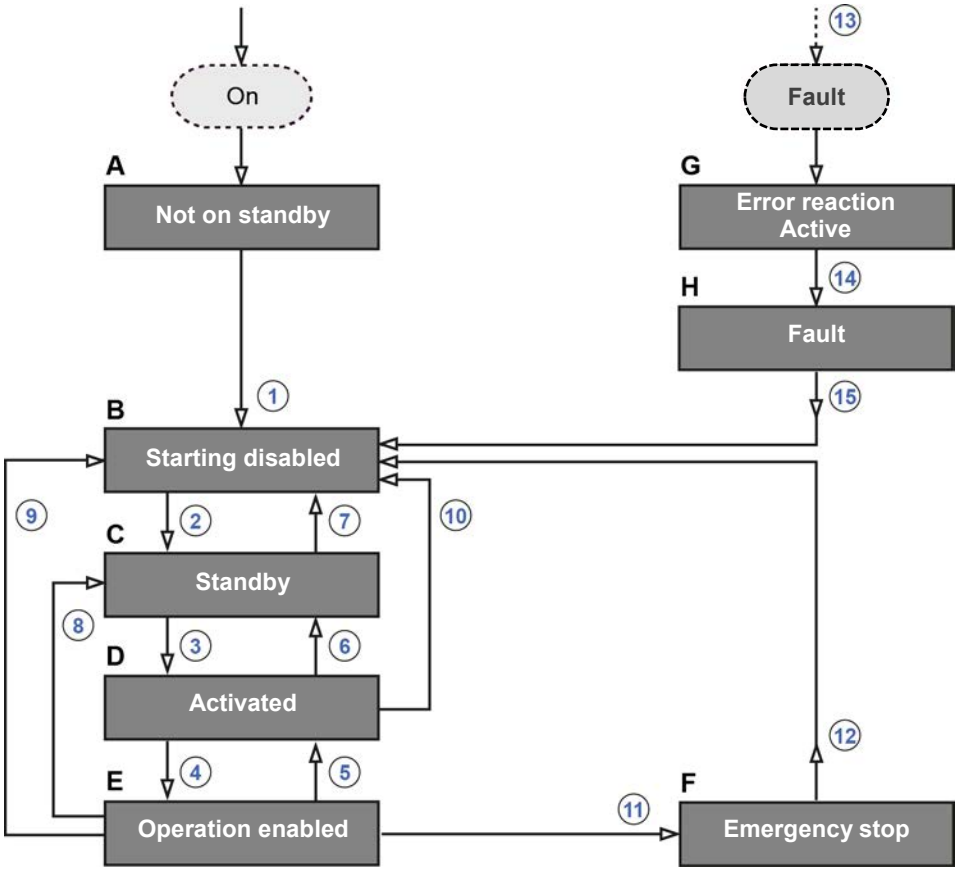

Figure 8: Frequency inverter status machine

Item	Meaning
A…H	Frequency inverter statuses (🕮 Table "Frequency inverter statuses**"**)
1…15	Status transitions (🕮 Table "Status transitions**"**)

Frequency inverter statuses

Status		Description
A	Not on standby	Initial state after switching on the frequency inverter. As soon as the loading relay engages, the frequency inverter automatically changes to the status "Switch-on block".
B	Switch-on block	Second status after switching on the frequency inverter, which can only be exited with the control command "Shut-down". The charging relay is switched on.
C	Standby	In this status, initialisation of the frequency inverter is complete. The output voltage is blocked. **Information** During the initialisation process the response to a bus master telegram does not yet contain the response to the control command which has been issued. On the basis of the response from the bus participant, the control system must determine whether the control command has been executed.
D	Activated	Frequency inverter ready for operation.
E	Operation enabled	The frequency inverter receives and processes setpoints.
F	Emergency stop active	Emergency stop function is being executed (the drive is stopped), the frequency inverter changes to the status "Switch-on block".
G	Error reaction active	If an error occurs, the frequency inverter changes to this status and all functions are blocked.
H	Fault	After processing of the response to the fault, the frequency inverter changes to this status, which can only be exited with the control command "Acknowledge fault".

Status transitions

Triggered status transition		Control command	Bit 7…0 of the control word[1]							
			7	6	5	4	3	2	1	0
1	From "Not ready for switch-on" to "Switch on block"	—	—							
	Automatic activation of the charging relay									
2	From "Switch-on block" to "Ready for switch-on"	Shut down	X	X	X	X	X	**1**	**1**	**0**
3	From "Ready for switch-on" to "Switched on"	Switch on	X	X	X	X	X	**1**	**1**	**1**
4	From "Switched on" to "Operation enabled"	Enable operation	X	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	Output voltage is enabled									
5	From "Operation enabled" to "Switched on"	Disable operation	X	X	X	X	**0**	**1**	**1**	**1**
	Output voltage is disabled									
6	From "Switched on" to "Ready for switch-on"	Shut down	X	X	X	X	X	**1**	**1**	**0**
	Voltage enabled at "f = 0 Hz"									
7	From "Ready for switch-on" to "Switch-on block"	Disable voltage	X	X	X	X	X	X	**0**	X
		Quick stop	X	X	X	X	X	**0**	**1**	X
8	From "Operation enabled" to "Ready for switch-on"	Shut down	X	X	X	X	X	**1**	**1**	**0**
9	From "Operation enabled" to "Switch on block"	Disable voltage	X	X	X	X	X	X	**0**	X
10	From "Switched on" to "Switch on block"	Disable voltage	X	X	X	X	X	X	**0**	X
		Quick stop	X	X	X	X	X	**0**	**1**	X
11	From "Operation enabled" to "Emergency stop active"	Quick stop	X	X	X	X	X	**0**	**1**	X
12	From "Emergency stop active" to "Switch on block"	Disable voltage	X	X	X	X	X	X	**0**	X
13	Automatically, after the occurrence of a fault from any status	—	—							
14	Automatically after completion of the response to a fault	—	—							
15	End fault	Acknowledge error	**0**	X	X	X	X	X	X	X
			→							
			1	X	X	X	X	X	X	X

X = The bit status (0 or 1) is not important for achieving the status. Please also note the list of control bits, 📖 Section 6.2.2 "Control word".

[1] Complete list of control bits (Bit 0…15) 📖 Section 6.2.2 "Control word".

Information — **Control bit 10**

Control bit 10 "Control data valid" must always be set to 1. Otherwise the process data will not be evaluated by the frequency inverter.

Decoded frequency inverter statuses

Status	Status bit[1]						
	6	5	4	3	2	1	0
Not ready for switch-on	0	X	X	0	0	0	0
Starting disabled	1	X	X	0	0	0	0
Ready to start	0	1	1	0	0	0	1
Activated	0	1	1	0	0	1	1
Operation enabled	0	1	1	0	1	1	1
Fault	0	X	X	1	0	0	0
Error active	0	X	X	1	1	1	1
Emergency stop active	0	0	1	0	1	1	1

[1] Complete list of status bits (Bit 0…15) 🕮 Section 6.2.3 "Status word".

6.2.5 Setpoints and actual values

Setpoints (from the bus master to the frequency inverter) and actual values (from the frequency inverter to the bus master) are specified via the following parameters of the frequency inverter:

Direction of transmission	Process value	Parameters		
		SK 1x0E, SK 2xxE frequency inverters	SK 500E…SK 535E frequency inverters	SK 54xE frequency inverters
To bus interface	Setpoint 1	**P546, Array [-01]**	**P546**	**P546, Array [-01]**
	Setpoint 2	**P546, Array [-02]**	**P547**	**P546, Array [-02]**
	Setpoint 3	**P546, Array [-03]**	**P548**	**P546, Array [-03]**
	Setpoint 4	—	—	**P546, Array [-04]**
	Setpoint 5	—	—	**P546, Array [-05]**
From bus interface	Actual value 1	**P543, Array [-01]**	**P543**	**P543, Array [-01]**
	Actual value 2	**P543, Array [-02]**	**P544**	**P543, Array [-02]**
	Actual value 3	**P543, Array [-03]**	**P545**	**P543, Array [-03]**
	Actual value 4	—	—	**P543, Array [-04]**
	Actual value 5	—	—	**P543, Array [-05]**

Setpoints and actual values are transmitted by three different methods:

Percentage transmission

The process value is transmitted as an integer with a value range of -32768 to 32767 (8000 hex to 7FFF hex). The value "16384" (4000 hex) corresponds to 100%. The value "-16384" (C000 hex) corresponds to -100%.

For frequencies, the 100% value corresponds to parameter **P105 Maximum frequency** of the frequency inverter. For current, the 100% value corresponds to parameter **P112 Torque current limit** of the frequency inverter.

Frequencies and currents result from the following formulae:

$$Frequency = \frac{Value^{*} \times P105}{16384} \qquad Current = \frac{Value^{*} \times P112}{16384}$$

* 16 Bit- setpoint or actual value which is transferred via the bus.

Binary transmission

Inputs and outputs as well as digital input bits and bus output bits are evaluated bit-wise.

Transmission of positions (SK 1x0E, SK 2xxE and SK 530E and above)

In the frequency inverter, positions have a value range of -50000.00....50000.00 rotations. A rotation of the motor can be subdivided into a maximum of 1000 increments. The subdivision depends on the encoder which is used.

The 32 Bit value range is divided into a "Low" and a "High" word, so that two setpoints or actual values are required for the transmission.

Direction of transmission	**Transmitted data**					
	SK 1x0E, SK 2xxE, SK 5xxE frequency inverters				**Only frequency inverters SK 540E…SK 545E**	
	1st word	**2nd word**	**3rd word**	**4th word**	**5th word**	**6th word**
To bus interface	Control word	32 Bit setpoint		Setpoint 3	Setpoint 4	Setpoint 5
From bus interface	Status word	Actual value 1	32 Bit actual value		Actual value 4	Actual value 5

Only the "Low" word for the position can also be transferred. This results in a limited value range from 32,767 to -32,768 rotations. This value range can be extended with the ratio factor (**Parameter P607 speed ratio** and **P608 Reduction**), however this reduces the resolution accordingly.

6.3 Parameter data transmission

Access to all parameters of the bus interface and the connected frequency inverters is via Explicit Messages. A point-to-point connection is established according to the Client/Server principle for the transmission.

The frequency inverters which are connected to the bus module are accessed via various classes.

EtherNet/IP Class	Accessed device
100	Bus interface
101	Frequency inverter FI1
102	Frequency inverter FI2
103	Frequency inverter FI3
104	Frequency inverter FI4
105	Frequency inverter FI5[1]
106	Frequency inverter FI6[1]
107	Frequency inverter FI7[1]
108	Frequency inverter FI8[1]

[1] Only bus interface SK TU3-EIP

Coding of frequency inverter parameters in EtherNet/IP format

Parameter number in EtherNet/IP format	
Class	🕮 previous table
Attribute	Parameter number
Instance	Sub-index

EtherNet/IP- format in parameter numbers	
Parameter number	Attribute
Sub-index	Instance

An instance is created, depending on the structure of the parameter.

The following applies for parameters without arrays which depend on parameter sets (e.g. parameter **P103**):

Parameter set	Bit 1	Bit 0	Instance
1	0	0	0
2	0	1	1
3	1	0	2
4	1	1	3

The following applies for parameters with arrays which do not depend on parameter sets (e.g. parameter **P465**):

Array	…	Bit 3	Bit 2	Bit 1	Bit 0	Instance
[-01]		0	0	0	0	0
[-02]		0	0	0	1	1
[-03]		0	0	1	0	2
[-04]		0	0	1	1	3
[-05]		0	1	0	0	4
…						

The following applies for parameters with arrays which depend on parameter sets (e.g. parameter **P400**):

		Array			Parameter set		
array	Parameter set	…	Bit 3	Bit 2	Bit 1	Bit 0	Instance
[-01]	1		0	0	0	0	0
[-01]	2		0	0	0	1	1
[-01]	3		0	0	1	0	2
[-01]	4		0	0	1	1	3
[-02]	1		0	1	0	0	4
[-02]	2		0	1	0	1	5
…							

Examples:

Device	Parameters	Array	Parameter set		Class	Attribute	Instance
FI1	P103	—	1	→	101	103	0
FI4	P103	—	3	→	104	103	2
FI3	P465	[-01]	—	→	103	465	0
FI3	P465	[-02]	—	→	103	465	1
FI2	P400	[-01]	3	→	103	400	2
FI2	P400	[-03]	1	→	103	400	12
FI2	P400	[-03]	3	→	103	400	14

6.4 Example of setpoint specification

The following example shows the specification of a setpoint for switching a frequency inverter on and off. The frequency inverter is operated with a setpoint (setpoint frequency) and responds with an actual value (actual frequency). The maximum frequency is set to 50 Hz.

Parameter settings on the frequency inverter:

Parameter No.	Parameter name	Setting value
P105	Maximum frequency	50 Hz
P543	Actual bus value 1	1 (= Actual frequency)
P546	Function bus setpoint 1	1 (= Setpoint frequency)

Example

Order to FI		Response from the FI		Remarks
Control word	**Setpoint 1**	**Status word**	**Actual value 1**	
—	—	0000h	0000h	
—	—	xx40h	0000h	The mains voltage is switched on at the frequency inverter
047Eh	0000h	xx31h	0000h	The frequency inverter switches to "Ready for switch-on" status
047Fh	2000h	xx37h	2000h	The frequency inverter is set to "Operation enabled" status and controlled with a 50 % setpoint.
The frequency inverter is enabled, the motor is supplied with current and rotates with a frequency of 25 Hz.				
0047Eh	2000h	xx31h	0000h	The frequency inverter switches to "Ready for switch-on" status The motor brakes to a standstill according to the parameterised ramp and is disconnected from the power supply.
The frequency inverter is blocked again and the motor is without current.				
047Fh	1000h	xx37h	1000h	The frequency inverter is set to "Operation enabled" status and controlled with a 25% setpoint.
The frequency inverter is enabled, the motor is supplied with current and rotates with a frequency of 12.5 Hz.				

7 Parameters

The bus interface and frequency inverter parameters are communicated as words (16 Bit/Word). Exceptions to this are position values (POSICON), which are communicated as double words (32 Bit).

For field bus operation, several parameters must be set on the bus interface and the frequency inverter.

The parameters can be set with

- An external control or ParameterBox (🕮 Manual BU 0040),
- NORD CON software (🕮 Manual BU 0000) or
- The operator's PLC project.

7.1 Parameter setting on the bus interface

The parameters of the bus interface are divided into NORD-specific standard parameters and field-bus specific information parameters:

Parameter No.	Description
P15x	NORD standard parameter (can be set and saved)
P16x	EtherNet/IP standard parameter (can be set and saved)
P17x	NORD information parameter (display)
P18x	EtherNet/IP information parameter (display)

The NORD standard parameters **P151**…**P154** must be set on the EtherNet/IP bus interfaces. In addition, depending on the use and configuration, the EtherNet/IP standard parameters **P160**…**P169** must be set.

A detailed description of the bus interface parameters can be found in the following sections.

7.1.1 NORD standard parameters

The basic settings of the bus interface can be made via NORD standard parameters.

P150	Set relay
Setting range	0…4
Factory setting	{ 0 }
Bus interface	**SK TU4-EIP**
Description	The setting of this parameter determines the switching state of each digital output.

Setting values

Value	Meaning	Comments
0	Via bus	All digital outputs are controlled via the PROFINET. The functions are defined in the frequency inverter (**P480**).
1	Outputs Off	All digital outputs are set to "Low" (0 V)
2	Output 1 On (DO1)	Digital output DO1 is set to "High" (active), digital output DO2 is set to "Low" (0 V).
3	Output 2 On (DO2)	Digital output DO2 is set to "High" (active), digital output DO1 is set to "Low" (0 V).
4	Outputs 1 and 2 ON	All digital outputs are set to "High" (active)

P151	Timeout for external bus
Setting range	0…32767 ms
Factory setting	{ 0 }
Bus interface	**SK CU4-EIP, SK TU4-EIP**
Description	Monitoring function of the bus interface After receipt of a valid telegram, the next telegram must arrive within the set time. Otherwise the bus interface or the connected frequency inverter reports an error (E010/10.3 "Time Out") and switches off. See also parameter **P513 Telegram timeout time** for the frequency inverter.

Setting values

-1 = Monitoring Off

0 = Control word monitoring Off, bus-communication monitoring active

Note

The following table shows an overview of the responses of the device to typical user errors in combination with certain monitoring parameter settings:

Action	Setting value P151	Error of the bus interface
Invalid control word set (e.g. PLC to Stop)	-1	Frequency inverter continues operation
Connection to EtherNet/IP-Busmaster lost	-1	Frequency inverter continues operation
Ethernet cable interrupted	-1	Frequency inverter continues operation
Invalid control word set (e.g. PLC to Stop)	0 sec	Frequency inverter continues operation
Connection to EtherNet/IP-Busmaster lost	0 sec	Error E10.2*
Ethernet cable interrupted	0 sec	Error E10.5*
Invalid control word set (e.g. PLC to Stop)	1 sec	Error E10.3*
Connection to EtherNet/IP-Busmaster lost	1 sec	Error E10.2*
Ethernet cable interrupted	1 sec	Error E10.5*

* Error E10.2 = Watchdog bus-communication
Error E10.3 = Bus Timeout (P151/P513)
Error E10.8 = No Ethernet connection

P152	Factory setting
Setting range	0…3
Factory setting	{ 0 }
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**
Description	Reset the present parameter settings of the bus interface to the factory setting.

Setting values

Value	Meaning	Remarks
0	No change	Current parameter settings will not be changed
1	Load factory setting	All bus interface parameters will be reset to the factory setting. The setting of parameter **P152** then automatically changes back to { 0 }.
2	Basic parameters	All basic parameters of the bus interface will be reset to the factory setting. The setting of parameter **P152** then automatically changes back to { 0 }.
3	i-Parameters	The individual safety parameters (P800 … P830) of the bus interface will be reset to the factory setting. The setting of parameter **P152** then automatically changes back to { 0 }.

P153	Min. system bus cycle
Setting range	0…250 ms
Arrays	[-01] = TxSDO Inhibit Time [-02] = TxPDO Inhibit Time
Factory setting	{ [-01] = 10 } { [-02] = 5 }
Bus interface	**SK CU4-EIP, SK TU4-EIP**
Description	Set the pause time for the system bus in order to reduce the bus load.

P154	TB-IO access	
Setting range	0…5	
Arrays	[-01] = Access to inputs [-02] = Access to outputs	
Factory setting	{ [-01] = 0 } { [-02] = 0 }	
Bus interface	**SK CU4-EIP, SK TU4-EIP**	
Description	Assign reading and writing rights of each connected frequency inverter to 2 inputs and 2 outputs of the bus interface. This is carried out via the following frequency inverter parameters:	
	Input 1	Evaluation via **P480 Funct. BusIO In Bits**, Array [-11]
	Input 2	Evaluation via **P480 Funct. BusIO In Bits**, Array [-12]
	Output 1	Evaluation via **P481 Funct. BusIO Out Bits**, Array [-09]
	Output 2	Evaluation via **P481 Funct. BusIO Out Bits**, Array [-10]

Setting values

Value	Meaning	Comments
0	No access	No influence by the frequency inverter.
1	Broadcast (inputs)	All connected frequency inverters read the inputs (Array [-02] = No function).
2	FI 1	Frequency inverter 1 reads and writes to the inputs and outputs.
3	FI 2	Frequency inverter 2 reads and writes to the inputs and outputs.
4	FI 3	Frequency inverter 3 reads and writes to the inputs and outputs.
5	FI 4	Frequency inverter 4 reads and writes to the inputs and outputs.

7.1.2 EtherNet/IP standard parameters

Field-bus specific settings of the bus interface are made via the EtherNet/IP standard parameters.

P160	**IP address**			
Setting range	0…255			
Arrays	[-01] = IP-High (NET-ID)		[-03] = IP (NET-ID)	
	[-02] = IP (NET-ID)		[-04] = IP Lo (Host)	
Factory setting	{ [-01] = 192 }	{ [-02] = 168 }	{ [-03] = 1 }	{ [-04] = 100 }
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**			
Description	Set the IP address of the bus interface, which consists of 4 bytes. After setting, restart the bus interface (switch the power supply off and on again) so that the parameter setting is read in.			
Note	• In order for the set IP address to be adopted, parameter **P165 addressing mode** must be set to the value "0". • All DIP switches for setting the fourth byte of the IP address must be in the "OFF" position. • The address which is set can be determined via the parameter **P185**.			

P161	**IP subnet mask**			
Setting range	0…255			
Arrays	[-01] = IP Sub 1	[-02] = IP Sub 2	[-03] = IP Sub 3	[-04] = IP Sub 4
Factory setting	{ [-01] = 255 }	{ [-02] = 255 }	{ [-03] = 255 }	{ [-04] = 0 }
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**			
Description	Set the IP address of the bus interface, which consists of 4 bytes. After setting, restart the bus interface (switch the power supply off and on again) so that the parameter setting is read in.			
Note	• In order for the set IP address to be adopted, parameter **P165 addressing mode** must be set to the value "0". • The address of the IP sub-mask which is set can be determined via the parameter **P186**.			

P164	**IP Gateway**			
Setting range	0…255			
Arrays	[-01] = IP High (NET-ID)		[-03] = IP (NET-ID)	
	[-02] = IP (NET-ID)		[-04] = IP Lo (Host)	
Factory setting	{ [-01] = 0 }	{ [-02] = 0 }	{ [-03] = 0 }	{ [-04] = 0 }
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**			
Description	Set the IP address for the gateway function, which consists of 4 bytes. After setting, restart the bus interface (switch the power supply off and on again) so that the parameter setting is read in.			

P165	Addressing mode
Setting range	0…2
Factory setting	{ 1 }
Bus interface	**SK CU4-EIP, SK TU3-EIP, SK TU4-EIP**
Description	The setting of this parameter determines the method by which the IP address of the bus interface is set. After setting, restart the bus interface (switch the power supply off and on again) so that the parameter setting is read in.
Note	• If this parameter is set to the value "0", the IP address is adopted from the settings of parameters **P160**, **P161** and **P164**. • The setting of this parameter is only adopted if all of the DIP switches for setting the IP address are in the "OFF" position.
Setting values	

Value	Meaning	
0	Fixed (P160/DIP)	Set the first three bytes of the IP address via parameter P160 and set the fourth byte via DIP switches on the bus interface.
1	BOOTP	Set the IP address in the EtherNet/IP configuration software in BOOTUP mode.
2	DHCP	Set the IP address in the EtherNet/IP configuration software via DHCP

P166	PZD transmission format
Setting range	0…1
Factory setting	{ 0 }
Bus interface	**SK CU4-EIP, SK TU3-EIP, SK TU4-EIP**
Description	Changing the transmission format of process data
Note	The setting "1" (Modeless Format) can only be used for the assembly instances 110 and 111 with variable data length. For instances 100 and 101 the data length is fixed and contains the 32 bit header.
Setting values	

Value	Meaning	
0	32 Bit header + status	Process data telegram with header and application data
1	Modeless Format	Process data telegram with only application data

P169	Password
Setting range	45…122 ASCII
Factory setting	{ 0 }
Bus interface	**SK CU4-EIP, SK TU3-EIP, SK TU4-EIP**
Description	Protect the bus interface with a password for remote maintenance access. Up to 20 characters (numbers, letters and special characters) from the ASCII code range 45...122 can be entered as the password.

7.1.3 NORD information parameters

NORD information parameters are used to display current and archived error messages, as well as current operating states.

P170	Actual error
Display range	0...9999
Arrays	[-01] = Actual error in bus interface [-02] = Last error in bus interface
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**
Description	Display of the actual error present. For a list of possible error messages please refer to 🕮 Section 8 "Error monitoring and error messages".
Note	The error message is reset when the supply voltage is switched off.

P171	Software version
Display range	0.0…9999.9
Arrays	[-01] = Software version [-02] = Software revision [-03] = Special version
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**
Description	Display of the software version and revision number of the bus interface. Array [-03] shows possible special versions (0 = standard version).

P172	Configuration level
Display range	0…
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**
Description	Display of the bus interface identifier.

Display values

Value	Meaning	
0	CU4 (internal)	Bus interfaceSK CU4-EIP,
1	TU4 (external)	Bus interfaceSK TU4-EIP
2	TU3 (Techn. Unit)	Bus interfaceSK TU3-EIP,
3	TU3 (Techn. Unit)+DIP	Bus interface SK TU3-EIP, with DIP switch

P173	Module status
Display range	0…FFFFh
Arrays[1]	[-01]…[-02]
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**
Description	Displays the operating state of the bus interface.

Display values

Bit	Meaning[1] (Array [-01][1])	Meaning (Array [-02][2])
0	Bus interface ready	FI1 status
1	Cyclic communication	
2	Timeout (Ethernet/IP)	FI2 status
3	Timeout (P151/P513)	
4	No communication with ASIC	FI 3 status
5	General configuration error	
6	System bus "Bus WARNING"	FI4 status
7	System bus "Bus Off"	
8	FI1 status	FI5 status[2]
9		
10	FI2 status	FI6 status[2]
11		
12	FI3 status	FI7 status[2]
13		
14	FI4 status	FI8 status[2]
15		

FI status

Frequency inverter status, Array [-01] Bit 8…Bit 15, or Array [-02] Bit 0 … Bit 15:

Bit "High"	Bit "Low"	Meaning
0	0	Frequency inverter "offline"
0	1	Unknown frequency inverter
1	0	Frequency inverter "online"
1	1	Frequency inverter lost or switched off

[1] With SK xU4-EIP bus interfaces this parameter does not have any arrays, the meaning of Bit 0…Bit 15 corresponds to the description in this column.

[2] With SK TU3-EIP bus interfaces this parameter has two arrays, whereby Array [-02] is only relevant if 8 frequency inverters are connected.

P174	Digital input status
Display range	0…255 (00000000…11111111b)
Bus interface	**SK CU4-EIP, SK TU4-EIP**
Description	Display of the actual switching status of the digital bus interface inputs.

Display values

Bit	Meaning
0	Input 1 (DIN1) of the bus interface
1	Input 2 (DIN2) of the bus interface
2	Input 3 (DIN3) of the bus interface[1]
3	Input 4 (DIN4) of the bus interface[1]
4	Input 5 (DIN5) of the bus interface[1]
5	Input 6 (DIN6) of the bus interface[1]
6	Input 7 (DIN7) of the bus interface[1]
7	Input 8 (DIN8) of the bus interface[1]

[1] Only bus interface , SK TU4-EIP

P175	Relay status
Display range	0…3 (00…11b)
Bus interface	**SK TU4-EIP**
Description	Display of the actual switching status of the relay outputs of the bus interface.

Display values

Bit	Meaning
0	Output 1 (DO1) of the bus interface
1	Output 2 (DO2) of the bus interface

P176	Process data Bus In				
Display range	-32768…32767				
Arrays	[-01] =	Bus module outputs[1]			
	[-02] =	Control word	[-03]…[-07] =	Setpoint 1…5	to FI1
	[-08] =	Control word	[-09]…[-13] =	Setpoint 1…5	to FI2
	[-14] =	Control word	[-15]…[-19] =	Setpoint 1…5	to FI3
	[-20] =	Control word	[-21]…[-25] =	Setpoint 1…5	to FI4
	[-26] =	Control word	[-27]…[-31] =	Setpoint 1…5	to FI5[2]
	[-32] =	Control word	[-33]…[-37] =	Setpoint 1…5	to FI6[2]
	[-38] =	Control word	[-39]…[-43] =	Setpoint 1…5	to FI7[2]
	[-44] =	Control word	[-45]…[-49] =	Setpoint 1…5	to FI8[2]
	[1] Only bus interface , SK CU4-EIP, , SK TU4-EIP [2] Only bus interface , SK TU3-EIP,				
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**				
Description	Display of data received from the EtherNet/IP-Busmaster.				
Note	• Setpoints 4 and 5 are only possible with SK 54xE frequency inverters. • Control data via UDP or TCP/IP are only displayed if there is no EtherNet/IP master.				

P177	Process data Bus Out				
Display range	-32768…32767				
Arrays	[-01] =	Bus module inputs[1]			
	[-02] =	Status word	[-03]…[-07] =	Actual value 1…5	from FI1
	[-08] =	Status word	[-09]…[-13] =	Actual value 1…5	from FI2
	[-14] =	Status word	[-15]…[-19] =	Actual value 1…5	from FI3
	[-20] =	Status word	[-21]…[-25] =	Actual value 1…5	from FI4
	[-26] =	Status word	[-27]…[-31] =	Actual value 1…5	from FI5[2]
	[-32] =	Status word	[-33]…[-37] =	Actual value 1…5	from FI6[2]
	[-38] =	Status word	[-39]…[-43] =	Actual value 1…5	from FI7[2]
	[-44] =	Status word	[-45]…[-49] =	Actual value 1…5	from FI8[2]
	[1] Only bus interface , SK CU4-EIP, , SK TU4-EIP [2] Only bus interface , SK TU3-EIP,				
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**				
Description	Display of the data sent from the bus interface to the EtherNet/IP-Busmaster.				
Note	Actual values 4 and 5 are only possible with SK 54xE frequency inverters.				

P178	Internal temperature
Display range	-128…127 °C
Bus interface	**SK CU4-EIP,**
Description	Display of the internal temperature in the associated frequency inverter.
Note	If a temperature of +97 °C is exceeded in the bus interface an error message is given (see Error 10.1, 🕮 Section 8.3 "Error messages").

7.1.4 EtherNet/IP information parameters

EtherNet/IP information parameters are used to display statuses and settings which are specific to the field bus.

P180	Active assembly
Display range	0…255
Arrays	[-01] = Consumer Assembly [-02] = Producer Assembly
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**
Description	Display of the currently assigned assembly object.

P181	MAC address
Display range	0…FFh
Arrays	[-01]…[-03] = Manufacturer ID (Getriebebau NORD GmbH & Co. KG "F0.5F.5A") [-04]…[-06] = free address area (for Getriebebau NORD GmbH & Co. KG)
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**
Description	Display of the unique MAC address of the bus interface.

P185	Present IP address
Display range	0…255
Arrays	[-01]…[-04]
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**
Description	Display of the currently set bus interface IP address.

P186	Present IP subnet mask
Display range	0…255
Arrays	[-01]…[-04]
Bus interface	**SK TU3-EIP, SK CU4-EIP, SK TU4-EIP**
Description	Display of the currently set bus interface sub-net mask.

7.2 Parameter settings on the frequency inverter

After connection and addressing of the bus interface, the additional parameters of the frequency inverter must be set as listed below. The additional parameters of the frequency inverter are used to set the bus interface, the pulse frequency and acknowledgement of errors.

A detailed description of the parameters can be found in the relevant manual for the frequency inverter.

Additional parameters

The following table contains a list of additional parameters which are relevant for the bus interface.

No.	Parameter name	Recommended setting			Comments
		SK CU4/SK TU4	SK TU3		
		SK 1x0E, SK 2xxE	SK 500E–SK 535E	SK 54xE	
P509	Source Control Word	"3" = System bus	"8" = Ethernet TU	"8" = Ethernet TU	SK 511E frequency inverters and above: Communication with the bus interface via the system bus is possible with setting "6" = CANopen.
P510	Setpoint source	"0" = Auto	"0" = Auto	"0" = Auto	If **P509** is set to "3", "6" or "8"
P513	Telegram timeout	—	○[1]	○[1]	
P514	CAN bus baud rate	"5" = 250 kBaud	"5" = 250 kBaud	"5" = 250 kBaud	
P515	CAN address (Array [-01])	32, 34, 36 or 38	32, 34, 36 oder 38*	32, 34, 36 oder 38*	System bus address
P543	Actual bus value Arrays [-01]…[-03]	○[2]	○[2]	○[2]	Refer to the relevant frequency inverter operating manual
	Actual bus value Arrays [-04]…[-05]	—	—	○[2]	
P543	Actual bus value 1	—	○[2]	—	
P544	Actual bus value 2	—	○[2]	—	
P545	Actual bus value 3	—	○[2]	—	
P546	Function Bus setpoint Arrays [-01]…[-03]	○[2]	—	○[2]	Refer to the relevant frequency inverter operating manual
	Function Bus setpoint Arrays [-04]…[-05]	—	—	○[2]	
P546	Function Bus setpoint 1	—	○[2]	—	
P547	Function Bus setpoint 2	—	○[2]	—	
P548	Function Bus setpoint 3	—	○[2]	—	

* Only necessary if more than one frequency inverter is connected to bus interface SK TU3-EIP,.

○[1] Depending on the application: Change the settings according to the requirements of the application.

○[2] Depending on the function: Setting according to the required function(s) is necessary.

Information parameters

Information parameters are used to display current and archived error messages, as well as current operating states and settings.

The following table contains a list of information parameters which are relevant for the bus interface.

<table>
<tr><th>No.</th><th>Parameter name</th><th>SK TU3</th><th>SK CU4</th><th>SK TU4</th></tr>
<tr><td rowspan="3">P700</td><td>Current error</td><td colspan="3">Array [-01]</td></tr>
<tr><td>Current warning</td><td colspan="3">Array [-02]</td></tr>
<tr><td>Reason for switch-on block</td><td colspan="3">Array [-03]</td></tr>
<tr><td>P701</td><td>Last fault</td><td colspan="3"></td></tr>
<tr><td>P740</td><td>Process data Bus In</td><td colspan="3">No display if P509 is set to "0"</td></tr>
<tr><td>P741</td><td>Process data Bus Out</td><td colspan="3"></td></tr>
<tr><td>P744</td><td>Configuration</td><td colspan="3"></td></tr>
<tr><td>P745</td><td>Module version</td><td colspan="2"></td><td>—</td></tr>
<tr><td>P746</td><td>Module status</td><td colspan="2">Possible values:
<table><tr><th>Bit</th><th>Meaning</th></tr><tr><td>0</td><td>Bus interface initialised</td></tr><tr><td>1</td><td>Cyclic communication</td></tr><tr><td>2</td><td>Reserved</td></tr><tr><td>3</td><td>Reserved</td></tr><tr><td>4</td><td>Error 1</td></tr><tr><td>5</td><td>Error 2</td></tr><tr><td>6</td><td>Error 3</td></tr><tr><td>7</td><td>Reserved</td></tr><tr><td>8…15</td><td>Bus interface ID (EtherNet/IP = "23")</td></tr></table>Table of errors:
<table><tr><th colspan="3">Error</th><th>Meaning</th></tr><tr><th>3</th><th>2</th><th>1</th><th></th></tr><tr><td>0</td><td>0</td><td>0</td><td>No error</td></tr><tr><td>0</td><td>0</td><td>1</td><td>No communication with ASIC</td></tr><tr><td>0</td><td>1</td><td>0</td><td>Bus timeout</td></tr><tr><td>0</td><td>1</td><td>1</td><td>P513 timeout</td></tr><tr><td>1</td><td>0</td><td>0</td><td>Double assignment of IP address</td></tr><tr><td>1</td><td>0</td><td>1</td><td>General configuration error</td></tr><tr><td>1</td><td>1</td><td>0</td><td>No Ethernet cable</td></tr><tr><td>1</td><td>1</td><td>1</td><td>Communication error</td></tr></table></td><td>—</td></tr>
<tr><td>P748</td><td>CANopen status</td><td colspan="3">Displays the system bus status</td></tr>
</table>

8 Error monitoring and error messages

Bus interfaces and frequency inverters are equipped with monitoring functions and generate error messages in case of deviations from the normal operating state.

8.1 Bus operation monitoring function

Independent of the specific bus watchdogs, comprehensive monitoring functions are integrated into Getriebebau NORD GmbH & Co. KG frequency inverters and bus interfaces. With the aid of this "Timeout" monitoring, communication problems are detected, which are either related to general functionalities ("No bus communication") or are related to special modules ("Failure of a participant").

Monitoring of communication at the field bus level is primarily carried out via the bus interface. Field bus communication faults are registered in the bus interface. If an error at field bus level causes an error in the frequency inverter, the frequency inverter also displays a corresponding error. The frequency inverter itself does not monitor communication on the field bus level.

Monitoring of communication on the NORD system bus level (between the frequency inverter and the bus interface) is carried out by the frequency inverter. An error in the system bus communication is registered in both the bus interface and the frequency inverter and results in specific error messages.

Function	**Parameter**					
	Bus interface	**SK CU4 and SK TU4 via NORD system bus**			**SK TU3[1)]**	**SK TU3 via CANopen/NORD system bus[2)]**	
	Frequency inverters	**SK 1x0E SK 2xxE**	**SK 511E … SK 535E**	**SK 54xE[3)]**	**SK 5xxE**	**SK 511E … SK 535E**	**SK 54xE**
Field bus timeout		**P151**	**P151**	**P151**	**P513**	**P513**	**P513**
Optional monitoring (system bus timeout)		**P120**	**P513**	**P120**	**—[4)]**	**P513**	**P120**
Bus interface error display		**P170 (P700)**	**P170 (P700)**	**P170 (P700)**	**P170[2)] P700**	**P170 P700**	**P170 P700**
Error display for frequency inverter and communication errors between the frequency inverter and the bus interface.		**P700**	**P700**	**P700**	**P700**	**P700**	**P700**

1) Only for communication between the SK TU3 bus interface and the frequency inverter on which which the bus interface is mounted.
2) Only for Ethernet-based bus interfaces
3) Connection for CANopen (Parameter **P509**)
4) Monitoring is automatic and cannot be set.

Information — **Parameter P513**

The setting ("-0.1" = No error) of parameter **P513 Telegram timeout time** ensures that the frequency inverter ignores all communication errors on both the field bus and the system bus level. The frequency inverter maintains its operating status.

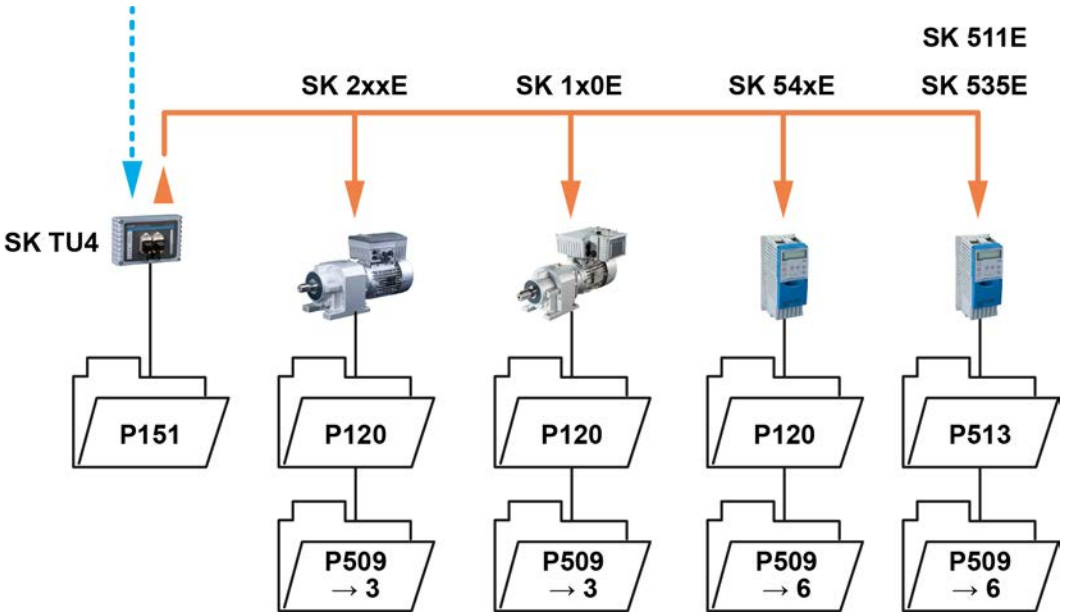

Figure 9: Examples of monitoring parameter settings – SK TU4 bus interface

Setting values for parameter **P509 Control word source**:

3 = System bus

6 = CANopen

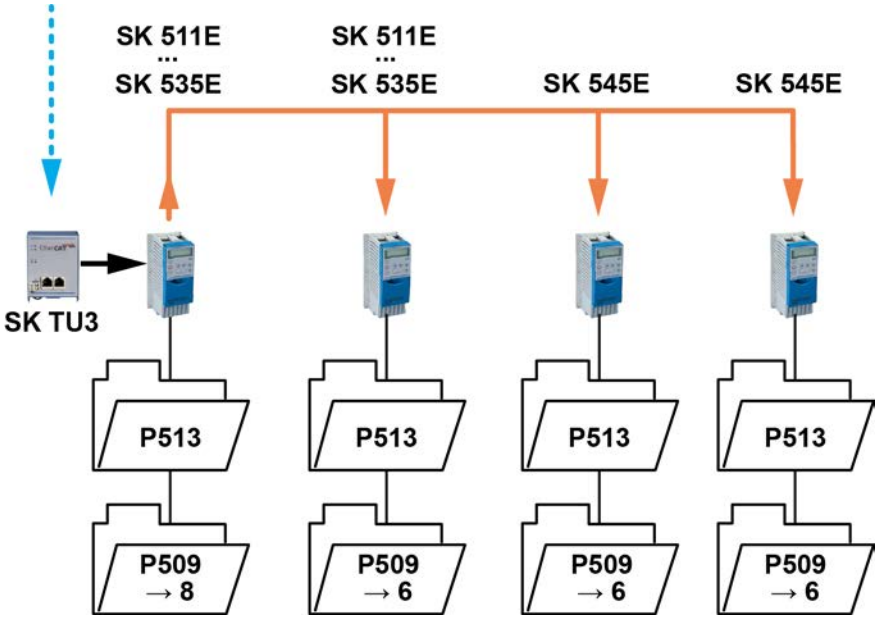

Figure 10: Examples of monitoring parameter settings – SK TU3 bus interface

Setting values for parameter **P509 Control word source**:

8 = Ethernet TU

6 = CANopen

8.2 Resetting error messages

There are several methods for resetting (acknowledging) an error message.

On the frequency inverter:

- Switch the mains voltage off and on again, or
- Actuate the programmed digital input with parameter **P420 Digital inputs** (Setting 12 = Acknowledge error), or
- Switch off "Enable" on the frequency inverter (if no digital input is parameterised to the function "Acknowledge errors"), or
- By carrying out a bus acknowledgement, or
- Automatic error acknowledgement by activating parameter **P506 Auto. error acknowledgement**.

On the bus interface

The error message (via information parameter **P170**, [-01]) is automatically reset if the error is no longer active. Otherwise:

- Switch the voltage supply to the bus interface off and on again, or
- Acknowledge the error via the field bus.

Information

Archiving error messages

An error message (display via parameter **P170**) is only displayed as long as it is active. After the error has been remedied, the message is deleted and is archived as the last error message in parameter **P170**, Array [-02]. If the mains supply is interrupted before the error is remedied, the message is lost, i.e. it is not archived.

Information

Error display in the SimpleBox

An error message is displayed in the operating display of the SimpleBox SK CSX-3H by display of the error group number "E1000". The bus interface parameter **P170**, Array [-01] must be selected to determine the actual error.

8.3 Error messages

Error messages from the bus interface can be read out via parameter **P170** of the bus interface (Array [-01] = Actual error, Array [-02] = Previous error).

Error	Meaning	Comments
100.0	EEPROM error	EMC fault, bus interface defective
102.0	Bus timeout P151	By means of timeout supervision parameter **P151/P513**
103.0	System bus Off	No 24 V voltage on bus, connections not correct
104.0	Overtemp. Bus interface	Only SK CU4-EIP bus interface
550.1	DIP switch error	The DIP switches (IP address) could not be read correctly
560.0 … 560.9	Internal error	Bus interface not ready
561.0	General network error	
561.1	Ethernet watchdog timeout	
561.2	Bus cable fault	Bus cable interrupted
561.3	IP address error	IP address of bus interface has been doubly assigned
564.0	MAC address error	MAC address defective

Error messages which occur in relation to the bus interface are depicted as follows in the error memory of the frequency inverter (Parameter **P700** and **P701**).

Error (E010)	Meaning	Comments
10.0	Connection error	• Contact to bus interface lost
10.1	ASIC error or temperature too high	• Communication with Ethernet ASIC lost *Only SK CU4-EIP bus interface:* • Excess bus interface temperature (>97 °C)
10.2	EtherNet/IP watchdog timeout	• Telegram transfer error. – Check the connections, links, program sequence and bus master
10.3	Timeout by **P151/P513**	• Telegram transfer error. – Check connections and links – Check watchdog time
10.4	IP address error	• IP address of bus interface doubly assigned
10.5	Internal error	• Bus interface not ready
10.6	Bus cable fault	• Bus cable connection interrupted
10.8	Connection error timeout	*Only SK TU3-EIP bus interface:* • Connection between bus interface and frequency inverter interrupted due to timeout.
10.9	Connection error timeout	*Bus interfaces SK CU4-DEIP and SK TU4-EIP only:* Connection between bus interface and frequency inverter interrupted (see setting of parameter **P120**).

9 Appendix

9.1 Repair information

In order to keep repair times as short as possible, please state the reasons for the return of the device and at least one contact partner in case of queries.

In case of repairs, please send the device to the following address:

NORD Electronic DRIVESYSTEMS GmbH

Tjüchkampstraße 37

26606 Aurich, Germany

Information **Third party accessories**

Before returning a bus interface and/or a frequency inverter, please remove any external accessories such as mains cables, potentiometers, external displays, etc., which were not supplied by Getriebebau NORD GmbH & Co. KG No liability can be accepted by Getriebebau NORD GmbH & Co. KG for devices which are returned with third party accessories.

Information **Accompanying document**

Please use the filled-in accompanying document for returns, You can find this on our homepage www.nord.com or directly under the link Warenbegleitschein.

For queries about repairs, please contact:

Getriebebau NORD GmbH & Co. KG

Tel.: +49 (0) 45 32 / 289-2515

Fax: +49 (0) 45 32 / 289-2555

9.2 Service and commissioning information

In case of problems, e.g. during commissioning, please contact our Service department:

☎ +49 4532 289-2125

Our Service department is available 24/7 and can help you best if you have the following information about the device and its accessories to hand:

- Type designation,
- Serial number,
- Firmware version

9.3 Documents and software

Documents and software can be downloaded from our website www.nord.com .

Other applicable documents and further information

Documentation	Contents
TI 275281119	Technical Information/Data Sheet for bus interface **SK TU4-EIP** (for IP55 devices)
TI 275281169	Technical Information/Data Sheet for bus interface **SK TU4-EIP-C** (for IP66 devices)
TI 275271019	Technical Information/Data Sheet for bus interface **SK CU4-EIP** (for IP55 devices)
TI 275271519	Technical Information/Data Sheet for bus interface **SK CU4-EIP-C** (for IP66 devices)
TI 275900150	Technical Information/Data Sheet for bus interface **SK TU3-EIP** (for IP20 devices)
BU 0180	Manual for **SK 1x0E** frequency inverters
BU 0200	Manual for **SK 2xxE** frequency inverters
BU 0250	Manual for **SK 2xxE-FDS** frequency inverters
BU 0500	Manual for frequency inverters **SK 500E to SK 535E**
BU 0505	Manual for **SK 54xE** frequency inverters
BU 0000	Manual for use of NORD CON software
BU 0040	Manual for use of NORD parameterisation units

Software

Software	Description
EDS file	Device description file for EtherNet/IP configuration software
NORD CON	Parametrisation and diagnostic software

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